

September 27, 2017

VIA E-MAIL ONLY

Nancy Breems
Secretary of State, Elections Division
180 State Office Building
100 Rev Dr Martin Luther King Jr Blvd
St. Paul, Minnesota 55155-1299
official.documents@state.mn.us



Re: *In the Matter of the Proposed Amendments to Minnesota Pollution Control Agency Rules, Chapters 7050 and 7052, Relating to Water Quality Standards and Tiered Aquatic Life Uses*
OAH 5-9003-33998 Revisor R-4237

Dear Ms. Breems:

Enclosed for filing is an electronic copy of the above-entitled adopted rules.

Please send the agency copy of the rules to:

Kevin Molloy
520 Lafayette Rd N
Saint Paul, MN 55155
kevin.molloy@state.mn.us

If you have any questions regarding this matter, please contact Katie Lin at (651) 361-7911 or katie.lin@state.mn.us.

Sincerely,

A handwritten signature in black ink, appearing to read 'Sheena Denny'.

Sheena Denny

Enclosures

cc: Kevin Molloy (via email)

180695

Office of the Revisor of Statutes

Administrative Rules



TITLE: Adopted Permanent Rule Relating to Water Quality Standards and Tiered Aquatic Life Use

AGENCY: Pollution Control Agency

REVISOR ID: R-4237

MINNESOTA RULES: Chapters 7050 and 7052

The attached rules are approved for
filing with the Secretary of State

Cindy K. Maxwell

Cindy K. Maxwell
Assistant Deputy Revisor

INCORPORATIONS BY REFERENCE:

Part 7050.0150, subpart 3a: Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List (2014 and as subsequently amended), available at <http://www.pca.state.mn.us/lupg1125>.

Part 7050.0222, subparts 2c, 3c, and 4c: Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012);

Development of a Fish-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014);

Development of a Macroinvertebrate-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014); and

Development of Biological Criteria for Tiered Aquatic Life Uses, Minnesota Pollution Control Agency (2016)

Available on the agency's Web site at www.pca.state.mn.us.

Part 7050.0470, subparts 1 through 9: "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at www.pca.state.mn.us.

Pollution Control Agency

Adopted Permanent Rule Relating to Water Quality Standards and Tiered Aquatic Life Use

7050.0140 USE CLASSIFICATIONS FOR WATERS OF THE STATE.

[For text of subps 1 and 2, see M.R.]

Subp. 3. **Class 2 waters, aquatic life and recreation.** Aquatic life and recreation includes all waters of the state that support or may support aquatic biota, 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.

[For text of subps 4 to 8, see M.R.]

7050.0150 DETERMINATION OF WATER QUALITY, BIOLOGICAL AND PHYSICAL CONDITIONS, AND COMPLIANCE WITH STANDARDS.

[For text of subps 1 and 2, see M.R.]

Subp. 3. **Narrative standards.** For all Class 2 waters, the aquatic habitat, which includes the waters of the state and stream bed, shall not be degraded in any material manner, there shall be no material increase in undesirable slime growths or aquatic plants, including algae, nor shall there be any significant increase in harmful pesticide or other residues in the waters, sediments, and aquatic flora and fauna; the normal aquatic biota and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of aquatic biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters.

~~Subp. 3a. **Assessment criteria.** The criteria by which water bodies are assessed to determine if beneficial uses are supported, and definitions of the data and information required for that assessment, is in Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List (2014 and~~

as subsequently amended), which is incorporated by reference. The guidance manual is not subject to frequent change and is available at <http://www.pca.state.mn.us/lupg-125>.

Subp. 4. **Definitions.** For the purposes of this chapter and chapter 7053, the following terms have the meanings given them.

A. "122-day ten-year low flow" or "122Q₁₀" means the lowest average 122-day flow with a once in ten-year recurrence interval. A 122Q₁₀ is derived using the same methods used to derive a 7Q₁₀, and the guidelines regarding period of record for flow data and estimating a 7Q₁₀ apply equally to determining a 122Q₁₀, as described in part 7050.0130, subpart 3.

B. "Altered materially," "material increase," "material manner," "seriously impaired," and "significant increase," as used in subparts 3, 5, and 6, mean that pollution of the waters of the state has resulted in degradation of the physical, chemical, or biological qualities of the water body to the extent that attainable or previously existing beneficial uses are actually or potentially lost.

C. "Aquatic biota" means the aquatic community composed of game and nongame fish, minnows and other small fish, mollusks, insects, crustaceans and other invertebrates, submerged or emergent rooted vegetation, suspended or floating algae, substrate-attached algae, microscopic organisms, and other aquatic-dependent organisms that require aquatic systems for food or to fulfill any part of their life cycle, such as amphibians and certain wildlife species.

D. "Assemblage" means a taxonomic subset of a biological community such as fish in a stream community.

E. "Biological condition gradient" means a concept describing how aquatic communities change in response to increasing levels of stressors. In application, the biological

condition gradient is an empirical, descriptive model that rates biological communities on a scale from natural to highly degraded.

F. "Biological criteria, narrative" or "biocriteria, narrative" means written statements describing the attributes of the structure and function of aquatic assemblages in a water body necessary to protect the designated aquatic life beneficial use. The singular form "biological criterion, narrative" or "biocriterion, narrative" may also be used.

G. "Biological criteria, numeric" or "biocriteria, numeric" means specific quantitative measures of the attributes of the structure and function of aquatic communities in a water body necessary to protect the designated aquatic life beneficial use. The singular form "biological criterion, numeric" or "biocriterion, numeric" may also be used.

