UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO ATTENTION OF

WW-16J

April 28, 2021

Glenn Skuta, Watershed Division Director
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Subject: Approval of the Kettle River-Upper St. Croix River Watershed TMDL

Dear Mr. Skuta:

The U.S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Loads (TMDLs) for the Kettle River-Upper St. Croix River Watershed, including supporting documentation and follow up information. The Kettle River-Upper St. Croix Watershed is located in northeast Minnesota. The TMDLs were calculated for phosphorus and *E. coli* to address the impaired Aquatic Recreation Use.

EPA has determined that these TMDLs meet the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, EPA hereby approves Minnesota's 22 TMDLs for the Kettle River-Upper St. Croix River Watershed. The statutory and regulatory requirements, and EPA's review of Minnesota's compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Minnesota's effort in submitting these TMDLs, and look forward to future submissions by the State of Minnesota. If you have any questions, please contact Christine Urban of the Watersheds and Wetlands Branch at urban.christine@epa.gov or 312-886-3493.

Sincerely,

Digitally signed by TERA FONG
Date: 2021.04.28 16:32:23 -05'00'

Tera L. Fong
Division Director, Water Division

Enclosure

cc: Celine Lyman, MPCA
Karen Evans, MPCA

wq-iw6-14g

TMDL: Kettle and Upper St Croix Rivers, MN Watershed TMDL, Minnesota
Date: 4/28/2021

DECISION DOCUMENT FOR THE APPROVAL OF THE KETTLE AND UPPER ST CROIX RIVERS WATERSHED TMDLS, MN

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see Section 2 below).

The TMDL submittal should include an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

(1) The spatial extent of the watershed in which the impaired waterbody is located;
(2) The assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) Population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
(4) Present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and

(5) An explanation and analytical basis for expressing the TMDL through *surrogate measures,* if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll-a (chl-a) and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

<u>Comments:</u>

Waterbody and Pollutant of Concern

The Kettle and Upper St Croix River (KUSC) TMDL addresses 10 stream reaches that are impaired due to *E. coli* bacteria and 12 lakes that are impaired due to phosphorus in in the Kettle River and Upper St. Croix River watersheds. Table 1 of this Decision Document lists the assessment unit IDs (AUID) and their impacted recreation designated uses based on Northern Lakes and Forest (NLF) ecoregion standards for the Kettle River and Upper St. Croix River Watersheds.

Location Description/Spatial Extent

The Minnesota Pollution Control Agency (MPCA) submitted a total of 22 TMDLs for waters within the KUSC watershed. The KUSC watershed boundaries, as shown by Figure 1 in the TMDL, contain portions of four counties in east-central Minnesota: Pine, Kanabec, Aitkin, and Carlton. MPCA also provides a map of the TMDL subwatersheds and the impaired assessment unit locations within the KUSC watershed, respectively (Figure 2 of the TMDL).

The majority of the Upper St. Croix River Watershed is in Wisconsin; the Wisconsin portion of the watershed is not addressed in this TMDL decision. The area of Upper St Croix watershed that is in Minnesota is 543 square-miles (347,719 acres) in size and lies completely within Pine County (Figure 2 of the TMDL). The 10 Kettle River *E. coli* impaired reaches that are addressed in this TMDL cover approximately 79 stream miles and drain approximately 300 square miles (191,000 acres) of land (Table 5 of the TMDL). The streams and tributaries within each of the two main rivers in the KUSC watershed flow to the St. Croix River, which marks the boundary of Minnesota and Wisconsin. (Section 3 of the TMDL). The St Croix River ultimately joins with the Mississippi River Watershed south of the TMDL study area near Hastings, Minnesota.

Table 1. Kettle and Upper St. Croix River TMDL Watershed TMDL waterbodies

TMDLs Identified in the KUSC Watershed TMDL					
Reach/Lake Name	**Assessment Unit ID** or MN DNR Lake #**	**Year Listed**	**Affected Designated Use**	**Use Class**	**Pollutant**
Grindstone River	501	1996	Aquatic Recreation	2B, 3C	*E. coli*
Split Rock River	513	2020*	Aquatic Recreation	2B, 3C	*E. coli*
Grindstone River, S. Branch	516	2002	Aquatic Recreation	2B, 3C	*E. coli*
Judicial Ditch	526	2020*	Aquatic Recreation	2B, 3C	*E. coli*
Kettle River	529	2020*	Aquatic Recreation	2B, 3C	*E. coli*
Grindstone River N. Branch	541	2010	Aquatic Recreation	2B, 3C	*E. coli*
Grindstone River N. Branch	544	2002	Aquatic Recreation	2B, 3C	*E. coli*

Unnamed Creek	546	2020*	Aquatic Recreation	2B, 3C	*E. coli*
Spring Creek	550	2020*	Aquatic Recreation	1B, 2A, 3B	*E. coli*
Pine River	631	2020*	Aquatic Recreation	2B, 3C	*E. coli*
Lakes					
Big Pine	58-0138-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Elbow	58-0126-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Eleven	33-0001-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Fox	58-0102-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Grace	58-0029-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Grindstone	58-0123-00	2020*	Aquatic Recreation	1B, 2A, 3B	phosphorus
McCormick	58-0058-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Merwin	09-0058-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Oak	58-0048-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Pine	01-0001-00	2012	Aquatic Recreation	2B, 3C	phosphorus
Rhine	58-0136-00	2020*	Aquatic Recreation	2B, 3C	phosphorus
Twentynine	09-0022-00	2020*	Aquatic Recreation	2B, 3C	phosphorus

* - impairments are included on the Draft MPCA 2020 Impaired Waters 303(d) list, which is subject to approval by EPA
** - All streams are part of the same Hydrologic Unit Code (HUC) 07030003

Land Use:
The Kettle River portion of the KUSC TMDL watershed spans 1,051 square-miles (672,924 acres), split between 4 counties with the majority of watershed in Pine County (53%). The land uses in the are slightly different in the two major watersheds in the study area. The top two Kettle River Watershed land uses are forest (39%) and wetland (38%). The next largest land use categories for Kettle River are pasture/hay (14%), followed by developed (4%), open water (3%) and cultivated land (2%). The Upper St. Croix River subwatersheds are dominated by forest at 52% (primarily deciduous forest) and wetlands (34%), followed by pasture/hay (8%), developed (2%), cultivated (2%) and open water (1%) (Table 6 and Figure 3 of the TMDL). Sandstone (pop. 2,849) and Moose Lake (pop. 2,751) are the largest cities in the Kettle River Watershed. Askov (pop. 364) is the largest population center in the Upper St. Croix River Watershed and the only community that participated in the 2010 Census. There are no cities in either watershed that are subject to MPCA's Municipal Separate Storm Sewer System (MS4) Permit program. MPCA noted that Mille Lacs Band of Ojibwe is the only Native American Tribe with lands within the KUSC watershed. The Tribal lands were excluded from the TMDL and are not included in this TMDL decision.

Problem Identification:
Most of the TMDL waterbodies in this study will be placed on the MPCA 2020 303(d) list of impaired waters (Table 1 of this Decision Document and Table 1 of the TMDL). Six of the ten rivers/streams in the TMDL study area were placed on the 2020 303(d) list due to *E. coli* impairments, and the remaining four with *E. coli* impairments were originally placed on 303(d) lists in 1996, 2002 or 2010. Of the 12 lakes listed as impaired due to phosphorus, Pine Lake is the only water originally listed on the 2010 303(d) list, the remaining 11 are being listed on the 2020 TMDL list.

MPCA noted that only data available through the MPCA's Environmental Quality Information System (EQuIS) through the 2018 field season (and after the 2000 field season) were used in this TMDL. Table 7 of the TMDL (*E. coli*) and Table 8 of the TMDL (phosphorus) summarize the data used to assess the waterbodies. Daily average flows were simulated using the MPCA's HSPF model for the Kettle River and Upper St. Croix River watersheds. MPCA utilized HSPF simulated flows for each impaired lake and reach for model years 1995 through 2009. For the years in which HSPF simulated flows are not available, MPCA used regression relationships that were established between each impaired reach/lake and the Kettle River USGS station (05336700), which has operated continuously since 1968. Appendix A of the TMDL shows the water quality assessment basis for listing each the waters.

Pollutants of Concern
MPCA developed a total of 22 TMDLs to address aquatic recreation impaired designated uses. MPCA developed ten *E. coli* TMDLs to address bacteria-impaired streams and twelve phosphorus TMDLs to address eutrophication-impaired lakes.

E. coli
E. coli bacteria is an indicator organism usually associated with fecal matter contamination. These organisms can be found in the intestines of warm-blooded animals (humans and livestock). The presence of *E. coli* bacteria in water suggests the presence of fecal matter and associated bacteria, viruses, and protozoa that are pathogenic to humans when ingested. MPCA summarized *E. coli* sampling data collected from the waterbodies of the KUSC watersheds from April through October from 2000-2018 in Table 7 of the TMDL and provided the percent exceedance of chronic and number of exceedances of the acute *E. coli* criteria used to determine the waters' impairment status (Section 3.5.1 of the TMDL). Exceedances of both the geometric mean portion of the criteria as well as the single sample maximum were recorded. In Section 5.1 of the TMDL, MPCA presents results of MPCA's TMDL analysis for *E. coli* in the KUSC reaches.

