Sources of Water Quality Problems in the Red Cedar River Basin



Bluegreen algae in Tainter Lake

Heavy macrophyte growth in the Red Cedar River

Sources

Lakes and streams are generally a reflection of their watershed. If there are few sources of pollutants, the lake or stream is usually clean and healthy. If there are many and large sources, they are typically polluted and unhealthy.





Phosphorus is the key nutrient affecting algae and plant growth in freshwater systems. It is the limiting nutrient and most readily controlled. One pound of phosphorus can grow up to 500 pounds of algae.



The main source of phosphorus in a watershed is usually runoff from land surfaces. Where silt & clay erode into waterbodies, phosphorus moves with it. Some phosphorus in runoff water is not attached to soil particles and is called soluble phosphorus.



Phosphorus frequently binds to fine soil particles keeping it out of groundwater. This binding capacity of soil is not unlimited and can be overwhelmed, such as underneath an old septic system. Also, some geologic rock formations will deliver groundwater high in soluble phosphorus but this tends to be a minor source in most watersheds.



Only soluble phosphorus grows algae and plants. However, once in a waterbody, chemical processes can release phosphorus from eroded soil particles in the sediments into the overlying water. Potential sources of phosphorus in the Red Cedar basin are extensive. Reducing phosphorus release from all anthropogenic (human caused) sources is needed to achieve water quality goals. It is also important to identify the most significant sources. These vary from one watershed to the next and studies are needed to identify them.

Rural residential property
Agricultural land
Urban land
Background sources



Rural residential sources:

- Runoff during construction
- Runoff following construction
- Failing septic systems
- Lawn fertilizers







Agricultural sources: – Barnyard runoff – Feedlot runoff – Cropland runoff – Streambank erosion







Urban Runoff

- Impervious areas (parking lots, roads, roofs, etc.)
- Runoff from urban turf areas
- Construction sites







Background sources

- Natural landscapes (woods, barren fields, wetlands, etc.)
- Groundwater
- Atmospheric deposition (precipitation)











Pollutant transport models are used to estimate the origin of phosphorus to the Gulf of Mexico. http://toxics.usgs.gov/hypoxia/hypoxic_zone.html

 WDNR is studying several watersheds in the state in order to develop plans to reduce impacts due to excessive phosphorus loads.





Pollutant modeling of the watershed above Tainter Lake shows that all land uses do not contribute phosphorus to the watershed equally. In these figures, point sources include municipal and industrial wastewater treatment plant discharges. "Urban" is phosphorus in stormwater from urbanized areas. (July 1999 SWRRB Report – Click <u>here</u> to see complete report) "Background" was estimated by simulating the conversion of all cropland and urban areas to grassland and eliminating all barnyards and point sources. As such, it is an estimate of the uncontrollable load outside the influence of land use decisions. Phosphorus often moves with eroded soil so modeling the loss and movement of soil helps us determine phosphorus sources. The darker shaded areas have higher soil loss. (1999 SWRRB Report)





Measures of Lake Quality

- Chlorophyll a (algal biomass)
- Algal bloom frequency
- Algal toxins
- Rooted aquatic plant density
- Water clarity
- Dissolved oxygen
- ♦ pH

For more information see <u>http://waterontheweb.org/under/waterquality/</u> <u>http://www.noble.org/AG/Wildlife/SecchiDisk/Index.htm</u> <u>http://www.uwsp.edu/cnr/uwexlakes/laketides/vol32-2/Text-only.htm#8</u> <u>http://dnr.wi.gov/lakes/bluegreenalgae/</u>

Tainter Lake Chlorophyll <u>a</u> vs. Total P Load



Models can simulate how Tainter Lake responds to phosphorus loading. This graph shows the effect of phosphorus reductions on the amount of chlorophyll *A*, a measure of algal biomass (June 1992 Lake Modeling report – Click <u>here</u> to see complete report).