H. "BOD₅" or "five-day biochemical oxygen demand" means the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at a certain temperature over a five-day period.

I. "Chlorophyll-a" means a pigment in green plants including algae. The concentration of chlorophyll-a, expressed in weight per unit volume of water, is a measurement of the abundance of algae.

J. "Diel flux" means the daily change in a constituent, such as dissolved oxygen or pH, when there is a distinct daily cycle in the measurement. Diel dissolved oxygen flux means the difference between the maximum daily dissolved oxygen concentration and the minimum daily dissolved oxygen concentration.

K. "Ecoregion" means an area of relative homogeneity in ecological systems based on similar soils, land use, land surface form, and potential natural vegetation. Minnesota ecoregions are shown on the map in part 7050.0468.

L. "Eutrophication" means the increased productivity of the biological community in water bodies in response to increased nutrient loading. Eutrophication is characterized

4.1 by increased growth and abundance of algae and other aquatic plants, reduced water
4.2 transparency, reduction or loss of dissolved oxygen, and other chemical and biological
4.3 changes. The acceleration of eutrophication due to excess nutrient loading from human
4.4 sources and activities, called cultural eutrophication, causes a degradation of water quality
4.5 and possible loss of beneficial uses.

4.6 M. "Eutrophication standard" means the combination of indicators of enrichment
4.7 and indicators of response as described in subpart 5. The indicators upon which the
4.8 eutrophication standard for specific water bodies are based are as provided under subparts
4.9 5a to 5c.

4.10 N. "Hydraulic residence time" means the time water resides in a basin or,
4.11 alternately, the time it would take to fill the basin if it were empty.

4.12 O. "Impaired water" or "impaired condition" means a water body that does not
4.13 meet applicable water quality standards or fully support applicable beneficial uses, due in
4.14 whole or in part to water pollution from point or nonpoint sources, or any combination
4.15 thereof.

4.16 P. "Index of biotic integrity," "index of biological integrity," or "IBI" means an
4.17 index developed by measuring attributes of an aquatic community that change in quantifiable
4.18 and predictable ways in response to human disturbance, representing the health of that
4.19 community.

4.20 Q. "Lake" means an enclosed basin filled or partially filled with standing fresh
4.21 water with a maximum depth greater than 15 feet. Lakes may have no inlet or outlet, an
4.22 inlet or outlet, or both an inlet and outlet.

4.23 R. "Lake morphometry" means the physical characteristics of the lake basin that
4.24 are reasonably necessary to determine the shape of a lake, such as maximum length and
4.25 width, maximum and mean depth, area, volume, and shoreline configuration.

5.1 ~~S.~~ S. "Lotic water" means a flowing or moving water body such as a stream, river,
5.2 or ditch.

5.3 ~~T.~~ T. "Mixing status" means the frequency of complete mixing of the lake water
5.4 from surface to bottom, which is determined by whether temperature gradients are established
5.5 and maintained in the water column during the summer season.

5.6 ~~U.~~ U. "Measurable increase" or "measurable impact" means a change in trophic
5.7 status that can be discerned above the normal variability in water quality data using a weight
5.8 of evidence approach. The change in trophic status does not require a demonstration of
5.9 statistical significance to be considered measurable. Mathematical models may be used as
5.10 a tool in the data analysis to help predict changes in trophic status.

5.11 ~~V.~~ V. "Natural causes" means the multiplicity of factors that determine the physical,
5.12 chemical, or biological conditions that would exist in a water body in the absence of
5.13 measurable impacts from human activity or influence.

5.14 ~~W.~~ W. "Normal aquatic biota" and "normally present" mean a healthy aquatic
5.15 community expected to be present in the water body in the absence of pollution of the water,
5.16 consistent with any variability due to natural hydrological, substrate, habitat, or other physical
5.17 and chemical characteristics. Expected presence is based on comparing the aquatic
5.18 community in the water body of interest to the aquatic community in representative reference
5.19 water bodies.

5.20 ~~X.~~ X. "Nuisance algae bloom" means an excessive population of algae that is
5.21 characterized by obvious green or blue-green pigmentation in the water, floating mats of
5.22 algae, reduced light transparency, aesthetic degradation, loss of recreational use, possible
5.23 harm to the aquatic community, or possible toxicity to animals and humans. Algae blooms
5.24 are measured through tests for chlorophyll-a, observations of Secchi disk transparency, and
5.25 observations of impaired recreational and aesthetic conditions by the users of the water

body, or any other reliable data that identifies the population of algae in an aquatic community.

~~Y.~~ Y. "Periphyton" means algae on the bottom of a water body. In rivers or streams, these forms are typically found attached to logs, rocks, or other substrates, but when dislodged the algae will become part of the seston.

~~Z.~~ Z. "Readily available and reliable data and information" means chemical, biological, and physical data and information determined by the commissioner to meet the quality assurance and quality control requirements in subpart 8, that are not more than ten years old from the time they are used for the assessment. A subset of data in the ten-year period, or data more than ten years old can be used if credible scientific evidence shows that these data are representative of current conditions.

~~AA.~~ AA. "Reference water body" means a water body minimally or least impacted by point or nonpoint sources of pollution that is representative of water bodies of a similar surface water body type and within a geographic region such as an ecoregion or watershed. Reference water bodies are used as a base for comparing the quality of similar water bodies in the same geographic region.