Total Phosphorus
Phosphorus is an essential nutrient for aquatic life, but elevated concentrations of phosphorus can lead to nuisance algal blooms that negatively impact aquatic life and recreation (swimming, boating, fishing, etc.). Excess algae increase turbidity which degrades aesthetics and causes adverse ecological impacts. Algal decomposition depletes oxygen levels stressing aquatic biota (fish and macroinvertebrate species). Oxygen depletion can cause phosphorus release from bottom sediments (i.e. internal loading), which contributes to increased nutrient levels in the water column. Excess phosphorus can alter biological communities by shifting species

composition toward organisms better suited to excess levels of phosphorus. In Section 3.5.2 and Table 8 of the TMDL, MPCA presents data results of samples collected for phosphorus, chlorophyl-a, and secchi disk transparency from June through September for the years 2000 through 2018.

Pollutant Sources
MPCA provides an overview of the pollutant source loads in Section 3.6 of the TMDL. The KUSC watershed sources are primarily attributed to nonpermitted sources. There are also state-permitted and non-permitted animal operations in the TMDL watershed. MPCA identifies Hinkley as the only the municipality in the KUSC watershed with a WWTP that is upstream from impaired segments 550, 501, 516, and 544 (Table 11 of the TMDL). MPCA indicates that that there are some natural sources of *E. coli* loading in the TMDL area. The pollutants and their corresponding sources are identified and described below.

MPCA also identified sources of phosphorus to the lakes in the TMDL watershed (Section 3.6.2 of the TMDL). Sources include urban stormwater, local watershed runoff, septic systems, and internal loading.

E. coli
MPCA identified several potential sources of *E. coli* impairing streams within the watershed (Section 3.6.1 of the TMDL). Tables 9, 10, 11, 12, and 13 of the TMDL describe sources of *E. coli* in the various subwatersheds, including permitted wastewater. Table 14 of the TMDL summarizes MPCA's analyses and estimates of the relative potential contributions of State-permitted livestock sources. The evaluation of unpermitted livestock contributions is presented in Table 16 of the TMDL.

Point sources - *E. coli*
Wastewater Treatment Facilities (WWTFs) - NPDES permitted facilities may contribute bacteria loads to surface waters through discharges of treated wastewater. Permitted facilities must discharge treated wastewater according to their NPDES permit. MPCA identified one WWTF in the KUSC watersheds which contributes bacteria from treated wastewater releases to segments impaired by bacteria. The City of Hinckley is the only municipality that contributes directly to impaired reaches addressed in this TMDL. MPCA assigned a portion of the bacteria wasteload allocation (WLA) to the facility. MPCA reviewed discharge monitoring data (Appendix D of the TMDL) from the Hinckley WWTF that discharges to Grindstone River Reach 501, and noted that *E. coli* effluent concentrations are routinely below the *E. coli* standard and therefore does not consider this a significant discharge for this reach.

Concentrated Animal Feedlot Operations (CAFOs) - CAFOs are generally defined as having over 1000 animal units confined for more than 45 days in a year. MPCA summarizes potential livestock *E. coli* sources for each TMDL subwatershed AUID which contains either permitted CAFOs or feedlots present in the subwatershed that could be contributing to each *E. coli* impaired AUID are listed in Table 10 of the TMDL. No CAFOs are identified in this table as part of the drainage area to impaired reaches or lakes. Under MPCA NPDES permit requirements, discharges of pollutants from CAFOs are not allowed except under extreme circumstances (24-hour storm duration exceeding the 25-year recurrence interval), and therefore

MPCA assigned no portion of the WLA to the manure-handling facilities (WLA = 0). Runoff from the spreading of manure in agronomic rates is not regulated as a point source discharge and is therefore considered in the nonpoint source load discussed below.

Illicit discharges – MPCA calculated that bacteria production from Imminent Threat to Public Health and Safety (ITPHS) Subsurface Sewage treatment systems (SSTS) across the 10 impaired reach watersheds. The bacteria production was significantly low (8% or less) compared to livestock production. The production exercise estimates that the number of ITPHS SSTS range from approximately 25 systems in Reach 501 to 1 system in Reach 513, Reach 631, Reach 526, Reach 546, and Reach 550. MPCA noted that although these numbers are relatively low, ITPHS systems that discharge near an impaired reach or a major tributary may be a critical source, particularly during low flow conditions.

Municipal Separate Storm Sewer System (MS4) communities – MS4 discharges can contain bacteria due to stormwater runoff containing pet and wildlife waste. MPCA did not identify any communities with MS4 permits in the KUSC TMDL study area.

Combined Sewer Overflows (CSOs) and Sanitary Sewer Overflows (SSOs) – MPCA did not identify any CSOs or SSOs in KUSC TMDL watershed.

Nonpoint sources - *E. coli*

MPCA conducted a "desktop bacteria accounting exercise" using GIS layers and literature rates of livestock and domestic animals, 2010 census information and SSTS failure rates by county and wildlife population to estimate the relative contributions of *E. coli* to the KUSC TMDL stream and river reaches (Section 3.6.1 of the TMDL). In general, livestock animals were by far the biggest bacteria producer (85% to 99%) in the 10 impaired reach watersheds that have at least one MPCA registered feedlot. There were two impaired reach watersheds, Reach 526 and Reach 550, which do not contain any MPCA registered feedlots (Figure 4 of the TMDL).

Non-permitted Medium and Small Animal Feeding Operations (AFOs) - Animal operations in close proximity to surface waters can be a source of bacteria to waterbodies in the KUSC watershed. These areas may contribute bacteria via the mobilization and transportation of pollutant laden waters from feeding, holding and manure storage sites. These sites are not regulated under the NPDES CAFO permit program, but may be regulated under State regulatory authority. Runoff from agricultural lands may contain significant amounts of bacteria which could lead to impairments in the KUSC watershed.

State permitted AFO facilities must be designed to contain all surface water runoff from the production facilities (i.e., have zero discharge from their facilities) and have a current manure management plan. MPCA explained that these facilities do not discharge effluent and therefore were not assigned a portion of the LA.

Feedlots generate manure which may be spread onto fields as fertilizer. Manure runoff from fields can be exacerbated by tile drainage lines that channelize and hasten the stormwater flows and reduce bacteria die-off potential. Additionally, unrestricted livestock access to streams in pasture areas can add bacteria directly to the surfaces waters or resuspend bacteria laden sediment that had settled on the stream bottom. Direct deposition of animal waste can result in very high localized bacteria counts and may contribute to downstream impairments. Smaller animal facilities may add bacteria to surface waters via wastewater from these facilities or stormwater runoff from near-stream pastures. Table 14 of the TMDL identifies the number of potential livestock sources of bacteria in the subwatersheds.

SSTS or Unsewered Communities - Failing septic systems are a potential source of bacteria within the KUSC watershed. Septic systems generally do not discharge directly into a waterbody, but effluents from SSTS may leach into groundwater or pond at the surface where they can be washed into surface waters via stormwater runoff events. Age, construction, and use of SSTS can vary throughout a watershed and influence the bacteria contribution from these systems.

Wildlife and Pets - Deer, geese, ducks, raccoons, and other wildlife were found by the MPCA desk exercise to represent a small portion of the bacteria produced in the impaired reach watersheds (Section 3.6.1 of the TMDL). Since urban/developed land accounts for only 2% to 8% (Table 5 of the TMDL) of the land use within the impaired reach watershed, urban sources (i.e. geese, domestic pets) represent a small portion of the total bacteria produced in each of the impaired reach watersheds.

Phosphorus
MPCA provides a detailed breakdown of the estimated source contributions for total phosphorus in Figure 5 of the TMDL. Phosphorus source summary for each impaired lake in the KUSC watershed is in Table 15 of the TMDL.

Point sources
Wastewater Treatment Facilities (WWTFs) - NPDES permitted facilities may contribute phosphorus loads to surface waters through discharges of treated wastewater. MPCA did not identify any WWTFs in the lake TMDL watersheds (Section 4.2.2 of the TMDL).

Concentrated Animal Feedlot Operations (CAFOs) - MPCA did not identify any CAFOs in the subwatersheds for the lake TMDLs (Section 3.6 of the TMDL). CAFOs are generally defined as having over 1000 animal units confined for more than 45 days in a year. Under MPCA NPDES permit requirements, discharges of pollutants from CAFOs are not allowed except under extreme circumstances (24-hour storm duration exceeding the 25-year recurrence interval), and therefore no allocations were developed by MPCA for the manure-handling facilities (WLA = 0). Runoff from the spreading of manure in agronomic rates is not regulated as a point source discharge and is therefore considered in the nonpoint source load discussed below.

Municipal Separate Storm Sewer System (MS4) communities - No MS4 communities were identified by MPCA in the KUSC study area watersheds

Stormwater from Construction and Industry - Stormwater from construction and industrial sites may contribute sediment containing phosphorus to a waterway if the stormwater is untreated. This sediment may have phosphorus sorbed to the sediment particles and in turn be a source of phosphorus in the KUSC lake subwatersheds. It is unlikely that these are significant sources of phosphorus based upon the amount of urban/developed land in the study area (Section 3 of the TMDL).

Nonpoint Sources - Phosphorus

Watershed runoff - Runoff from agricultural lands may contain significant amounts of nutrients, organic material and organic-rich sediment, which may contribute to impairments in the KUSC watershed. Manure spread onto fields is often a source of phosphorus, and can be exacerbated by tile drainage lines, which channelize the stormwater. Tile lined fields and channelized ditches enable particles to move more efficiently into surface waters. Stormwater field runoff may contribute nutrients and organic-rich sediment to surface waters from livestock manure, fertilizers, vegetation and erodible soils. Stormwater from unregulated AFO feedlots can be high in nutrients. Furthermore, livestock with direct access to a waterway can directly deposit nutrients via animal wastes into a waterbody, which may result in very high localized nutrient concentrations.

