



BEAR CREEK WATERSHED

Fact Sheet 70 Trophic State Evergreen Lake March 2020

The Bear Creek Watershed Association protects and restores water and environmental quality within the Bear Creek Watershed from the effects of land use.

Membership

Clear Creek County
 Jefferson County
 City of Lakewood
 Town of Morrison
 Aspen Park Metropolitan District
 Conifer Sanitation Association
 Denver Water Department
 Evergreen Metropolitan District
 Forrest Hills Metropolitan District
 Genesee Sanitation & Water District
 Geneva Glen
 Jefferson County School District
 Kittredge Water & Sanitation District
 West Jefferson County Metro District
 Tiny Town Foundation

Phosphorus is a vital nutrient for plants to convert sunlight into usable energy. It is essential to cellular growth and reproduction. It is one of the 20 most abundant elements in the solar system, and the 11th most abundant in the earth's crust.

Under natural conditions phosphorus is typically scarce in water. In the late 1960s scientists discovered phosphorus contributed by human activity to be a major cause of excessive algae growth and degraded lake water quality throughout the country.

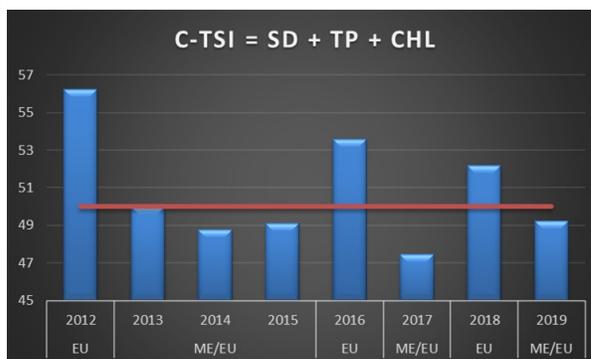
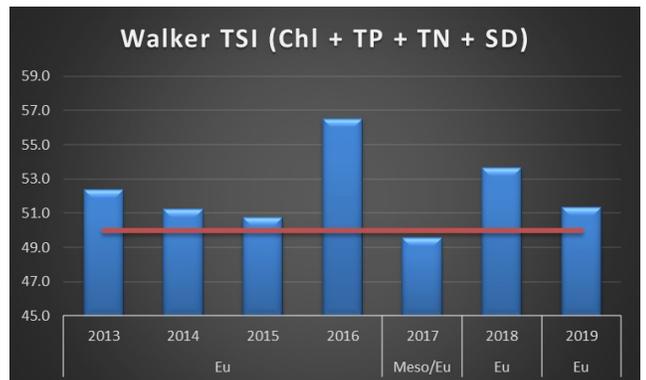
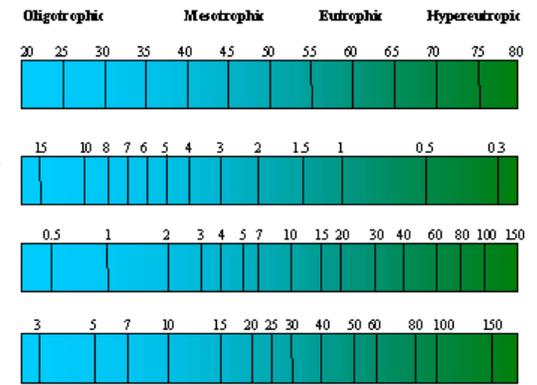
Phosphorus and nitrogen are primary nutrients that in excessive amounts pollute our lakes, streams, and wetlands. Nitrogen is essential to the production of plant and animal tissue. It is used primarily by plants and animals to synthesize protein. Nitrogen enters the ecosystem in several chemical forms and also occurs in other dissolved or particulate forms, such as tissues of living and dead organisms.

Evergreen Lake (Stream Segment 1d) is a small reservoir (669 acre-feet) constructed in 1927 by the City and County of Denver (BCWA Fact Sheet 8 Evergreen Lake Management & Monitoring). The pool volume remains relatively constant at about 514 acre-feet. The segment is designated by the Water Quality Control Commission (Regulation #38) as a direct use water supply for the Evergreen community as operated by the Evergreen Metropolitan District. The Association began collecting additional water quality data beginning in 2013, which included parameters to assess the direct use supply quality. This additional data allows the Association to predict the trophic (nutrient) state of water quality in Evergreen Lake. The trophic state is a relative measure of the productivity of waterbody and ranges from Oligotrophic to Hypereutrophic.

Mesotrophic lake have medium levels of nutrients with intermittent higher levels of biological productivity. Mesotrophic lakes have clearer water with good light penetration (measured by Secchi depth) down to 10-30 feet. As nutrient loads increase and biological productivity increases, a waterbody becomes more eutrophic. This accelerated plant growth (measured by chlorophyll levels) increases oxygen supplies and triggers denser overgrowth of algae or aquatic flora. Eutrophic lakes usually have light penetration or transparency limited to less than 3 feet. As the dense algae layers lose light, the plants die and sink to the bottom where other biological processes breakdown the plant matter and cause the oxygen to crash. The loss of deep water oxygen then stresses or kills the aquatic animals. Tracking the trophic state of a waterbody is a management tool to help maintain the health of a waterbody.

Since trophic state data collection began in 2013, Evergreen Lake has balanced between being a mesotrophic lake and eutrophic system. Essentially, Evergreen Lake is at a tipping point in terms of water quality. Signs of advancing eutrophication are a major concern due to the direct use water supply designation. Advanced eutrophic waterbodies (such as Bear Creek Reservoir) can have taste and odor problems, high phytoplankton growth can clog water plant membranes, excessive plant growth can negatively impact both the current fishery and recreational uses. The Association uses

two established trophic state indices to estimate the trophic state. The Carlson index (C-TSI) relies on chlorophyll, total phosphorus, and Secchi depth to predict the trophic state. It also determines if a lake is nutrient balanced or is limited by either phosphorus or nitrogen. The Walker index (W-TSI) relies



on average or peak chlorophyll, total phosphorus, total nitrogen and Secchi depth. The ratio of nitrogen to phosphorus indicates Evergreen Lake is generally nutrient balanced with some earlier years showing nitrogen limitation. Carlson and Walker indexes are showing similar trends towards advancing eutrophication.

TSI Scale	
0-25	Oligotrophic
25-30	Oligotrophic-Mesotrophic
30-45	Mesotrophic
45-50	Mesotrophic-Eutrophic
50-65	Eutrophic
65+	Hypereutrophic