~~BB.~~ BB. "Reservoir" means a body of water in a natural or artificial basin or watercourse where the outlet or flow is artificially controlled by a structure such as a dam. Reservoirs are distinguished from river systems by having a hydraulic residence time of at least 14 days. For purposes of this item, residence time is determined using a flow equal to the 122Q₁₀ for the months of June through September.

~~CC.~~ CC. "River nutrient region" means the geographic basis for regionalizing the river eutrophication criteria as described in Heiskary, S. and K. Parson, Regionalization of Minnesota's Rivers for Application of River Nutrient Criteria, Minnesota Pollution Control Agency (2013), which is incorporated by reference. The document is not subject to frequent change and is available through the Minitex interlibrary loan system.

7.1 ~~CC.~~ DD. "Secchi disk" means a tool that is used to measure the transparency of
7.2 lake water. A Secchi disk is an eight-inch weighted disk on a calibrated rope, either white
7.3 or with quadrants of black and white. To measure water transparency with a Secchi disk,
7.4 the disk is viewed from the shaded side of a boat. The depth of the water at the point where
7.5 the disk reappears upon raising it after it has been lowered beyond visibility is recorded.

7.6 ~~DD.~~ EE. "Secchi disk transparency" means the transparency of water as measured
7.7 by a Secchi disk, a Secchi tube, or a transparency tube.

7.8 ~~EE.~~ FF. "Secchi tube" means a tool that is used to measure the transparency of
7.9 stream or river water. A Secchi tube is a clear plastic tube, one meter in length and 1-3/4
7.10 inch in diameter, with a mini-Secchi disk on a string. To measure water transparency, the
7.11 tube is filled with water collected from a stream or river and, looking into the tube from the
7.12 top, the weighted Secchi disk is lowered into the tube by a string until it disappears and then
7.13 raised until it reappears, allowing the user to raise and lower the disk within the same water
7.14 sample numerous times. The depth of the water at the midpoint between disappearance and
7.15 reappearance of the disk is recorded in centimeters, which are marked on the side of the
7.16 tube. If the Secchi disk is visible when it is lowered to the bottom of the tube, the transparency
7.17 reading is recorded as "greater than 100 centimeters."

7.18 ~~FF.~~ GG. "Seston" means particulate matter suspended in water bodies and includes
7.19 plankton and organic and inorganic matter.

7.20 ~~GG.~~ HH. "Shallow lake" means an enclosed basin filled or partially filled with
7.21 standing fresh water with a maximum depth of 15 feet or less or with 80 percent or more
7.22 of the lake area shallow enough to support emergent and submerged rooted aquatic plants
7.23 (the littoral zone). It is uncommon for shallow lakes to thermally stratify during the summer.
7.24 The quality of shallow lakes will permit the propagation and maintenance of a healthy
7.25 indigenous aquatic community and they will be suitable for boating and other forms of
7.26 aquatic recreation for which they may be usable. Shallow lakes are differentiated from

wetlands and lakes on a case-by-case basis. Wetlands are defined in part 7050.0186, subpart 1a.

~~HH.~~ II. "Summer-average" means a representative average of concentrations or measurements of nutrient enrichment factors, taken over one summer season.

~~H.~~ JJ. "Summer season" means a period annually from June 1 through September 30.

~~JJ.~~ KK. "Transparency tube" means a tool that is used to measure the transparency of stream or river water. A transparency tube is a graduated clear plastic tube, 24 inches or more in length by 1-1/2 inches in diameter, with a stopper at the bottom end. The inside surface of the stopper is painted black and white. To measure water transparency, the tube is filled with water from a surface water; the water is released through a valve at the bottom end until the painted surface of the stopper is just visible through the water column when viewed from the top of the tube. The depth, in centimeters, is noted. More water is released until the screw in the middle of the painted symbol on the stopper is clearly visible; this depth is noted. The two observed depths are averaged to obtain a transparency measurement.

~~KK.~~ LL. "Trophic status or condition" means the productivity of a lake as measured by the phosphorus content, algae abundance, and depth of light penetration.

~~LL.~~ MM. "Use attainability analysis" means a structured scientific assessment of the physical, chemical, biological, and economic factors affecting attainment of the uses of water bodies. A use attainability analysis is required to remove a designated use specified in section 101(a)(2) of the Clean Water Act that is not an existing use. The allowable reasons for removing a designated use are described in Code of Federal Regulations, title 40, section 131.10 (g).

~~MM.~~ NN. "Water body" means a lake, reservoir, wetland, or a geographically defined portion of a river or stream.

9.1 ~~NN. OO.~~ "Water body type" means a group of water bodies with similar natural
9.2 physical, chemical, and biological attributes, where the characteristics are similar among
9.3 water bodies within each type and distinct from water bodies of other types.

9.4 [For text of subps 5 to 5c, see M.R.]

9.5 Subp. 6. **Impairment of biological community and aquatic habitat.** In evaluating
9.6 whether the narrative standards in subpart 3, which prohibit serious impairment of the normal
9.7 aquatic biota and the use thereof, material alteration of the species composition, material
9.8 degradation of stream beds, and the prevention or hindrance of the propagation and migration
9.9 of aquatic biota normally present, are being met, the commissioner will consider all readily
9.10 available and reliable data and information for the following factors of use impairment:

9.11 [For text of items A to D, see M.R.]