Internal Loads - When phosphorus inputs are greater than the in-lake biological needs and phosphorus input is greater than export it can build up in lake sediment. Phosphorus then can be leached from sediments, released by physical disturbance from benthic fish (rough fish, ex. carp), mixing of the water column, low dissolved oxygen levels and by decaying curly-leaf pondweeds. MPCA noted that internal loading of phosphorus varies by lake. (Section 4.2.7 of the TMDL).

Atmospheric Deposition - Phosphorus and organic material may be added via wet and dry particulate deposition. Particles from the atmosphere may fall onto lake surfaces or other surfaces within the KUSC subwatersheds. Phosphorus can be bound to these particles which may add to the phosphorus inputs to surface water environments.

SSTS or Unsewered Communities - Septic systems generally do not discharge directly into a waterbody, but effluents from SSTS or failing SSTS may leach into groundwater or pond at the surface where they can be washed into surface waters via stormwater runoff events. Age, construction and use of SSTS can vary throughout a watershed and influence the nutrient contribution from these systems. The number of residents in each lake-shed was estimated using aerial photos to count the number of homes/cabins based on proximity to the lakes, and multiplied by the average number of people per household for the St. Croix River Basin and an adjustment factor for cabins used only four months each year. For areas not adjacent to the lakes, 2010 U.S. Census data was used. Phosphorus loads were then estimated (Section 3.6.2 of the TMDL).

Watershed Loads - The flow and phosphorus concentrations of watershed unregulated stormwater runoff to each lake was estimated using the Kettle and Upper St. Croix River HSPF models (Appendix E of the TMDL), except in the case of Pine and Grindstone Lakes, where monitored rather than modeled TP concentrations were used. HSPF-predicted average annual runoff depths and TP concentrations for the impaired lakes ranged from 10.5 to 18.4 inches/year and 37 to 70 milligrams per liter (µg/L), respectively. Appendix C of the TMDL contains a more detailed description of the watershed load broken down by the sub-categories.

Upstream Impaired Lake Loads - Big Pine and Grindstone Lakes are the only lakes in the Kettle River and Upper St. Croix River watersheds that contain impaired lakes in their drainage areas (Pine and Elbow Lakes, respectively). Outflow volumes from Pine and Elbow Lakes were estimated using the HSPF model and routed directly into Big Pine and Grindstone Lakes within the lake response models. Average annual TP loads from Pine Lake to Big Pine Lake and from Elbow Lake to Grindstone Lake were then calculated by multiplying the HSPF predicted flow volumes by the average summer growing season observed TP concentrations for Pine and Elbow Lakes.

Priority Ranking
As discussed in Section 1.3 of the TMDL, MPCA's schedule for TMDL completions, as indicated on the 303(d) impaired waters list, reflects Minnesota's priority ranking of this TMDL. The MPCA has aligned TMDL priorities with the watershed approach and Watershed Restoration and Protection Strategy (WRAPS) cycle. The schedule for TMDL completion corresponds to the WRAPS report completion on the 10-year cycle. Mainstem river TMDLs, which are not contained in major watersheds and thus not addressed in WRAPS, must also be completed. The MPCA developed a state plan, Minnesota's TMDL Priority Framework Report, to meet the needs of EPA's national measure (WQ-27) under EPA's Long-Term Vision for Assessment, Restoration and Protection under the CWA section 303(d) program. As part of these efforts, the MPCA identified water quality-impaired segments that will be addressed by TMDLs by 2022. The waters of the KUSC watershed addressed by this TMDL are part of the MPCA prioritization plan to meet EPA's national measure.

EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the first criterion.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy (40 C.F.R. §130.7(c)(l)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s), a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as dissolved oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comments:
The KUSC Watershed TMDL addresses twenty-two impaired waterbodies with TMDLs. The TMDLs address impaired segments not meeting the Aquatic Recreation Use Designations (Table 1 of this Decision Document). Section 2 of the TMDL describes the applicable water quality standards (WQS) for the impaired waterbodies. The impaired assessment units are shown in Figure 2 of the TMDL. Table 1 of this Decision Document also lists the pollutant associated with each impairment and Table 2 of the Decision Document summarizes the criteria for *E. coli* and phosphorus.

Designated Use
WQS are the fundamental benchmarks by which the quality of surface waters is measured. Within the State of Minnesota, WQS are developed pursuant to the Minnesota Statutes Chapter 115, Sections 03 and 44. Authority to adopt rules, regulations, and standards as are necessary and feasible to protect the environment and health of the citizens of the State is vested with the MPCA. Through adoption of WQS into Minnesota's administrative rules (principally Chapters 7050 and 7052), MPCA has identified designated uses to be protected in each of its drainage basins and the criteria necessary to protect these uses.

The TMDL report addresses the waterbodies that do not meet the standards for Class 1, 2, and 3 waters. All of the impaired streams and Lakes in this report are classified as Class 2B, and 3C, except for two waters. Spring Creek and Grindstone Lake, which are trout waters, are classified as Class 1B, 2A and 3B (Table 1 of this Decision Document; Section 2 of the TMDL). Class 2A waters are protected for the propagation and maintenance of a healthy community of cold water sport or commercial fish and associated aquatic life and their habitats. Class 2B waters are protected for the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life and their habitats. Both Class 2A and 2B waters are also protected for aquatic recreation activities including swimming and bathing (Section 2.1 of the TMDL). Minnesota Rule Chapter 7050 designates uses for waters of the state. All of the assessment units addressed by the KUSC TMDL are designated as Class 2 waters for aquatic recreation use (fishing, swimming, boating, etc.) and aquatic life use. The Class 2 designated use is as follows:

> "*Aquatic life and recreation includes all waters of the state that support or may support fish, other aquatic life, bathing, boating, or other recreational purposes and for which quality control is or may be necessary to protect aquatic or terrestrial life or their habitats or the public health, safety, or welfare.*"

Spring Creek and Grindstone Lake are designated by Minnesota as Class 1 waters or water for domestic consumption. The Class 1 designated use is as follows (in part):

> *"Domestic consumption includes all waters of the state that are or may be used as a source of supply for drinking, culinary or food processing use, or other domestic purposes and for which quality control is or may be necessary to protect the public health, safety, or welfare."*

For phosphorus and *E. coli*, there is no difference between Class 1 and Class 2 numeric criteria.

All waters in the TMDL study area listed as impaired for aquatic recreation use and are in the Northern Lakes and Forest Ecoregions and meet the class 2B designation. The applicable narrative criteria states:

> *"The quality of class 2B surface waters shall be such as to permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life and their habitats. These waters shall be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. This class of surface waters is also protected as a source of drinking water. The applicable standards are given below. Abbreviations, acronyms, and symbols are explained in subpart 1."*

Table 2: Minnesota Water Quality Standards - Numeric Criterion

Applicable Water Quality Standards					
Parameter	**Water Quality Standard**		**Units**	**Criteria**	**Applicable Time Period**
E. coli Class 1 & 2 streams	Not to exceed 126		org/100 mL	Monthly geometric mean of a least 5 samples within one calendar year	April 1st – October 31st
	Not to exceed 1,260		org/100 mL	Monthly upper 10th percentile	
Phosphorus – Northern Lakes and Forest Ecoregion 2A/ 2B Lakes	12[a]	≤30[b]	P µg/L	Concentration should not exceed	June 1st – September 30ith
	3[a]	≤ 9[b]	chl-a µg/L	Concentration should not exceed	
	4.8[a]	≥ 2.0[b]	meters	Secchi depth measurement should exceed	

a 2A waters NLF
b 2B waters NLF

E. coli

The applicable numeric criteria for the waters of the KUSC watershed are in Table 2 of this Decision Document. MPCA determined that the focus of these TMDLs is on the **126** organisms per 100 mL (126 orgs/100 mL) geometric mean portion of the standard for the Class 1 and 2 waters. Additionally, MPCA determined that using the geometric mean portions of the standards will result in the greatest bacteria reductions within the KUSC and will also result in the attainment the maximum portion of the standard. While the bacteria TMDLs will focus on the geometric mean portion of the water quality standard, attainment of both criteria of the water quality standard is required.

Phosphorus

Numeric criteria for phosphorus, chl-a, and Secchi Disk (SD) depth in lakes are set forth in Minnesota Rules 7050.0222. These three parameters form the MPCA eutrophication standard that must be achieved to attain the Aquatic Recreation Use. The numeric eutrophication criteria which are applicable to the KUSC lake TMDLs are found in Table 2 of this Decision Document.

By evaluating multiple lakes in multiple ecoregions, MPCA has determined that achieving these phosphorus targets will also achieve the targets for SD depth and chlorophyll-a.

MPCA indicated that there is a clear causal relationship between phosphorus, and the response variables, chl-a and Secchi depth. Therefore, MPCA anticipates that by meeting the phosphorus concentration of less than **12** or **30** µg/L will sufficiently address their respective chl-a and Secchi depth parameters in that ecosystem, achieving their designated beneficial uses. For lakes to achieve their designated beneficial use, the lake must not exhibit signs of eutrophication and must allow water-related recreation, fishing and aesthetic enjoyment. MPCA views the control of eutrophication as the lake experiencing minimal nuisance algal blooms and exhibiting desirable water clarity.

EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the second criterion.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation. TMDLs must take into account critical conditions for steam flow, loading, and water quality parameters as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(l)). TMDLs should define applicable critical conditions and describe their approach to estimating both point and nonpoint source loadings under such critical conditions. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:
Functionally a TMDL is represented by the equation:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS + RC,$$

where: LC is the loading capacity; WLA is the wasteload allocation; LA is the load allocation; MOS is the margin of safety; and (pursuant to MPCA rules) RC is any reserve capacity set aside for future growth. In the KUSC TMDLs, MPCA did not set aside any RC.

