



EPA Region 7 TMDL Review

TMDL ID: IA 03-SKU-00650-L_0
Document Name: LAKE GEODE

State: IA

Basin(s): SKUNK RIVER BASIN
HUC(s):
Water body(ies): LAKE GEODE
Tributary(ies): CEDAR CREEK
Pollutant(s): E. COLI, PH, PHOSPHORUS

Submittal Date: 5/6/2009

Approved: Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.

The TMDL for Lake Geode was formally submitted by a letter February 23, 2009 from the Iowa Department of Natural Resources (IDNR) and received by the Region 7, United States Environmental Protection Agency (EPA) on March 6, 2009. A revised version of the TMDL was submitted by e-mail attachments on July 16, 2009 and September 9, 2009.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.

The LC is set through the use of a lake response model to target the annual amount of total phosphorus (TP) that Lake Geode can receive to meet its designated uses. High pH in the lake is associated with photosynthesis by algae, for which TP is the limiting nutrient. Carlson's trophic state index (TSI) was used to evaluate the relationships between TP, algae (chlorophyll-a), and transparency (Secchi depth (SD)) in Lake Geode. The LC for Lake Geode is set at 8,576 pounds per year (lbs/yr) (average annual) for TP which calculates to 111 lbs/day (maximum daily) to achieve a chlorophyll-a concentration of 16.5 micrograms per liter (ug/L). The targeted TSI values for TP and chlorophyll-a are 60 and 65 respectively. The TSI value for SD is 47. To meet the target loads, a reduction of 39.8 percent of the TP load is required. For pH, the submittal states that pH shall not be less than 6.5 nor greater than 9.0.

The LC for *E. coli* is set based on both single sample maximum concentration of 235 colony-forming units (cfu) per 100 milliliters (ml) and a geometric mean concentration of 126 cfu/100 ml. The LC was determined by use of a near shore beach value calculation. For example, segment IA 03-SKU-00650-L_0, the maximum LC is 1.68E+11 cfu/day and the geometric mean LC is 2.95E+11 cfu/day.

EPA agrees that attainment of the LCs should result in the attainment of WQS.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site

specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

The designated uses listed for Lake Geode are Primary Contact Recreation (A1), Class B (LW), Drinking water supply (C), and Fish Consumption (HH). The specific water quality criteria for these designated uses listed below are published in the Environmental Protection Rule 567, Chapter 61 WQS:

Subrule 61.3(5) for Class A waters and pH states, "The pH shall not be less than 6.5 nor greater than 9.0. The maximum change permitted as a result of a waste discharge shall not exceed 0.5 pH units."

Subrule 61.3(5) 6(1) for Class B (LW) waters states, "The minimum value at any time during 24-hour period should be 5.0 mg/L." The value 5.0 mg/L applies only to the upper layer of stratification in lakes.

Subrule 61.3(3) states, "The waters shall contain no substances in concentrations which will make fish or shellfish inedible due to undesirable tastes or cause a hazard to humans after consumptions." Specific toxic chemical criteria were also available.

Applicable WQS as it pertains to Lake Geode is referenced from the 2006 305(b) report that states that primary contact recreation in Lake Geode is "not supported" due to high levels of indicator bacteria, specifically *E. coli*, that violate the state WQS. Primary contact recreation is also impaired due to violations of the WQS by high pH levels. In addition, high pH has resulted in the warm water aquatic life designated use to be assessed as impaired ("partially supporting").

The pollutant causing the impairment of the WQS are *E. coli* bacteria. *E. coli* bacteria concentrations exceed the Class A1 criteria of single-sample maximum = 235 cfu/100 ml and geometric mean (5 samples in 30 days) = 126 cfu/100 ml. These standards apply during the recreation season (March 15 to November 15).

The translation of the narrative standards using a numeric phosphorous target, was derived through the use of models. The models included the Generalized Watershed Loading Function (GWLF) and eutrophication model (BATHTUB), an empirical receiving water quality model that was developed by United States Army Corps Engineers.

Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

TSI values of 65 for chlorophyll-a, 47 for SD, and 60 for TP were the established criteria used as surrogate measures for excess algae within the lake. To achieve attainment of WQS, the submittal states that pH shall not be less than 6.5 nor greater than 9.0. Water quality data show that pH in Lake Geode is positively correlated to the amount of algae, as represented by a green pigment present in algal cells called chlorophyll-a. Phosphorus is the limiting nutrient for algal growth in Lake Geode, the TMDL target is based on the amount of phosphorus the lake can assimilate without causing algal blooms and subsequent pH violations of the WQS. The critical condition for the occurrence of algal blooms and pH violations is the growing season (April through September).

The TP load to Lake Geode originates entirely from external watershed loads, internal recycling loads, and a small amount of atmospheric direct deposition load on the lake surface. The allowable in-lake chlorophyll-a concentration was established by simulating lake water quality using the BATHTUB model. TP is expressed as both maximum annual average and a daily maximum load. The average annual LC is 8,576 lbs/yr and the allowable maximum daily load LC is 111 lbs/day. To meet the pH criterion, the TP load must be reduced by 39.8 percent.