9.12 E. any other scientifically objective, credible, and supportable factors.

9.13 A finding of an impaired condition must be supported by data for the factors listed in
9.14 at least one of items A to C. The biological quality of any given surface water body will be
9.15 assessed by comparison to the biological conditions determined by the commissioner using
9.16 a biological condition gradient model or a set of reference water bodies which best represents
9.17 the most natural condition for that surface water body type within a geographic region.

9.18 [For text of subps 7 and 8, see M.R.]

9.19 **7050.0155 PROTECTION OF DOWNSTREAM USES.**

9.20 All waters must maintain a level of water quality that provides for the attainment and
9.21 maintenance of the water quality standards of downstream waters, including the waters of
9.22 another state.

7050.0217 OBJECTIVES FOR PROTECTION OF SURFACE WATERS FROM TOXIC POLLUTANTS.

Subpart 1. **Purpose and applicability.** The purpose of this part is to establish the objectives for developing numeric water quality standards listed in parts 7050.0220, 7050.0222, 7050.0227, and 7052.0100 and site-specific water quality criteria for toxic pollutants or chemicals developed in the absence of numeric standards. The listed numeric standards for toxics and site-specific numeric criteria established by methods in parts 7050.0218 and 7050.0219 protect Class 2 waters for the propagation and maintenance of aquatic biota, the consumption of fish and edible aquatic life by humans, the use of surface waters for public and private domestic consumption where applicable, and the consumption of aquatic organisms by wildlife. These criteria also protect the uses assigned to Class 7, limited resource value, waters as described in parts 7050.0140 and 7050.0227.

[For text of subp 2, see M.R.]

7050.0218 FOR TOXIC POLLUTANTS: DEFINITIONS AND METHODS FOR DETERMINATION OF HUMAN HEALTH-BASED NUMERIC STANDARDS AND SITE-SPECIFIC NUMERIC CRITERIA FOR AQUATIC LIFE, HUMAN HEALTH, AND FISH-EATING WILDLIFE.

[For text of subps 1 and 2, see M.R.]

Subp. 3. **Definitions.** For the purposes of parts 7050.0217 to 7050.0227, the following terms have the meanings given them.

[For text of items A to R, see M.R.]

S. "Criterion" means a number or numbers established for a pollutant derived under this part or part 7050.0219 or 7052.0110, or issued by the USEPA, to protect aquatic life, humans, or wildlife.

T. "Developmental health endpoint" or "developmental toxicity" means an adverse effect on the developing organism that may result from parental exposure prior to conception,

maternal exposure during prenatal development, or direct exposure postnatally until the time of sexual maturation. Developmental toxicity may be detected at any point in the lifespan of the organism. The major manifestations of developmental toxicity include:

- (1) death of the developing organism;
- (2) structural abnormality;
- (3) altered growth; or
- (4) functional deficiency.

U. "Duration" means the time over which the instream concentration of a pollutant is averaged for comparison with the standard or criterion.

V. "Durations for human health-based algorithms" or "D" means the length of the exposure period under consideration for noncancer and linear cancer algorithms.

(1) The four default D used in developing reference doses and corresponding intake rates are:

- (a) acute: a period of 24 hours or less;
- (b) short-term: a period of more than 24 hours, up to 30 days;
- (c) subchronic: a period of more than 30 days, up to eight years based on application of the less than ten percent standard life expectancy of 70 years for humans; or
- (d) chronic: a period of more than eight years.

(2) The default durations for use in the linear cancer algorithms with age dependent adjustment factors are:

- (a) two years for the birth up to two-year age group;
- (b) 14 years for the two- up to 16-year age group; and

12.1 (c) 54 years for the 16- up to 70-year age group.

12.2 For any algorithm, use of chemical-specific data to define durations for noncancer or linear
12.3 cancer algorithms are preferred when acceptable data are available.

12.4 W. "Effect concentration" or "EC50" means the toxicant concentration that causes
12.5 equilibrium loss, immobilization, mortality, or other debilitating effects in 50 percent of the
12.6 exposed organisms during a specific time of observation.

12.7 X. "Endocrine" or "E" means a change in circulating hormone levels or interactions
12.8 with hormone receptors, regardless of the organ or organ system affected. Health endpoints
12.9 with or without the E designation are deemed equivalent, for example, thyroid (E) = thyroid,
12.10 and must be included in the same health risk index equation.

12.11 Y. "Final acute value" or "FAV" means an estimate of the concentration of a
12.12 pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the
12.13 acute toxicity values for the genera or species from the acceptable acute toxicity tests
12.14 conducted on a pollutant. The FAV is the acute toxicity limitation applied to mixing zones
12.15 in part 7050.0210, subpart 5; and to dischargers in parts 7053.0215, subpart 1; 7053.0225,
12.16 subpart 6; and 7053.0245, subpart 1.

12.17 Z. "Food chain multiplier" or "FCM" means the ratio of a bioaccumulation factor
12.18 by trophic level to an appropriate bioconcentration factor. FCM refers to values developed
12.19 using USEPA models or from available and reliable field studies.

12.20 AA. "Frequency" means the number of times a standard can be exceeded in a
12.21 specified period of time without causing acute or chronic toxic effects on the aquatic
12.22 community, human health, or fish-eating wildlife.

