The Water Line

Newsletter for the Lakes of Missouri Volunteer Program

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Water - A Resource Taken For Granted

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Next month a book titled *Tapped Out* (Welcome Rain Publishing) will hit the shelves at bookstores. The book is written by former U.S. Senator Paul Simon (D, IL) and addresses the potential of water shortages in the future for America as well as the world. The world population is increasing (it is estimated to double during the next 50 to 90 years) and the per capita use of water is increasing at an even faster rate. Because the volume of fresh water in the world is generally constant, the increases in demand will at some point lead to a shortage in supply. While 92% of the world currently has a sufficient supply of water, it is estimated that by the year 2050 this number will drop to 58%. The rest of the world's population will have a stressed or scarce supply. In his book, Simon warns that some day in the near future, countries may go to war over water much as they have battled for land and oil. Controversy over water is occurring even now as a number of states, including Missouri, feud over water levels in the Missouri River. As a resource, water has often been taken for granted, but that might change in the near future.

While you are out on one of Missouri's large lakes it is difficult to comprehend that fresh water could be a limited resource. The lake may cover thousands of acres and have an average depth of 20 feet or more. The volume of water in the lake is, to most of us, unimaginable. But after you do some calculations the truth is that the water in one lake is not as limitless as you might think. The U.S. has a per capita demand of 1,400 gallons a day. This includes all uses such as the growing and processing of the food we eat and the manufacturing of the goods we use. Missouri has a population of 5,117,000. By multiplying these two values we get the theoretical amount of water that Missourians use in a single day, 7,163,800,000 gallons. This 7.16 billion gallons of water is the approximate volume of Clearwater Lake in Reynolds County. On average, the state of Missouri uses the amount of water found in it's eleventh largest lake during the course of one day. Below is a table containing the volumes of the largest lakes in the state and the theoretical number of days that it would take the state to use those amounts of water.

While fresh water is a renewable resource that is constantly replaced, the simple fact is that at any given time there is only so much fresh water available for use. Solutions to the potential problems include stabilizing the world population, decreasing the per capita need, and improving our ability to make potable water through the desalination of salt

water. The next time you're on one of the large lakes in the state, take a look around at what seems to be an immeasurable amount of water and realize just how limited this resource may be.

Table 1. The theoretical number of days for our state's population to use the amount of water in Missouri's largest lakes listed to the right.

Table 1.

Lake	Volume in billions of gallons	Days
Table Rock	880.5	122.9
Lake of the Ozarks	625.9	87.4
Truman	391.9	54.7
Stockton	285.2	39.8
Wappapello	199.8	27.9
Mark Twain	177.0	24.7
Pomme De Terre	79.2	11.1
Smithville	47.1	6.6
Thomas Hill	18.4	2.6
Long Branch	11.3	1.6
Clearwater	7.2	1

PHOSPHORUS!!!

Anyone who has listened to an LMVP data review session is familiar with the term phosphorus. You know it is something we measure in lake water but you might be confused because we call in a nutrient, mention it as being a fertilizer, and in some cases indicate that it is a pollutant. You may wonder if phosphorus can really be all of these things. Truth is phosphorus is all of this and more. Phosphorus is an element, which means it can not be broken down into separate, lesser parts. Like many other elements, phosphorus is essential for life on earth. This requirement by living organisms makes phosphorus a nutrient. It is essential for energy storage and transfer in cells and is also an important component in genetic material. It is not considered scarce but compared to other essential elements it is in low supply. This means that it is readily taken up by organisms in the environment when it becomes available. Phosphorus can be found in nature in over 200 different minerals but the most common form is apatite $Ca5(PO4)3$ which is found in igneous rocks. As rain and wind act to erode the rocks, phosphorus is released into soils. Human activities also act to put phosphorus into the environment. Some of these activities include application of fertilizers, releases of sewage treatment effluent, seepage from septic systems and runoff from livestock feedlots and high intensity farms.

Phosphorus enters lakes through runoff associated with rain. Phosphorus in a lake can be in numerous forms. It can be organic, such as part of an algal cell or inorganic which would include all phosphorus not incorporated into a living organism such as that bound to soil

particles. Phosphorus can also be divided into dissolved or particulate forms. Once in a lake, phosphorus is constantly shifting from one form to another. It is taken up by algae and other aquatic plants and utilized in the cells. When these plant materials are eaten by zooplankton and fish the phosphorus is passed on. Some of the nutrient is used by the animal while some is released through defecation. Bacteria in the lake water also plays a big role in the constant cycling of phosphorus from one form to another. This recycling of phosphorus is important in keeping a usable form of phosphorus in the water for algal use. Some phosphorus falls out of the water column in the form of dead algal cells, fecal materials, soil particles with bound phosphorus, etc. Once this phosphorus becomes part of the sediment it is removed from the constant cycling that occurs in the water. In shallow areas some of the phosphorus in the sediment is returned to the system by aquatic plants that pull the nutrient out of the sediments through their roots. Some of this phosphorus is released through the plants leaves and stems back into the water.

Some algae have evolved ways of dealing with low phosphorus supplies. Many species of algae produce enzymes known as alkaline phosphatase. This enzyme allows the algal cell to strip phosphorus off of inorganic particles such as soil. Algal cells use this enzyme when the concentration of phosphorus that is dissolved and usable is low. Some algae have developed a way to store phosphorus in the cell. This way the algae can take advantage of times when there is abundant phosphorus and still survive when the concentrations of phosphorus in the lake decline.

