

Sources:

Excerpt regarding Phosphorous Loading Estimates by LimnoTech. For full document visit the Higgins Lake Land Conservancy Website.
<http://www.higginslakelandconservancy.com/>



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Memorandum

From: Derek Schlea, Dave Dilks

Date: November 1, 2021

To: Jack Cornell, Robert Frye

CC:

SUBJECT: Evaluation and critique of Higgins lake phosphorus loading estimates

Introduction

LimnoTech was contracted by the Higgins Lake Land Conservancy to provide water quality-related services for understanding phosphorus loading to Higgins Lake, located in Roscommon County, Michigan. The objective of this effort was to compile, review, and critique previous studies that estimated phosphorus loading to Higgins Lake. Emphasis was placed on critiquing load source estimates from the Higgins Lake Watershed Management Plan (Huron Pines, Inc. 2007), which was referenced in materials advocating for a public sanitary sewer system that suggested "over 99% of the total phosphorus load" to the lake comes from septic systems (Fleis & VanderBrink 2019). This review focused on three aspects of the 2007 study: 1) mathematical errors, 2) transcription errors, and 3) validity of assumptions. This effort also included review of other local, regional, and state studies with information relevant to variability in phosphorus loading from different pathways.

Three modifications to the loading summary table were made. First, we included the 1,032lbs- p/year estimated by Huron Pines, Inc. (2007) for the watershed loading component, which apparently was inadvertently omitted from the summary table in the watershed management plan. We did not attempt to scrutinize or modify this value. Second, we modified the septic system loading according to the four items identified above: (1) corrected the unit conversion from mg- p/day to lbs-P/year, (2) increased the daily average septic system flow rate to 379liters/day, (3) decreased the septic tank effluent concentration to 9 mg P/L, and (4) assumed a 60% attenuation of phosphorus between the septic tank effluent and Higgins Lake. The daily average septic flow rate was assumed from 50 gallons/person/day, times two persons per septic system and converted to liters/day. The septic tank effluent concentration of 9 mg/L was the median of the 6-12 mg P/L range suggested by USEPA (2002). The 60% attenuation accounts for reduction of phosphorus in drain fields and other soil layers and was determined from the median of the 40-80% range suggested by OEPA (2020). Third, we assumed a 75% reduction in lawn fertilizers to account for presumed reductions in residential phosphorus fertilizer use after Michigan adopted restrictions that went into effect in 2012 (MDARD 2011). The resulting modified annual phosphorus loading estimates and relative proportions for each source category are shown in Table 3.

Table 3: Modified annual phosphorus loading estimates for six source categories described in the 2007 Watershed Management Plan.

Source	Phosphorus (lbs-)	Proportion
Shoreline erosion	80	1.3%
Road/stream crossing	28	0.4%
Road end erosion	105	1.7%
Septic systems	4,965	79.2%
Fertilizer usage	56	0.9%
Watershed runoff	1,032	16.5%
TOTAL	6,266	