12.23 BB. "Genus mean acute value" or "GMAV" means the geometric mean of the
12.24 SMAVs available for the genus.

13.1 CC. "Health risk index" means the sum of the quotients calculated by identifying
13.2 all chemicals that share a common health endpoint or are based on linear carcinogenicity
13.3 and dividing the water or fish tissue concentration for each chemical (measured or statistically
13.4 derived) by its applicable chronic standard or chronic criterion. To meet the objectives in
13.5 part 7050.0217, the health risk index must not exceed a value of one. The equations for the
13.6 risk indices are found in part 7050.0222, subpart 7, items D and E.

13.7 DD. "Health risk index endpoint" or "health endpoint" means the general
13.8 description of toxic effects used to group chemicals for the purpose of calculating a health
13.9 risk index.

13.10 EE. "Intake rate" or "IR" means rate of ingestion, inhalation, or dermal contact,
13.11 depending on the route of exposure, expressed as the amount of a media taken in, on a per
13.12 body weight and daily basis, for a specified duration.

13.13 FF. "Lethal concentration" or "LC50" means the toxicant concentration killing
13.14 50 percent of the exposed organisms in a specific time of observation.

13.15 GG. "Lowest observable adverse effect level" or "LOAEL" means the lowest
13.16 exposure level that caused a statistically or biologically significant increase in the frequency
13.17 or severity of adverse effects observed between the exposed population and its appropriate
13.18 control group.

13.19 HH. "Magnitude" means the acceptable amount of a toxic pollutant in water or
13.20 fish tissue expressed as a concentration.

13.21 II. "Maximum criterion" or "MC" means the highest concentration of a toxicant
13.22 in water to which aquatic organisms can be exposed for a brief time with zero to slight
13.23 mortality. The MC equals the FAV divided by two.

13.24 JJ. "Maximum standard" or "MS" means the highest concentration of a toxicant
13.25 in water to which aquatic organisms can be exposed for a brief time with zero to slight

14.1 mortality. The MS equals the FAV divided by two. Maximum standards are listed in part
14.2 7050.0222.

14.3 KK. "MDH" means the Minnesota Department of Health.

14.4 LL. "Mode of action" or "MOA" means the sequence of key events following
14.5 pollutant or chemical exposure upon which the toxic outcome depends.

14.6 MM. "National methods" means the methods the USEPA uses to develop aquatic
14.7 life criteria as described in Stephan, C.E., D.J. Mount, D.J. Hansen, J.H. Gentile, G.A.
14.8 Chapman, and W.A. Brungs, 1985, "Guidelines for Deriving Numerical National Water
14.9 Quality Criteria for the Protection of Aquatic Organisms and Their Uses," USEPA, Office
14.10 of Research and Development, Environmental Research Laboratories, Duluth MN;
14.11 Narragansett, RI, Corvallis, OR. 98 p; available through the National Technical Information
14.12 Service, Springfield, VA. (Publication PB85-227049)

14.13 NN. "No observable adverse effect level" or "NOAEL" means the highest exposure
14.14 level at which there is no statistically or biologically significant increase in the frequency
14.15 or severity of adverse effects between the exposed population and its appropriate control
14.16 group.

14.17 OO. "Octanol to water partition coefficient" or " K_{ow} " means the ratio of the
14.18 concentration of a chemical in the octanol phase to its concentration in the aqueous phase
14.19 of a two-phase octanol to water system after equilibrium of the chemical between the two
14.20 phases has been achieved. The base 10 logarithm of the K_{ow} or $\log K_{ow}$ is used in the
14.21 calculation of bioaccumulation factors. The $\log K_{ow}$ has been shown to be proportional to
14.22 the bioconcentration potential of lipophilic organic chemicals.

14.23 PP. "Percent effluent" means the representation of acute or chronic toxicity of an
14.24 effluent as a percent of whole effluent mixed in dilution water, where acute toxicity is
14.25 expressed by LC50s or EC50s and chronic toxicity is expressed by NOAEL.

15.1 QQ. "Reference dose" or "RfD" means an estimate of a dose for a given duration
15.2 to the human population, including susceptible subgroups such as infants, that is likely to
15.3 be without an appreciable risk of adverse effects during a lifetime. It is derived from a
15.4 suitable dose level at which there are few or no statistically or biologically significant
15.5 increases in the frequency or severity of an adverse effect between the dosed population
15.6 and its associated control group. The RfD includes one or more divisors, applied to the
15.7 suitable dose level, accounting for:

15.8 (1) uncertainty in extrapolating from mammalian laboratory animal data to
15.9 humans;

15.10 (2) variation in toxicological sensitivity among individuals in the human
15.11 population;

15.12 (3) uncertainty in extrapolating from effects observed in a short-term study
15.13 to effects of long-term exposure;

15.14 (4) uncertainty in using a study in which health effects were found at all doses
15.15 tested; and

15.16 (5) uncertainty associated with deficiencies in the available data.

15.17 The product of the divisors is not to exceed 3,000 in an RfD used for a chronic standard.

15.18 The RfD is expressed in units of daily dose as milligrams of chemical per kilogram of body
15.19 weight-day or mg/kg-day.

15.20 RR. "Relative source contribution factor" or "RSC" means the percentage or
15.21 apportioned amount (subtraction method) of the reference dose for a pollutant allocated to
15.22 surface water exposures from drinking or incidental water ingestion and fish consumption.
15.23 In the absence of sufficient data to establish a pollutant- or chemical-specific RSC value,
15.24 the default RSC is 0.2 or 0.5 as described in part 7050.0219, subpart 5.

16.1 SS. "Species mean acute value" or "SMAV" means the geometric mean of all the
16.2 available and acceptable acute values for a species.