HSPF: MPCA explained that HSPF is a comprehensive modeling package used to simulate watershed hydrology and water quality on a basin scale. HSPF model applications can be used to determine critical environmental conditions (e.g., low/high flows or seasons) for the impaired segments by providing continuous flow and concentration predictions throughout the system and is often used in TMDLs, to estimate watershed runoff and pollutant loading to the impaired reaches. Depending on the available observed data, the model can document and simulate the link between land surface and subsurface hydrologic and water-quality processes, with corresponding stream, wetland, and reservoir processes. The package includes both an agricultural runoff model and a more general nonpoint source model. MPCA used the HSPF Model for a number of purposes in the KUSC watershed TMDL, as described in the development of the *E. coli* TMDL LC (Section 4.1.2 of the TMDL) and the Phosphorus TMDL LC (Sections 3.6.2 and 4.1.1 of the TMDL).

MPCA further explained that HSPF parametrizes numerous hydrologic and hydrodynamic processes to determine flow rate, sediment, and nutrient loads. HSPF used continuous meteorological records to create hydrographs, and to estimate time series pollution concentrations. MPCA used the HSPF model to predict the range of flows that have historically occurred in the modeled study area, the load contributions from a variety of point and nonpoint sources in a watershed, and the source contributions where data are limited for paired flow and concentration data. *The Kettle River and Upper St. Croix River Watersheds HSPF Model* (Appendix E of the TMDL) was developed to inform the KUSC Watershed Restoration and Protection Strategy (WRAPS) report and TMDL studies.

The output of the HSPF process is a model of multiple Hydrologic Response Units (HRUs), or subwatersheds of the overall KUSC. The KUSC Watersheds HSPF model validation used data from nearby MPCA/MDNR flow gages and USGS Gage 05336700 in the Kettle River (Appendix E of the TMDL). Flows generated from the model were used to develop flow duration curves for the KUSC *E .coli* TMDLs and was used along with in-lake monitoring data to develop nutrient budgets for each lake and set up the lake response models and TMDL equations for the lake TMDLs (Section 3.6.2 of the TMDL).

E. Coli

All of the stream TMDLs use the load duration curve (LDC) methods. Information about the models used and specifics related to their use for *E. coli* TMDL*s* (including the TMDL tables) can be found in Sections 3.6 and 4.1 of the TMDL. The *E. coli* TMDL summary tables can be found in Tables 3-12 in Attachment 1 of this Decision Document.

LDC - Flow Duration Curve (FDC) graphs have flow duration interval (percentage of time flow exceeded) on the X-axis and discharge (flow per unit time) on the Y-axis. For the KUSC TMDLs, FDCs were generated from the spatially relevant flow generated by their HSPF HRUs. The FDC were transformed into LDC by multiplying individual flow values by the WQS and then multiplying that value by a conversion factor. The resulting points are plotted onto a LDC graph. LDC graphs, have flow duration interval (percentage of time flow exceeded) on the X-axis and the pollutant load (count of colonies for *E. coli*) on the Y-axis. The curved line on a LDC graph represents the TMDL of the respective flow conditions observed at that location. Water quality monitoring was completed in the KUSC subwatersheds and measured pollutant concentrations were converted to individual sampling loads by multiplying the sample concentration by the instantaneous flow measurement observed/estimated at the time of sample collection. The individual sampling loads were plotted on the same figure with the created LDC. Individual LDCs representing each TMDL are found in Section 4 of the TMDL document.

The LDC plots were subdivided into five flow regimes; very high flow conditions (exceeded 0–10% of the time), high flow conditions (exceeded 10–40% of the time), mid-range flow conditions (exceeded 40–60% of the time), low flow conditions (exceeded 60–90% of the time), and very low flow conditions (exceeded 90–100% of the time). LDC plots can be organized to display individual sampling loads with the calculated LDC. Watershed managers can interpret LDC graphs with individual sampling points plotted alongside the LDC to understand the relationship between flow conditions and water quality exceedances within the watershed. Individual sampling loads that plot above the LDC represent violations of the WQS for those flow conditions. The difference between individual sampling loads plotted above the LDC and the LDC, measured at the same flow, is the amount of reduction necessary to meet WQS.

The LDC TMDL tables in this Decision Document report five points (the midpoints of the designated flow regime) on the loading capacity curve, but the components of the TMDL equation could be illustrated for any point on the entire loading capacity curve. The LDC method can be used to display pollutant monitoring data and allows for the estimation of load reductions necessary for attainment of the appropriate WQS. Using this method, daily loads were developed based upon the flow in the waterbody. Loading capacities were determined for the segment from multiple flow regimes. The TMDL tables identify the loading capacity for the waterbody at each flow regime. Although there are numeric loads for each flow regime the entire curve represents the TMDL and the LDC is what is ultimately approved by the EPA as a TMDL

The strengths of using the LDC method are that critical conditions and seasonal variation are considered in the creation of the FDC by plotting hydrologic conditions over the flows measured during the recreation season. Additionally, the LDC methodology is relatively easy to use and cost-effective. The weaknesses of the LDC method are that nonpoint source allocations cannot be assigned to specific sources, and specific source reductions are not quantified.
Overall, MPCA believes and EPA concurs that the strengths outweigh the weaknesses for the LDC method. The LDC approach is useful in determining loading capacities, wasteload allocations, load allocations and the margin of safety for *E. coli* TMDLs. The methods used are consistent with EPA technical memos.[1]

Typically loading capacities are expressed as a mass per time (e.g. pounds per day). However, for *E. coli* loading capacity calculations, mass is not always an appropriate measure instead, *E. coli* is expressed in terms of organism counts. This approach is consistent with the EPA's

[1] An Approach for Using Load Duration Curves in the Development of TMDLs https://www.epa.gov/sites/production/files/2015-07/documents/2007_08_23_tmdl_duration_curve_guide_aug2007.pdf

regulations which define “load” as “an amount of matter that is introduced into a receiving water”. To establish the loading capacities for the KUSC *E. coli* TMDLs, MPCA used Minnesota’s WQS for *E. coli* (in orgs/mL). A loading capacity is, “the greatest amount of loading that a water can receive without violating water quality standards.” Therefore, a loading capacity set at the WQS will assure that the water does not violate WQS. MPCA’s *E. coli* TMDL approach is based upon the premise that all discharges (point and nonpoint) must meet the WQS when entering the waterbody. If all sources meet the WQS at discharge, then the waterbody should meet the WQS and the designated use.

MPCA uses the geometric mean for *E. coli* counts to calculate loading capacity values for the *E. coli* TMDLs (126 orgs/100 mL). MPCA believes the geometric mean portion of the WQS provides the best overall characterization of the status of the watershed. EPA agrees with this assertion, as stated in the preamble of, “The WQS for Coastal and Great Lakes Recreation Waters Final Rule”, “…the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation, and more directly linked to the underlying studies on which the 1986 bacteria criteria were based.”[2] MPCA stated that the *E. coli* TMDLs will focus on the geometric mean portion of the WQS (126 orgs/100 mL) and that it expects that by attaining the geometric mean portion of the *E. coli* WQS the single sample portion of the *E. coli* WQS will also be attained. EPA finds these assumptions to be reasonable.

In addition to using the geometric mean, MPCA structures its WQSs to reflect when the highest potential for contact occurs (April 1st to October 31st). By targeting this critical exposure period MPCA can achieve the greatest overall protection. A review of historical data indicates that *E. coli* loading is a problem for the entire flow regime for most of the stream TMDLs. Some LDCs indicate more of a problem under higher flows, but there is often limited data for the lower flow regimes.

EPA supports the data analysis and modeling approach used by MPCA in its calculation of wasteload allocations, load allocations, and the margin of safety for the KUSC *E. coli* TMDLs. Additionally, EPA concurs with the loading capacities calculated by MPCA in the *E. coli* TMDLs. EPA finds MPCA’s approach for calculating the loading capacity to be reasonable and consistent with EPA guidance

Phosphorus
Canfield-Bachmann Lake Response Model - MPCA’s method to develop the phosphorus LC for each impaired lake in the KUSC watersheds utilized the Canfield Bachmann Lake Response (CBLR) model. The CBLR model estimates the lake phosphorus sedimentation rate, which is needed to determine the relationship between in-lake phosphorus concentrations and phosphorus load inputs. Phosphorus that settles out is less available for use for algal and plant growth (Canfield and Bachmann, 1981). MPCA explained that the model uses lake-specific data to determine the phosphorus concentration in each lake (Section 3.6.2 of the TMDL).

[2] 69 FR 67218-67243 (November 16, 2004) – https://Cwww.gpo.gov/fdsys/pkg/FR-2004-11-16/html/04-25303.htm

The model predictions are then compared to lake sampling data, and the model adjusted until a good fit was achieved. To set the LC for each impaired lake, the nutrient inputs were partitioned between sources in the lake response models and systematically reduced the source values until the model predicted that each lake met its ecoregion TP standard (Section 4.2.6 of the TMDL).

No reductions to atmospheric load were assigned since these loads were generally a small portion of the total load to the lake and the sources are extremely difficult to define and control. ITPHS SSTS are not allowed under Minnesota Rule and were not given a WLA. Section 3.6.2 of the TMDL discusses in more detail the methods used to estimate SSTS contributions. MPCA noted that upstream lakes may need reductions to ensure downstream lakes meet WQS. Internal loading was determined during the model operation. If the initial model results did not match the sampling data, internal load was added to the model until the model results more accurately matched the sampling data.