The linkage for *E. coli* bacteria is direct. *E. coli* is allocated to address the impairment. Both the single sample maximum 235 cfu/100 ml and the geometric mean of 126 cfu/100 ml criteria are addressed in the submittal. The allocations calculated are based on the single sample maximum so a daily maximum load can be allocated. To account for natural variability, to meet water quality criteria, and to satisfy the recommendations put forth in the November 2006 EPA memorandum, two target loads were set for this TMDL: a median daily *E. coli* load of 1.68E+11 cfu/day to represent dry to normal conditions, and a maximum daily load of 2.95E+11 cfu/day, which is the 95th percentile load and represents wet to high-flow conditions. To meet the *E. coli* WQS, the median daily *E. coli* load must be reduced by 93.8 percent, and the maximum daily load must be reduced by 93.5 percent.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.

There are no permitted sources of phosphorus in the lake watershed. Sources accounted for, as nonpoint sources of phosphorus, for this TMDL, which are contributing to high pH levels, include livestock manure application, cattle in streams, livestock grazing, geese, other wildlife, septic systems, phosphorus fertilizer, sheet and rill erosion, and gully erosion.

Based upon the information currently before us, the state's decision to apply the discharges associated with unpermitted sources to the LA, as opposed to the WLA for purposes of this TMDL is acceptable. The decision to allocate these sources to the LA does not reflect any determination by EPA as to whether they are, in fact, unpermitted point source discharges within this watershed. In addition, by approving these TMDLs with some sources treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated \sum WLA in this TMDL. WLA in addition to that allocated here is not available.

Livestock manure application, cattle in streams, livestock grazing, geese, other wildlife, and septic systems also contribute *E. coli* pollution to Lake Geode.

EPA agrees the submittal considers all known significant sources.

Allocation - Loading Capacity

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2 (i)]. If this is a phase II TMDL the change in LC will be documented in this section.

Allocations were set using models BATHTUB and GWLF. The LC for Lake Geode is 8,576 lbs/yr or 111 lbs/day for TP. The WLA is zero. The LA is 7,718 lbs/yr or 100 lbs/day TP.

Using the relationship established between chlorophyll-a and pH, an in-lake target of 16.5 ug/L of chlorophyll-a was developed. This in-lake target was related to TP loading using BATHTUB simulations, discussed at the end of section D.3 of Appendix D in this TMDL.

Two target loads were set for this TMDL: a median daily *E. coli* load of 1.68E+11 cfu/day to represent dry to normal conditions, and a maximum daily load of 2.95E+11 cfu/day, which is the 95th percentile load and represents wet to high flow conditions.

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

There are no permitted point sources in the Lake Geode watershed. The WLA is set at zero.

It should be noted that Geode State Park historically used a lagoon for wastewater treatment within the park. This lagoon was not permitted, and wastewater was pumped from the lagoon and hauled from the watershed since 2003. The lagoon was replaced with separate on-site zero discharge treatment systems in the summer of 2008. The TP loads from the onsite wastewater systems in the park were not incorporated into the TMDL.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.

The LA is set at 7,718 lbs/yr, or 100 lbs/day TP.

The entire *E. coli* bacteria impairment of Lake Geode is attributed to nonpoint sources of pollution, including natural/background loading. The LA for the *E. coli* TMDL is based on the applicable WQS for the lake's designated uses. The median daily LA is 1.68E+11 cfu/day, and the maximum daily LA is 2.95E+11 cfu/day.

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

The MOS is set at an explicit 10 percent. This is equivalent to 858 lbs/yr of TP (11 lbs/day of TP).

An explicit MOS of 10 percent was set in the development of this TMDL for *E. coli*. This equates to 1.68E+10 cfu/day for dry to normal conditions, 2.95E+10 cfu/day for wet conditions.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

The pH TMDL is based on annual TP loading. Critical TP loads and pH increases both generally occur during the growing season, long-term annual TP loads must be controlled. The *E. coli* TMDL is based on the primary contact recreation season, which runs from March 15 to November 15. Both dry to normal and wet to high-flow conditions were considered.

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

In the early stages of TMDL development, an agency stakeholder meeting was conducted at the Geode State Park office on January 24, 2008.

The draft TMDL was posted on the IDNR website on December 31, 2008 and comments were accepted from December 31, 2008 to February 9, 2009. On January 15, 2009, a public meeting was held in Danville, Iowa to obtain comments and input. Over 30 citizens attended this meeting, not including state agency personnel. A community-based planning process for watershed improvement and lake restoration was also discussed.

IDNR received one electronic comment on the draft Lake Geode TMDL Water Quality Improvement Plan. The comment and IDNR's response letter are included in Appendix F of the TMDL.

The original drafts of the TMDL documents were revised based on comments received through the 2008 public comment period. All comments were considered.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

Future water quality data collection in Lake Geode to assess water quality trends and compliance with WQS is expected to include monitoring conducted as part of the IDNR Beach Monitoring Program and the IDNR Ambient Lake Monitoring Program. At least three sampling events are scheduled every summer, typically between Memorial Day and Labor Day.

Reasonable Assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

Reasonable assurances are not required as there are no point sources in the watershed.