16.3 TT. "Standard" means a number or numbers established for a pollutant or water
16.4 quality characteristic to protect a specified beneficial use as listed in parts 7050.0221 to
16.5 7050.0227. The standard for a toxic pollutant includes the CS, MS, and FAV. Some pollutants
16.6 do not have an MS or an FAV due to insufficient data. For these pollutants, the CS alone
16.7 is the standard.

16.8 UU. "Toxic effect" means an observable or measurable adverse biological event
16.9 in an organ, tissue, or system. The designation of health endpoints does not exclude other
16.10 possible observable or measurable biological events. For the purpose of grouping chemicals
16.11 and creating a health risk index when multiple chemicals are present, toxic effects may be
16.12 ascribed to more general health risk index endpoints or health endpoints.

16.13 VV. "Toxic pollutant" has the meaning given it in part 7050.0185, subpart 2, item
16.14 F. Toxic pollutant is used interchangeably in this part and parts 7050.0217, 7050.0219, and
16.15 7050.0222, subpart 7, items B to G, with the terms "pollutant" and "chemical."

16.16 WW. "Toxic unit" means a measure of acute or chronic toxicity in an effluent.
16.17 One acute toxic unit (TUa) is the reciprocal of the effluent concentration that causes 50
16.18 percent effect or mortality to organisms for acute exposures (100/LC50); one chronic toxic
16.19 unit (TUc) is the reciprocal of the effluent concentration that causes no observable adverse
16.20 effect level on test organisms for chronic exposures (100/NOAEL).

16.21 XX. "Trophic level" or "TL" means the food web level in an ecosystem that is
16.22 occupied by an organism or group of organisms because of what they eat and how they are
16.23 related to the rest of the food web. For example, trophic level 3 in an aquatic ecosystem
16.24 consists of small fish such as bluegills, crappies, and smelt and trophic level 4 consists of
16.25 larger carnivorous fish such as walleye, northern pike, and most trout species.

17.1 YY. "USEPA" means the United States Environmental Protection Agency.

17.2 ZZ. "Water quality characteristic" means a characteristic of natural waters, such
17.3 as total hardness or pH. Some water quality characteristics can affect the toxicity of pollutants
17.4 to aquatic organisms.

17.5 AAA. "Whole effluent toxicity test" means the aggregate toxic effect of an effluent
17.6 measured directly by a toxicity test. Effects on tested organisms are measured and expressed
17.7 as toxic units or percent effluent for both acute and chronic whole effluent toxicity tests.

17.8 Subp. 4. **Adoption of USEPA national criteria.** The USEPA establishes aquatic life
17.9 and human health-based criteria under section 304(a)(1) of the Clean Water Act, United
17.10 States Code, title 33, section 1314. The USEPA criteria, subject to modification as described
17.11 in this subpart, are applicable to Class 2 waters of the state. The USEPA has described the
17.12 national methods for developing aquatic life criteria in "Guidelines for Deriving Numerical
17.13 National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses."

17.14 USEPA criteria that vary with an ambient water quality characteristic such as total
17.15 hardness or pH will be established for specific waters or reaches using data available to the
17.16 commissioner. Central values such as the means or medians for the characteristic will be
17.17 used unless there is evidence to support using different values. Values for water quality
17.18 characteristics can be estimated for specific waters or reaches that have no data by using
17.19 data from a nearby watershed with similar chemical properties.

17.20 A. The USEPA aquatic life criteria are adopted unchanged by the agency, unless
17.21 modified under item C, as the criteria applicable to designated Class 2A waters in parts
17.22 7050.0420 and 7050.0470.

17.23 B. The USEPA criteria are adopted, subject to modification as described in this
17.24 item or item C, for application to cool and warm water habitats and wetlands. Cool and
17.25 warm water habitats (Class 2Bd and 2B) are defined in part 7050.0430 or listed in part

18.1 7050.0470. Wetlands (Class 2D) waters are defined in part 7050.0425 or listed in part
18.2 7050.0470.

18.3 (1) Acute data, in the form of the ranked genus mean acute values used by
18.4 the USEPA to determine the national criteria, are the data used to determine the Class 2Bd,
18.5 2B, and 2D criteria.

18.6 [For text of subitems (2) to (4), see M.R.]

18.7 (5) If, as a result of the recalculation of the USEPA criterion for application
18.8 to Class 2Bd, 2B, and 2D waters, the FAV for these water classes is lower than the FAV
18.9 for Class 2A waters, the Class 2Bd, 2B, or 2D FAV will be changed to equal the Class 2A
18.10 FAV, unless the lower Class 2Bd, 2B, or 2D FAV is justified based on the available
18.11 toxicological data.

18.12 [For text of subitems (6) and (7), see M.R.]

18.13 [For text of item C, see M.R.]

18.14 [For text of subps 5 to 8, see M.R.]

18.15 Subp. 9. **Wildlife-based criteria.** The agency shall use the procedures in this subpart
18.16 to establish wildlife-based criteria. Wildlife criteria shall protect wildlife consumers of
18.17 freshwater aquatic organisms from adverse effects of toxic pollutants. Wildlife criteria are
18.18 applicable to all surface waters, subject to the exceptions in subpart 10, item B, subitem (1).

18.19 [For text of items A to C, see M.R.]

18.20 D. A final BAF for calculating a wildlife chronic criterion (CC_w) is determined
18.21 as in subpart 7, except that the BCFs and BAFs are adjusted to represent whole body BCFs
18.22 and BAFs.