Additional detail about the CBLR analysis can be found in Appendix C of the TMDL.

The TMDL summary tables for the phosphorus TMDLs are found in Tables 15-24 in Attachment 2 of this Decision Document and in Section 4 of the TMDL.

EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the third criterion.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R.§130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources. levels of soil erosion from both stream channels and upland areas that would occur under natural conditions.

Comment:

E. coli

MPCA determined the LA for each *E. coli* stream impairment in the KUSC by subtracting the MOS and WLA from the total LC for each flow regime. Although MPCA did not further subdivide the LA by source type, MPCA did document estimated loadings from several source types, as noted in TMDL Summary Tables 3-12 in Attachment 1 of this Decision Document. Section 3.6.1 and Table 14 of the TMDL summarizes the actual or potential sources of bacteria loadings in the subwatersheds.

Phosphorus

MPCA determined the LA for each lake by subtracting the WLA and MOS from the LC determined for each lake. LAs were determined for atmospheric deposition, drainage area, septic systems, and internal load (for certain lakes) (Tables 13-24 of Attachment 2 of this Decision Document). MPCA also determined an allocation reduction needed from upstream lakes as appropriate. MPCA did not identify a natural background component of the LA (Section 4.2.3 of the TMDL).

EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the fourth criterion.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass-based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment:

E. coli

MPCA addresses the WLA for the KUSC *E. coli* TMDLs in Section 4.1.5 of the TMDL. The Hinckley WWTP is the only NPDES permitted surface wastewater discharger that is a source of *E. coli* bacteria that discharges to an *E. coli*-impaired reach (Reach 501) covered in this TMDL (Table 3 of Attachment 1 of this Decision Document). The WLA for the Hinckley WWTP was calculated by multiplying the facility's wet-weather design flow by the *E. coli* standard (126 cfu/100 mL). MPCA noted that NPDES wastewater permit limits for bacteria are currently expressed in fecal coliform concentrations, not *E. coli*. However, the fecal coliform permit limit for Hinckley WWTP (200 organisms/100 mL) is consistent with the *E. coli* limit of 126 cfu/100ml, and therefore will ensure a consistent level of protection.

As noted in Section 1 of this Decision Document, MPCA did not identify any MS4, CSO, or SSO discharges in the TMDL watersheds. MPCA explained that a WLA for construction or industrial stormwater was not determined, as these sites are not expected to contribute bacteria loads to the impaired waterbodies (Section 4.1.5 of the TMDL). MPCA also did not identify any CAFOs in the TMDL watersheds. MPCA stated that for CAFOs, under MPCA NPDES permit requirements, discharges of pollutants from CAFOs are not allowed except under extreme circumstances (24-hour storm duration exceeding the 25-year recurrence interval), and therefore

MPCA assigned no portion of the WLA to the manure-handling facilities (WLA = 0)(Section 3.6 of the TMDL).

EPA finds the MPCA's approach for calculating the WLAs for the KUSC watershed bacteria TMDLs to be reasonable and consistent with EPA guidance.

Phosphorus
MPCA described WLA methodology for the KUSC phosphorus TMDLs in Section 4.2.2 of the TMDL. The methods for identifying sources and establishing and comparing the relative importance of loads are found in Section 3.6.2 of the TMDL.

NPDES Permitted Wastewater Dischargers
MPCA determined that there are no permitted wastewater dischargers located in the watersheds draining to the impaired lakes covered in this TMDL.

NPDES Permitted MS4 Stormwater
MPCA determined that there are no permitted MS4s located in the watersheds draining to the impaired lakes covered in this TMDL

NPDES Permitted Construction and Industrial Stormwater
Construction and industrial stormwater WLAs were established based on estimated percentage of land in the Kettle River and Upper St. Croix River Watersheds currently under construction or permitted for industrial use. MPCA reviewed permits across the watershed (Section 4.2.2 of the TMDL) and determined that approximately 0.12% and 0.06% of the Kettle River and Upper St. Croix River watersheds have construction or industrial stormwater activity at any time. The percentage was multiplied by the drainage area value in the TMDL to determine the WLA.

TMDL Summary Tables 13-24 in Attachment 2 of the Decision Document present the allocations for the impaired lakes in the Kettle River and Upper St. Croix River watersheds.

EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the fifth criterion.

6. **Margin of Safety (MOS)**
The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(l)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comments:
E. coli
The KUSC TMDLs incorporated a 10% explicit MOS applied to the total loading capacity calculation for each flow regime of the LDC. Ten percent of the total loading capacity was

reserved for MOS with the remaining load allocated to point and nonpoint sources (Tables 3-12 of Attachment 1 of this Decision Document). MPCA explained that 10% was considered an appropriate MOS for the bacteria TMDLs because the LDC approach minimizes the uncertainty associated with developing TMDLs. For the bacteria TMDLs, MPCA also considered the fact that they did not include a rate of decay or die-off rate of pathogen species when calculating the TMDL or creating LDCs. As stated in the EPA's *Protocol for Developing Pathogen TMDLs* (EPA 841-R-00-002), many different factors affect the survival of pathogens, including the physical condition of the water.

Phosphorus
An explicit MOS of 10% was used for each of the impaired lake TMDLs (Section 4.2.4 of the TMDL; Tables 13-24 of Attachment 2 of this Decision Document). The KUSC River HSPF model was calibrated and validated using 15 years (1995 through 2009) of flow data from one USGS gaging station (USGS 5336700, Kettle River near Sandstone). Calibration results indicate that the HSPF model is a valid representation of hydrological and chemical conditions in the watershed. Appendix E of the TMDL provides additional information on the HSPF model calibration and validation results.

EPA agrees that this MOS accounts for any uncertainty attributed to the modeling efforts and finds that the TMDL document submitted by the MPCA satisfies the requirements of the sixth criterion.

7. **Seasonal Variation**
The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations (CWA §303(d)(l)(C), 40 C.F.R. §130.7(c)(l)).

Comment:
***E. coli*:**
MPCA addressed seasonal variation in Section 4.1.8 of the TMDL. Seasonal variation is taken into account in the *E. coli* TMDLs through the application of load duration curves. Load duration curves evaluate water quality conditions across all flow regimes including high flow, which is the runoff condition where pollutant transport and loading from upland sources tend to be greatest, and low flow, when loading from wastewater and other direct sources to the waterbodies has the greatest impact. Seasonality is accounted for by addressing all flow conditions in a given reach.

Phosphorus:
MPCA addressed seasonal variation in Section 4.2.5 of the TMDL. Seasonal variation is accounted for by using annual loads and developing targets for the summer period, where the frequency and severity of nuisance algal growth is the greatest. Although the critical period is summer, lakes are not sensitive to short-term changes in water quality, rather lakes respond to long-term changes such as changes in the annual load. Therefore, seasonal variation is accounted for in the annual loads. By setting the TMDL to meet targets established for the most critical period (summer), the TMDL will inherently be protective of water quality during the other seasons.

The frequency and severity of nuisance algal growth in Minnesota lakes is typically highest during the growing season. MPCA determined that by setting the TMDL to meet targets established for the most critical period (summer), the TMDL will inherently be protective of water quality during all other seasons. Established for the most critical period (summer), the TMDL will inherently be protective of water quality during all other seasons if the standards are met for the critical summer months. Seasonal variation is also addressed by the water quality standards' application during the period when high pollutant concentrations are expected via storm event runoff.

EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the seventh criterion.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a NPDES permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comment:

The KUSC bacteria and phosphorus TMDLs provide reasonable assurance that actions identified in the reasonable assurance and implementation sections of the final TMDL (i.e., Sections 6 and 8 of the TMDL), will be applied to attain the loading capacities and allocations calculated for the impaired reaches within the KUSC. The recommendations made by MPCA will be successful at improving water quality if the appropriate local groups work to implement these recommendations. Those mitigation suggestions, which fall outside of regulatory authority, will require commitment from state agencies and local stakeholders to carry out the suggested actions.

MPCA has identified several local partners which have expressed interest in working to improve water quality within the SMRW. Implementation practices will be implemented over the next several years. It is anticipated that staff from the KUSC Watershed counties (primarily Pine and Carlton County), and Soil and Water Conservation Districts (SWCDs), will work together to reduce pollutant inputs to the KUSC. MPCA has authored a "Final Kettle River-and Upper St. Croix River Watershed Restoration and Protection Strategy Report" (approved by MPCA on March 25, 2021) which provides information on the development of scientifically supported restoration and protection strategies for implementation planning and action. MPCA sees the WRAPS document as a starting point for which MPCA and local partners can develop tools that will help local governments, land owners, and special interest groups determine (1) the best strategies for making improvements and protecting resources that are already in good condition, and (2) focus those strategies in the best places to do work.

County SWCDs have a history of implementation efforts in the KUSC. SWCDs have a history completing water quality improvement projects with a well-developed infrastructure in place. In the WRAPS document MPCA outlines completed projects that have been effective in reducing pollutants loads to Minnesota waters. In 2016, the Carlton SWCD developed a Comprehensive Local Water Management Plan designed to evaluate and control pollutant impacts in the county. Pine County is in the process of updating the Pine County Water Plan to provide additional efforts in controlling pollutants in the KUSC watershed. Both SWCDs have ongoing monitoring efforts in the TMDL watershed, providing additional data and information on problems in the watershed. Selection of sites for new best management practices (BMPs) will be led by local government units (LGUs), including SWCDs, watershed districts, and county planning and zoning offices, with support from state and federal agencies. These BMPs are supported by programs administered primarily by the SWCDs, Board of Water and Soil Resources (BWSR), and the Natural Resource Conservation Service (NRCS).