Because phosphorus is in short supply relative to the demand for it, it is often times the limiting nutrient. This means that algal growth is regulated by the amount of phosphorus available. As the concentration of phosphorus in the lake increases there is often an increase in the amount of algae found in the lake. In this way it acts as a fertilizer. If phosphorus levels increase dramatically the lake can become so productive that many recreational uses can be impaired. If this happens the phosphorus can be considered a pollutant. Lakes that are most at risk are those with significant human influences that add phosphorus to the watershed, smaller lakes that do not have the ability to dilute inputs of phosphorus, lakes that have small amounts of inflow which reduces the flushing rate of the lake. Shallower lakes may also be influenced by internal loading, which is the release of phosphorus from the sediment into the water.

Phosphorus is a naturally occurring element that is essential for a lake. It is only a problem when human influences lead to increases of the nutrient which then lead to increases in the amount of algae in the lake. The best way to manage the amount of phosphorus in a lake is by managing the watershed to reduce the influences of humans.

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MISSOURI MISSOURI WATERSHED INFORMATION NETWORK SOON TO BECOME OPERATIONAL

Want to know what the acronym CARES stands for? How about the acronym LMVP? Where you can find financial resources for doing a better job of watershed stewardship? Which meetings and events are scheduled? You may want to know what water quality projects are ongoing or planned for your watershed, or what the current events are, or who are the local contacts. The answers to these questions and much more will soon be available from the Missouri Watershed Information Network (MoWIN).

The idea for a watershed information clearinghouse was one objective of a Watershed Stewardship Workshop held in Columbia, Missouri in April 1996. At the workshop, a majority of the 162 participants embraced the clearinghouse concept. Later, a post-workshop survey revealed an almost unanimous feeling for a centralized tracking system for the many and varied ongoing watershed and water quality programs and initiatives. By June 1996, the Water Quality Focus Team of the University of Missouri Extension Division assumed leadership to explore the idea. The University granted $10,000 for project development, and organized a task force representing state and federal agencies and several non-governmental organizations to further develop the concept.

MoWIN is being established to assist individuals, government and private agencies, schools and other groups in locating and accessing information about current watershed conditions and best management practices to improve the state's water quality.

MoWIN is unique in that it will emphasize people, activities, and education, not just data about watersheds. The intent is to provide what the clients have already indicated they want. It will provide "a single point of contact" for people seeking information and data on watershed projects, activities and initiatives. It will consolidate widely scattered information into a standardized system for all to use, and avoid duplication of effort among agencies saving both time and money. MoWIN is a true partnership effort which is currently supported by 21 General Operating Partners from various segments of Missouri's natural resources community.

MoWIN is located on the Columbia Campus of the University of Missouri in the Agriculture Engineering Building. You may contact MoWIN by phone (573/882-0085), fax (573/884-5650), e-mail **(dillard@missouri.edu)**, mail (205 Ag Engr. Bldg, UMC, Columbia, MO 65211), or visit the MoWIN web site **http://outreach,missouri,edu/mowin/** .

Your ideas, comments and suggestions for MoWIN are welcomed.

Joe G. Dillard, Director
Missouri Watershed Information Network

ARTICLE PUBLISHED

An article entitled *Evaluation of Data Generated from Lake Samples Collected by Volunteers* was published in the March, 1998 issue of Lake and Reservoir Management. The article investigates the reliability of samples collected by volunteers in the Lakes of Missouri Volunteer Program. This was done by comparing results from samples collected by LMVP volunteers to samples collected by University personnel during the period 1992 - 94. We also compared split samples from 1995 and evaluated the replication of paired chlorophyll filters from 1992- 95. In the end, the data suggested that samples collected by volunteers were reliable and provided useful data that was similar to data generated by the University. Lake and Reservoir Management is an international journal published by the North American Lake Management Society. If you would like a copy of the article please let us know.

1998's Most Endangered Rivers as Ranked by the Conservation Group American Rivers

River	Threat
1. COLUMBIA RIVER - Hanford Reach Washington	Agricultural development and nuclear waste contamination
2. MISSOURI RIVER Iowa, Kansas, Missouri, Nebraska, North Dakota, South Dakota, Montana	Channels and dams that destroy wildlife habitat
3. POCOMOKE RIVER Eastern Shore, Maryland	Polluted runoff from poultry farms
4. KERN RIVER California	Small hydropower dams that destroy trout habitat
5. BLACKFOOT RIVER Montana	Potential cyanide runoff from proposed gold mine
6. COLORADO RIVER DELTA Baja California, Sonora, Mexico	Lack of clean inflows due to diversions for drinking and irrigation
7. CHATTAHOOCHEE RIVER Alabama, Florida, Georgia	Development, sewage, polluted runoff and competition for water supply
8. LOWER SNAKE RIVER Washington	Dams block spawning of endangered species
9. APPLE RIVER Illinois, Wisconsin	Polluted runoff from factory hog farms
10. PINTO RIVER Arizona	Potential runoff from proposed copper mine

Other endangered rivers include; Wolf River in Wisconsin, Potomac River on the East coast, Rougue/Illinois River systems in Oregon, Taku River in Alaska, Crooked Creek in northern Arkansas, Passaic River in New Jersey, Mattaponi River in Virginia, Walla Walla River in Oregon and Washington, Uinta River in Utah and Kansas River near Topeka. If you would like more information about these endangered rivers or American Rivers you can visit their web site at **www.amrivers.org/intro.html** or phone them at (202) 547-6900.