18.23 [For text of subitem (1), see M.R.]

19.1 (2) Normalized BCFs and BAFs are multiplied by five percent lipid for CC_w
19.2 applicable to Class 2Bd and 2B waters.

19.3 [For text of subitem (3), see M.R.]

19.4 (4) BCFs estimated using the relationship between BCFs and the log K_{ow} are
19.5 normalized by dividing the estimated BCF by 7.6 and then multiplying by 12 for Class 2A
19.6 waters or by five for Class 2Bd and 2B waters.

19.7 [For text of subitem (5), see M.R.]

19.8 Subp. 10. **Applicable criteria or human health-based standard.** The final criteria
19.9 or chronic standard for human health for toxic pollutants for surface waters must be the
19.10 lowest of the applicable criteria or standards for human health derived under this part and
19.11 part 7050.0219.

19.12 A. Applicable criteria or standards for human health by use for Class 2A, 2Bd,
19.13 2B, and 2D surface waters are listed for each applicable population protected (aquatic life,
19.14 humans, and fish-eating wildlife). The applicable criteria or standards for human health
19.15 must be the lowest of the CC or CS as described in subitems (1) to (3):

19.16 [For text of subitems (1) to (3), see M.R.]

19.17 [For text of items B to D, see M.R.]

19.18 **7050.0219 HUMAN HEALTH-BASED CRITERIA AND STANDARDS.**

19.19 [For text of subps 1 to 10, see M.R.]

19.20 Subp. 11. **Final baseline BAF by trophic level.** Determine the final baseline BAF
19.21 by trophic level (TL):

19.22 A. Calculate geometric mean baseline BAF for TL₃ and TL₄ using available
19.23 species-means for each baseline BAF method. For Class 2A water, preference is given for
19.24 *Salmonidae* data and developed as a single representative TL₄ baseline BAF.

20.1 [For text of items B and C, see M.R.]

20.2 [For text of subps 12 to 15, see M.R.]

20.3 **7050.0220 SPECIFIC WATER QUALITY STANDARDS BY ASSOCIATED USE**
20.4 **CLASSES.**

20.5 Subpart 1. **Purpose and scope.** The numeric and narrative water quality standards in
20.6 this chapter prescribe the qualities or properties of the waters of the state that are necessary
20.7 for the designated public uses and benefits. If the standards in this chapter are exceeded, it
20.8 is considered indicative of a polluted condition which is actually or potentially deleterious,
20.9 harmful, detrimental, or injurious with respect to designated uses or established classes of
20.10 the waters of the state.

20.11 All surface waters are protected for multiple beneficial uses. Numeric water quality
20.12 standards are tabulated in this part for all uses applicable to four common categories of
20.13 surface waters, so that all applicable standards for each category are listed together in
20.14 subparts 3a to 6a. The four categories are:

20.15 A. cold water aquatic life and habitat, also protected for drinking water: Classes
20.16 1B; 2A, 2Ae₂ or 2Ag; 3A or 3B; 4A and 4B; and 5 (subpart 3a);

20.17 B. cool and warm water aquatic life and habitat, also protected for drinking water:
20.18 Classes 1B or 1C; 2Bd, 2Bde, 2Bdg, or 2Bdm; 3A or 3B; 4A and 4B; and 5 (subpart 4a);

20.19 C. cool and warm water aquatic life and habitat and wetlands: Classes 2B, 2Be,
20.20 2Bg, 2Bm, or 2D; 3A, 3B, 3C, or 3D; 4A and 4B or 4C; and 5 (subpart 5a); and

20.21 D. limited resource value waters: Classes 3C; 4A and 4B; 5; and 7 (subpart 6a).

20.22 Subp. 2. **Explanation of tables.**

20.23 [For text of items A to C, see M.R.]

21.1 D. The tables of standards in subparts 3a to 6a include the following abbreviations
21.2 and acronyms:

21.3 AN means aesthetic enjoyment and navigation, Class 5 waters
21.4 * an asterisk following the FAV and MS values or double dashes (–) means part
21.5 7050.0222, subpart 7, item G, applies
21.6 (c) means the chemical is assumed to be a human carcinogen
21.7 CS means chronic standard, defined in part 7050.0218, subpart 3
21.8 DC means domestic consumption (drinking water), Class 1 waters
21.9 – double dashes means there is no standard
21.10 exp. () means the natural antilogarithm (base e) of the expression in parenthesis
21.11 FAV means final acute value, defined in part 7050.0218, subpart 3
21.12 IC means industrial consumption, Class 3 waters
21.13 IR means agriculture irrigation use, Class 4A waters
21.14 LS means agriculture livestock and wildlife use, Class 4B waters
21.15 MS means maximum standard, defined in part 7050.0218, subpart 3
21.16 NA means not applicable
21.17 (S) means the associated value is a secondary drinking water standard
21.18 su means standard unit. It is the reporting unit for pH
21.19 TH means total hardness in mg/L, which is the sum of the calcium and magnesium
21.20 concentrations expressed as CaCO₃
21.21 TON means threshold odor number

21.22 [For text of items E and F, see M.R.]

21.23 Subp. 3. [Repealed, 24 SR 1105]

21.24 Subp. 3a. **Cold water aquatic life and habitat, drinking water, and associated use**
21.25 **classes.** Water quality standards applicable to use Classes 1B; 2A, 2Ae₂ or 2Ag; 3A or 3b;
21.26 4A and 4B; and 5 surface waters. The water quality standards in part 7050.0222, subpart

2, that apply to Class 2A also apply to Classes 2Ae and 2Ag. In addition to the water quality standards in part 7050.0222, subpart 2, the biological criteria defined in part 7050.0222, subpart 2d, apply to Classes 2Ae and 2Ag.