For the TMDLs in this report, most of the pollutant loads are attributed to nonpoint sources. The existing state statutes/rules pertaining to nonpoint sources include:

- Average of a 50-foot buffer (minimum of 30 feet) required for the shore impact zone of streams classified as protected waters (Minn. Stat. § 103F.201) for agricultural land uses.
- 16.5-foot minimum width buffer required on public drainage ditches (Minn. Stat. § 103E.021).
- Protecting highly erodible land within the 300-foot shoreland district (Minn. Stat. § 103F.201).
- Excessive soil loss statute (Minn. Stat. § 103F.415).
- Nuisance nonpoint source pollution (Minn. R. 7050.0210, subp. 2).

Monitoring in the watershed will be conducted by volunteers and county/SWCDs as well as by MPCA. Continued water quality monitoring within the basin is supported by MPCA. Details of the monitoring approach were specified during the KUSC WRAPS process. Monitoring will also be conducted by state and local groups independent of the WRAPS schedule through the MPCA's Watershed Pollutant Load Monitoring Network and the Minnesota Department of Natural Resources (MDNR) Cooperative Stream Gaging program, both of which have provided useful long-term water monitoring data. The next intensive watershed monitoring in the next iteration of the Kettle River and Upper St. Croix River WRAPS project is scheduled to start in 2027 with waterbody condition assessments in early 2028.

Various funding mechanisms will be utilized to execute the recommendations made in the implementation section of this TMDL. The Clean Water Legacy Act (CWLA) was passed in Minnesota in 2006 for the purposes of protecting, restoring, and preserving Minnesota water. The CWLA provides the protocols and practices to be followed in order to protect, enhance, and restore water quality in Minnesota. The CWLA outlines how MPCA, public agencies and private entities should coordinate in their efforts toward improving land use management practices and water management. The CWLA anticipates that all agencies (i.e., MPCA, public agencies, local authorities and private entities, etc.) will cooperate regarding planning and restoration efforts. Cooperative efforts would likely include informal and formal agreements to jointly use technical, educational, and financial resources.

The CWLA also provides details on public and stakeholder participation, and how the funding will be used. In part to attain these goals, the CWLA requires MPCA to develop WRAPS. The WRAPS are required to contain such elements as the identification of impaired waters, watershed modeling outputs, point and nonpoint sources, load reductions, etc. (*Chapter 114D.26*; CWLA). The WRAPS also contain an implementation table of strategies and actions that are capable of achieving the needed load reductions, for both point and nonpoint sources (*Chapter 114D.26*, Subd. 1(8); CWLA). Implementation plans developed for the TMDLs are included in the table, and are considered "priority areas" under the WRAPS process (*Watershed Restoration and Protection Strategy Report Template*, MPCA). This table includes not only needed actions but a timeline for achieving water quality targets, the reductions needed from both point and nonpoint sources, the governmental units responsible, and interim milestones for achieving the actions. MPCA has developed guidance on what is required in the WRAPS (*Watershed Restoration and Protection Strategy Report Template*, MPCA).

The Minnesota Board of Soil and Water Resources administers the Clean Water Fund, and has developed a detailed grants policy explaining what is required to be eligible to receive Clean Water Fund money (FY 2014 Clean Water Fund Competitive Grants Request for Proposal (*RFP*); *Minnesota Board of Soil and Water Resources*, 2014).

National and State Wild and Scenic River and Outstanding Resource Value Water Status

The St. Croix National Scenic Riverway, which includes the Namekagon River in Wisconsin and the upper portion of the St. Croix, was established as part of the original National Wild and Scenic Rivers Act in 1968. The Lower St. Croix National Scenic Riverway was added in 1972 (Section 6.1.7 of the TMDL).

In 1975, the Kettle River was designated by the Federal government as both a Scenic (from the Carlton-Pine County line downstream to the [former] Kettle River dam site at Sandstone) and a Wild (from the [former] dam site downstream to its confluence with the Saint Croix River) River. The MPCA noted that these designations ensure preservation and restoration of continuous natural vegetation within the river's riparian corridor and the preservation of floodplains, which is critical to protecting and preserving wildlife, water quality, flood abatement and the scenic nature of the river.

Minnesota has designated the entire St. Croix and Kettle River tributary as Outstanding Resource Value Waters (ORVW). Under Minnesota Law, ORVW designation means that no new or expanded discharge of any sewage, industrial waste, or other waste is allowed unless there is no prudent, feasible alternative to the discharge. If allowed, the discharge is restricted to the extent necessary, to preserve the existing high quality, or to preserve the wilderness, scientific, recreational, or other special characteristics that make the water an ORVW.

MPCA provided the information in Table 39 of the TMDL (presented below in this Decision Document) which summarizes BMP activities in the KUSC Watershed.

Table 39 Reported BMPs in the KUSC Watersheds by type (2004-2019)

BMP Strategy Type	Total BMPs	
	Kettle	Upper St. Croix
Designed Erosion Control	1	3
Nutrient Management (Cropland)	26	23
Tillage/residue Management	1	2
Buffers and Filters	4	--
Stream Banks, Bluffs, and Ravines	29	--
Converting Land to Perennials	51	18
Tile Inlet Improvements	8	6
Living Cover to Crops in Fall/Spring	2	1
Drainage Ditch Modifications	4	--
Septic System Improvements	24	--
Pasture Management	58	13
Tile Drainage Treatment/Storage	3	--
Habitat and Stream Connectivity	72	19
Feedlot Runoff Controls	2	4
Other BMPs	452	201

Reasonable assurance that WLAs will be implemented is provided by regulatory actions. According to 40 CFR 122.44(d)(1)(vii)(B), NPDES permit effluent limits must be consistent with assumptions and requirements of all WLAs in an approved TMDL. MPCA implements its storm water and NPDES permit programs, and is responsible for making the effluent limits consistent with the WLAs in this TMDL.

In order to address pollutant loading in the KUSC, required point source controls will be effective in improving water quality if accompanied by considerable reductions in nonpoint source loading. Reasonable assurance for permitted sources such as stormwater, CAFOs, and wastewater is provided primarily via compliance with their respective NPDES/SDS permit programs, as described in Section 3.6 of the TMDL.

EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the eighth criterion.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that assess if load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment:

MPCA discusses the Monitoring Plan in Section 7 of the TMDL. MPCA has a comprehensive water quality monitoring program, Minnesota’s Water Quality Monitoring Strategy. This program is comprised of three monitoring programs: Intensive Watershed Monitoring, Watershed Pollutant Load Monitoring Network, and the Citizen Stream and Lake Monitoring Program. MPCA’s statewide monitoring program assesses the State’s waters on a ten-year rotating timeframe. This historical monitoring created the dataset that was used for the model development of the KUSC TMDL and will be used as a baseline to evaluate overall improvements in the watershed. The next intensive watershed monitoring in the next iteration of the KUSC WRAPS project is scheduled to start in 2027 with waterbody condition assessments in early 2028.

EPA finds that the ninth criterion has been adequately addressed.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment:

As was stated in the Reasonable Assurance section of this Decision Document, MPCA outlines various BMPs to be implemented providing a roadmap towards achieving WQS.

The findings from the KUSC TMDLs, WRAPS, and other existing plans will be used to support local working groups and jointly develop scientifically supported restoration and protection strategies. These goals will be accomplished through education and outreach, local ordinances, and BMPs. Various locally specific BMPs and restorations strategies outlined in the existing plans and in Section 8 of the KUSC TMDL can be found in the subsections below. Many of the BMPS will target both *E. coli* and phosphorus loads.

MPCA’s main approach to address bacteria and phosphorus loading is to increase understanding of the main sources and provide that knowledge to the residents of the watershed. Increased education and outreach to the general public bring greater awareness to the issues surrounding pollutant loading and strategies. Education efforts targeted to the general public are commonly used to provide information on the status of impacted waterways as well as to address pet waste and wildlife issues. Education can also be targeted to municipalities, land managers and other groups who play a key role in the management of bacteria and phosphorus sources.

Pasture Management/Livestock Exclusion Plans – Reducing livestock access to stream environments will lower the opportunity for direct transport of bacteria and phosphorus to surface waters. The installation of exclusion fencing near stream and river environments to prevent direct access for livestock, installing alternative water supplies, and installing stream crossings between pastures, would work to reduce the influxes of pollutants and improve water quality within the watershed. Additionally, introducing rotational grazing to increase grass coverage in pastures, and maintaining appropriate numbers of livestock per acre for grazing, can also aid in the reduction of bacteria inputs.

Manure Collection and Storage Practices – Manure has been identified as a source of bacteria and phosphorus. These pollutants can be transported to surface waterbodies via stormwater runoff. Bacteria and phosphorus laden water can also leach into groundwater resources. Improved strategies for the collection, storage and management of manure can minimize impacts of pollutants entering the surface and groundwater system. Repairing manure storage facilities or building roofs over manure storage areas may decrease the amount of bacteria and/or phosphorus in stormwater runoff.

Manure Management Plans – Developing manure management plans can ensure that the storage and application rates of manure are appropriate for land conditions. Determining application rates that consider the crop to be grown on that particular field and soil type will ensure that the correct amount of manure is spread on a field given the conditions. Spreading the correct amount of manure will reduce the availability of bacteria and phosphorus to migrate to surface waters.

Feedlot Runoff Controls – Treatment of feedlot runoff via diversion structures, holding/storage areas, and stream buffering areas can all reduce the transmission of pollutants to surface water environments. Additionally, cleaner stormwater runoff can be diverted away from feedlots to prevent contamination.

SSTS – Improvements to septic management programs and educational opportunities can reduce the occurrence of septic pollution. Educating the public on proper septic maintenance, repairing failing systems, and finding and eliminating illicit discharges could lessen the impacts of septic derived bacteria and phosphorus inputs into the KUSC.

Riparian Area Management Practices – Protection of streambanks within the watershed through planting of vegetated/buffer areas with grasses, legumes, shrubs or trees will mitigate bacteria and phosphorus inputs into surface waters. These areas will filter stormwater runoff before the runoff enters the main stem or tributaries of the KUSC.

MS4s – While not currently a source if future areas are placed under an MS4 permit, retention basins are often used as a primary mechanism for achieving any necessary WLA reductions.

Internal loading – Internal loading was a specific concern for the lake phosphorus TMDLs (Section 8.3.5 of the TMDL). MPCA stated that in-lake efforts may be needed to achieve water quality standards. MPCA strategies include internal loading control measures such as rough fish control, chemical binding of phosphorus, and a re-establishment of native vegetation. Additionally, MCPA has indicated that controlling lake levels may help mitigate phosphorus release from sediment. These practices in combination with watershed controls can reduce or eliminate the impact of internal loading on overall lake water quality.

EPA finds the tenth criterion has been adequately addressed. EPA reviews, but does not approve TMDL implementation plans.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(l)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comment:

Meetings and/or other informal communications with County and SWCD staff, other state agency staff, and other stakeholders were held at various points during the project. Opportunities were given to provide feedback on the TMDL methodology and review draft versions of the TMDL report. As part of implementing the communication plan for the watershed, two community outreach events were held near Grindstone Lake, Minnesota during development of the TMDL.

The public notice period on the draft TMDL report was provided via a public notice in the State Register from January 11, 2021 through February 10, 2021. The draft TMDL was posted online by the MPCA at (http://www.pca.state.mn.us/water/tmdl). No comments were received.

EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval.* Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for

EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment:
The EPA received the final KUSC watershed TMDL document, submittal letter and accompanying documentation from the MPCA on April 1, 2021. The transmittal letter explicitly stated that the final Kettle-Upper St. Croix Watershed TMDLs for *E. coli* and phosphorus were being submitted to EPA pursuant to Section 303(d) of the Clean Water Act for EPA review and approval. The letter also contained the name of the watershed as it appears on Minnesota's 303(d) list, and the causes/pollutants of concern. This TMDL was submitted per the requirements under Section 303(d) of the Clean Water Act and 40 CFR 130.

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of this twelfth element.

13. Conclusion
After a full and complete review, the EPA finds that the TMDLs for the Kettle and St. Croix Rivers Watershed TMDLs for *E. coli* and phosphorus meet all of the required elements of approvable TMDLs. This TMDL approval is for a total of **twenty two (22) TMDLs**: ten (10) *E. coli* TMDLs and twelve (12) phosphorus TMDLs. These TMDLs address impairments for aquatic recreational use impairments.

The EPA's approval of the these TMDLs extend to the waterbodies which are identified in this Decision Document with the exception of any portions of the waterbodies that are within Indian Country, as defined in 18 U.S.C. Section 1151. The EPA is taking no action to approve or disapprove the State's TMDLs with respect to those portions of the waters at this time. The EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under Section 303(d) for those waters.

EPA sent a letter to the Mille Lacs Band of Ojibwe in Minnesota. In the letter, EPA offered the Tribal representatives the opportunity to consult with the EPA regarding these TMDLs. EPA received no official response.

Attachment 1

Kettle and St Croix River Watershed – *E. coli* TMDL Summary

Table 3: *E. coli* TMDL summary, Grindstone River Reach 501

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Hinckley WWTP (MN0023701)	3	3	3	3	3
	Total WLA	3	3	3	3	3
Load	Total LA	880	277	111	38	11
	MOS	98	31	13	5	2
	Total load	981	311	127	46	16
	Existing Concentration Apr-Oct (org/100 mL)**	202				
	Maximum Monthly Geometric Mean (org/100mL)**	606				
	Overall Estimated Percent Reduction**	79%				

* Model simulated flow for HSPF reach 627 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S001-270 (years 2007-2009, 2016 and 2017)

Table 4: *E. coli* TMDL summary, Split Rock River Reach 513

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	526	165	74	37	14
	MOS	58	18	8	4	2
	Total load	584	183	82	41	16
	Existing Concentration Apr-Oct (org/100 mL)**	172				
	Maximum Monthly Geometric Mean (org/100mL)**	329				
	Overall Estimated Percent Reduction**	62%				

* Model simulated flow for HSPF reach 467 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S008-823 (years 2016 and 2017)

Table 5: *E. coli* TMDL summary, South Branch Grindstone River Reach 516

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	367	115	49	19	6
	MOS	41	13	5	2	0.7
	Total load	408	128	54	21	7
	Existing Concentration Apr-Oct (org/100 mL)**	104				
	Maximum Monthly Geometric Mean (org/100mL)**	217				
	Overall Estimated Percent Reduction**	42%				

* Model simulated flow for HSPF reach 624 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach
** Water quality monitoring station(s) used to estimate reductions: S001-263 (years 2007 through 2009)

Table 6: *E. coli* TMDL summary, Judicial Ditch #1 Reach 526

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	62	19	8	3	1
	MOS	7	2	0.9	0.3	0.1
	Total load	69	21	9	3	1
	Existing Concentration Apr-Oct (org/100 mL)**	185				
	Maximum Monthly Geometric Mean (org/100mL)**	624				
	Overall Estimated Percent Reduction**	80%				

* Model simulated flow for HSPF reach 622 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach
** Water quality monitoring station(s) used to estimate reductions: S004-894 (years 2008 through 2010)

Table 7: *E. coli* TMDL summary, Kettle River Reach 529

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	1,377	416	184	78	27
	MOS	153	46	20	9	3
	Total load	1,530	462	204	87	30
	Existing Concentration Apr-Oct (org/100 mL)**	232				
	Maximum Monthly Geometric Mean (org/100mL)**	529				
	Overall Estimated Percent Reduction**	76%				

* Model simulated flow for HSPF reach 430 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S008-822 (years 2016 and 2017)

Table 8: *E. coli* TMDL summary, North Branch Grindstone River Reach 541

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	107	33	14	5	2
	MOS	12	4	2	0.6	0.2
	Total load	119	37	16	6	2
	Existing Concentration Apr-Oct (org/100 mL)**	105				
	Maximum Monthly Geometric Mean (org/100mL)**	210				
	Overall Estimated Percent Reduction**	40%				

* Model simulated flow for HSPF reach 625 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S004-891 (years 2006-2009, 2016 and 2017)

Table 9: *E. coli* TMDL summary, North Branch Grindstone River Reach 544

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	386	121	47	14	3
	MOS	43	13	5	2	0.4
	Total load	429	134	52	16	3
	Existing Concentration Apr-Oct (org/100 mL)**	86				
	Maximum Monthly Geometric Mean (org/100mL)**	279				
	Overall Estimated Percent Reduction**	55%				

* Model simulated flow for HSPF reach 626 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S001-262 (years 2007 through 2009)

Table 10: *E. coli* TMDL summary, Unnamed Creek Reach 546

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	52	16	7	3	0.8
	MOS	6	2	0.8	0.3	0.09
	Total load	58	18	8	3	0.9
	Existing Concentration Apr-Oct (org/100 mL)**	140				
	Maximum Monthly Geometric Mean (org/100mL)**	530				
	Overall Estimated Percent Reduction**	76%				

* Model simulated flow for HSPF reach 624 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S002-245 (years 2008 and 2009)

Table 11: *E. coli* TMDL summary, Spring Creek Reach 550

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	50	15	6	3	0.9
	MOS	6	2	0.7	0.3	0.1
	Total load	56	17	7	3	1
	Existing Concentration Apr-Oct (org/100 mL)**	121				
	Maximum Monthly Geometric Mean (org/100mL)**	603				
	Overall Estimated Percent Reduction**	79%				

* Model simulated flow for HSPF reach 628 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S004-895 (years 2008 through 2010)

Table 12: *E. coli* TMDL summary, Pine River Reach 631

E. coli		Flow zones*				
		Very high	High	Mid-range	Low	Very low
Sources		*E. coli* load (billions of org/day)				
Wasteload	Total WLA	--	--	--	--	--
Load	Total LA	124	40	19	9	3
	MOS	14	4	2	1	0.3
	Total load	138	44	21	10	3
	Existing Concentration Apr-Oct (org/100 mL)**	90				
	Maximum Monthly Geometric Mean (org/100mL)**	194				
	Overall Estimated Percent Reduction**	35%				

* Model simulated flow for HSPF reach 521 from April-October (2000-2017) was used to develop the flow zones and LCs for this reach

** Water quality monitoring station(s) used to estimate reductions: S004-889 (years 2008-2010)

Attachment 2
Kettle and St Croix River Watershed – Phosphorus TMDL Summary Tables

Table 13: KUSC Phosphorus TMDL Summary Big Pine Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**0.8**	**0.002**	**0.8**	**0.002**	**0**	**0%**
	Construction/Industrial SW	0.8	0.002	0.8	0.002	0	0%
Load	**Total LA**	**3,119**	**8.5**	**2,407**	**6.7**	**712**	**23%**
	Atmosphere	103	0.3	103	0.3	0	0%
	Drainage Area	653	1.8	512	1.4	141	22%
	Upstream Lakes (Pine)	1,584	4.3	1,239	3.4	345	22%
	Septic Systems	193	0.5	94	0.3	99	51%
	Internal Load	586	1.6	459	1.3	127	22%
MOS				**268**	**0.7**		
Total load		**3,120**	**8.5**	**2,676**	**7.4**	**712****	**21%**

* Model calibration year(s): 2008, 2009, 2014, 2015, 2016, 2017
** Net reduction from current load to TMDL is 370 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 444 + 268 = 712 lbs/yr.

Table 14: KUSC Phosphorus TMDL Summary Elbow Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**0.5**	**0.001**	**0.5**	**0.001**	**0**	**0%**
	Construction/Industrial SW	0.5	0.001	0.5	0.001	0	0%
Load	**Total LA**	**444**	**1.2**	**272**	**0.8**	**172**	**42%**
	Atmosphere	27	0.1	27	0.1	0	0%
	Drainage Area	367	1.0	203	0.6	164	45%
	Septic Systems	36	0.1	28	0.1	8	22%
	Internal Load	14	0.04	14	0.04	0	0%
MOS				**30**	**0.1**		
Total load		**445**	**1.2**	**303**	**0.9**	**172****	**39%**

* Model calibration year(s): 2011, 2012
** Net reduction from current load to TMDL is 142 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 142 + 30 = 172 lbs/yr.

Table 15: KUSC Phosphorus TMDL Summary Eleven Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**0.3**	**0.0009**	**0.3**	**0.0009**	**0**	**0%**
	Construction/Industrial SW	0.3	0.0009	0.3	0.0009	0	0%
Load	**Total LA**	**444**	**1.2**	**279**	**0.7**	**165**	**37%**
	Atmosphere	78	0.2	78	0.2	0	0%
	Drainage Area	273	0.8	125	0.3	148	54%
	Septic Systems	49	0.1	32	0.1	17	35%
	Internal Load	44	0.1	44	0.1	0	0%
MOS				**31**	**0.1**		
Total load		**444**	**1.2**	**310**	**0.8**	**165****	**37%**

* Model calibration year(s): 2008, 2010, 2015, 2016
** Net reduction from current load to TMDL is 134 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 134 + 31 = 165 lbs/yr.

Table 16: KUSC Phosphorus TMDL Summary Fox Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**1**	**0.003**	**1**	**0.003**	**0**	**0%**
	Construction/Industrial SW	1	0.003	1	0.003	0	0%
Load	**Total LA**	**1,370**	**3.8**	**636**	**1.8**	**734**	**54%**
	Atmosphere	59	0.2	59	0.2	0	0%
	Drainage Area	801	2.2	547	1.5	254	32%
	Septic Systems	20	0.1	14	0.04	6	28%
	Internal Load	490	1.3	16	0.04	474	97%
MOS				**71**	**0.2**		
Total load		**1,371**	**3.8**	**708**	**2.0**	**734****	**54%**

* Model calibration year(s): 2016, 2017
** Net reduction from current load to TMDL is 663 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 661 +71 = 734 lbs/yr.

Table 17: KUSC Phosphorus TMDL Summary Grace Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	0.2	0.0004	0.2	0.0004	0	0%
	Construction/Industrial SW	0.2	0.0004	0.2	0.0004	0	0%
Load	Total LA	732	2.0	242	0.6	490	67%
	Atmosphere	21	0.06	21	0.06	0	0%
	Drainage Area	245	0.7	191	0.5	54	22%
	Septic Systems	17	0.05	12	0.03	5	29%
	Internal Load	449	1.2	18	0.05	431	96%
	MOS			27	0.1		
	Total Load	732	2.0	269	0.7	490**	66%

* Model calibration year(s): 2016, 2017
** Net reduction from current load to TMDL is 463 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 463 + 27 = 490 lbs/yr.

Table 18: KUSC Phosphorus TMDL Summary Grindstone Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	2	0.006	2	0.006	0	0%
	Construction/Industrial SW	2	0.006	2	0.006	0	0%
Load	Total LA	2,319	6.4	1,836	5.1	483	21%
	Atmosphere	137	0.4	137	0.4	0	0%
	Drainage Area	1,695	4.6	1,315	3.6	380	22%
	Upstream Lakes (Elbow)	250	0.7	184	0.5	66	27%
	Septic Systems	180	0.5	143	0.4	37	20%
	Internal Load	57	0.2	57	0.2	0	0%
	MOS			204	0.6		
	Total Load	2,321	6.4	2,042	5.7	483**	21%

* Model calibration year(s): 2008, 2016, 2017
** Net reduction from current load to TMDL is 279 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 279 + 204 = 483 lbs/yr

Table 19: KUSC Phosphorus TMDL Summary McCormick Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**0.8**	**0.002**	**0.8**	**0.002**	**0**	**0%**
	Construction/Industrial SW	0.8	0.002	0.8	0.002	0	0%
Load	**Total LA**	**677**	**1.8**	**509**	**1.4**	**168**	**25%**
	Atmosphere	16	0.04	16	0.04	0	0%
	Drainage Area	633	1.7	471	1.3	162	26%
	Septic Systems	18	0.05	12	0.03	6	29%
	Internal Load	10	0.03	10	0.03	0	0%
MOS				**57**	**0.2**		
Total load		**678**	**1.8**	**567**	**1.6**	**168****	**25%**

* Model calibration year(s): 2016, 2017
** Net reduction from current load to TMDL is 111 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 111 + 57 = 168 lbs/yr.

Table 20: KUSC Phosphorus TMDL Summary Merwin Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	**Total WLA**	**0.1**	**0.0004**	**0.1**	**0.0004**	**0**	**0%**
	Construction/Industrial SW	0.1	0.0004	0.1	0.0004	0	0%
Load	**Total LA**	**167**	**0.5**	**108**	**0.3**	**59**	**36%**
	Atmosphere	14	0.04	14	0.04	0	0%
	Drainage Area	110	0.3	70	0.2	40	37%
	Septic Systems	9	0.03	8	0.02	1	16%
	Internal Load	34	0.1	16	0.04	18	52%
MOS				**12**	**0.03**		
Total load		**167**	**0.5**	**120**	**0.3**	**59****	**35%**

* Model calibration year(s): 2016, 2017
** Net reduction from current load to TMDL is 47 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 47 + 12 = 59 lbs/yr.

Table 21: KUSC Phosphorus TMDL Summary Oak Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	0.6	0.002	0.6	0.002	0	0%
	Construction/Industrial SW	0.6	0.002	0.6	0.002	0	0%
Load	Total LA	683	1.8	547	1.5	136	20%
	Atmosphere	118	0.3	118	0.3	0	0%
	Drainage Area	444	1.2	316	0.9	128	29%
	Septic Systems	37	0.1	29	0.1	8	21%
	Internal Load	84	0.2	84	0.2	0	0%
MOS				61	0.2		
Total load		684	1.8	609	1.7	136**	20%

* Model calibration year(s): 2011, 2012, 2016
** Net reduction from current load to TMDL is 75 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 75 + 61 = 136 lbs/yr.

Table 22: KUSC Phosphorus TMDL Summary Pine Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	3	0.008	3	0.008	0	0%
	Construction/Industrial SW	3	0.008	3	0.008	0	0%
Load	Total LA	4,812	13.2	3,046	8.3	1,766	37%
	Atmosphere	98	0.3	98	0.3	0	0%
	Drainage Area	2,442	6.7	1,917	5.2	525	22%
	Septic Systems	175	0.5	143	0.4	32	18%
	Internal Load	2,097	5.7	888	2.4	1,209	58%
MOS				339	0.9		
Total load		4,815	13.2	3,388	9.2	1,766**	37%

* Model calibration year(s): 2008, 2009, 2014, 2015, 2016, 2017
** Net reduction from current load to TMDL is 1,427 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 1,427 + 339 = 1,766 lbs/yr.

Table 23: KUSC Phosphorus TMDL Summary Rhine Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	0.5	0.001	0.5	0.001	0	0%
	Construction/Industrial SW	0.5	0.001	0.5	0.001	0	0%
Load	Total LA	752	2.1	294	0.8	458	61%
	Atmosphere	29	0.1	29	0.1	0	0%
	Drainage Area	385	1.1	220	0.6	165	43%
	Septic Systems	16	0.04	13	0.04	3	20%
	Internal Load	322	0.9	32	0.1	290	90%
	MOS			33	0.1		
	Total load	753	2.1	328	0.9	458**	61%

* Model calibration year(s): 2011, 2012

** Net reduction from current load to TMDL is 425 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 425 + 33 = 458 lbs/yr.

Table 24: KUSC Phosphorus TMDL Summary Twentynine Lake

Phosphorus Sources		Existing TP load*		Allowable TP load		Estimated load reduction	
		lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	%
Wasteload	Total WLA	0.09	0.0003	0.09	0.0003	0	0%
	Construction/Industrial SW	0.09	0.0003	0.09	0.0003	0	0%
Load	Total LA	249	0.7	104	0.3	145	58%
	Atmosphere	13	0.04	13	0.04	0	0%
	Drainage Area	74	0.2	70	0.2	4	5%
	Septic Systems	5	0.01	4	0.01	1	20%
	Internal Load	157	0.4	17	0.05	140	89%
	MOS			12	0.03		
	Total load	249	0.7	116	0.3	145**	58%

* Model calibration year(s): 2016, 2017

** Net reduction from current load to TMDL is 133 lbs/yr, but the gross load reduction from all sources must also accommodate the MOS and is therefore 132 + 12 = 145 lbs/yr.