[For text of items A to E, see M.R.]

Subp. 4. [Repealed, 24 SR 1105]

Subp. 4a. **Cool and warm water aquatic life and habitat, drinking water, and associated use classes.** Water quality standards applicable to use Classes 1B or 1C; 2Bd, 2Bde, 2Bdg, or 2Bdm; 3A or 3B; 4A and 4B; and 5 surface waters. The water quality standards in part 7050.0222, subpart 3, that apply to Class 2Bd also apply to Classes 2Bde, 2Bdg, and 2Bdm. In addition to the water quality standards in part 7050.0222, subpart 3, the biological criteria defined in part 7050.0222, subpart 3d, apply to Classes 2Bde, 2Bdg, and 2Bdm.

[For text of items A to F, see M.R.]

Subp. 5. [Repealed, 24 SR 1105]

Subp. 5a. **Cool and warm water aquatic life and habitat and associated use classes.** Water quality standards applicable to use Classes 2B, 2Be, 2Bg, 2Bm, or 2D; 3A, 3B, or 3C; 4A and 4B; and 5 surface waters. See parts 7050.0223, subpart 5; 7050.0224, subpart 4; and 7050.0225, subpart 2, for Class 3D, 4C, and 5 standards applicable to wetlands, respectively. The water quality standards in part 7050.0222, subpart 4, that apply to Class 2B also apply to Classes 2Be, 2Bg, and 2Bm. In addition to the water quality standards in part 7050.0222, subpart 4, the biological criteria defined in part 7050.0222, subpart 4d, apply to Classes 2Be, 2Bg, and 2Bm.

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

23.1	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
23.2	CS	MS	FAV	IC	IR	LS	AN

23.3

23.4 [For text of subitems (1) to (5), see M.R.]

23.5	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
23.6	CS	MS	FAV	IC	IR	LS	AN

23.7

23.8 [For text of subitem (6), see M.R.]

23.9 (7) Eutrophication standards for lakes, shallow lakes, and reservoirs (phosphorus, total,
23.10 µg/L; chlorophyll-a, µg/L; Secchi disk transparency, meters)

23.11	See part	--	--	--	--	--	--
23.12	7050.0222,						
23.13	subparts						
23.14	4 and 4a						

23.15 [For text of subitems (8) to (11), see M.R.]

23.16	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
23.17	CS	MS	FAV	IC	IR	LS	AN

23.18

23.19 (12) Oxygen, dissolved, mg/L

23.20	See part	--	--	--	--	--	--
23.21	7050.0222,						
23.22	subparts						
23.23	4 and 6						

23.24 [For text of subitems (13) to (16), see M.R.]

23.25	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
23.26	CS	MS	FAV	IC	IR	LS	AN

23.27

23.28 [For text of subitems (17) to (22), see M.R.]

24.1 B. METALS AND ELEMENTS

24.2	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
24.3	CS	MS	FAV	IC	IR	LS	AN

24.4

24.5 [For text of subitems (1) to (4), see M.R.]

24.6 (5) Cadmium, total, µg/L

24.7	1.1	33	67	--	--	--	--
------	-----	----	----	----	----	----	----

24.8 Class 2B and 2D cadmium standards are hardness dependent. Cadmium values shown are
 24.9 for a total hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other
 24.10 hardness values and equations to calculate cadmium standards for any hardness value not
 24.11 to exceed 400 mg/L.

24.12	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
24.13	CS	MS	FAV	IC	IR	LS	AN

24.14

24.15 (6) Chromium +3, total, µg/L

24.16	207	1,737	3,469	--	--	--	--
-------	-----	-------	-------	----	----	----	----

24.17 Class 2B and 2D trivalent chromium standards are hardness dependent. Chromium +3 values
 24.18 shown are for a total hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples
 24.19 at other hardness values and equations to calculate trivalent chromium standards for any
 24.20 hardness value not to exceed 400 mg/L.

24.21 [For text of subitems (7) and (8), see M.R.]

24.22 (9) Copper, total, µg/L

24.23	9.8	18	35	--	--	--	--
-------	-----	----	----	----	----	----	----

24.24 Class 2B and 2D copper standards are hardness dependent. Copper values shown are for a
 24.25 total hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other
 24.26 hardness values and equations to calculate copper standards for any hardness value not to
 24.27 exceed 400 mg/L.

25.1 (10) Lead, total, µg/L

25.2 3.2 82 164 -- -- --

25.3 Class 2B and 2D lead standards are hardness dependent. Lead values shown are for a total
25.4 hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other hardness
25.5 values and equations to calculate lead standards for any hardness value not to exceed 400
25.6 mg/L.

25.7	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
25.8	CS	MS	FAV	IC	IR	LS	AN

25.9

25.10 [For text of subitems (11) and (12), see M.R.]

25.11 (13) Nickel, total, µg/L

25.12 158 1,418 2,836 -- -- --

25.13 Class 2B and 2D nickel standards are hardness dependent. Nickel values shown are for a
25.14 total hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other
25.15 hardness values and equations to calculate nickel standards for any hardness value not to
25.16 exceed 400 mg/L.

25.17 [For text of subitem (14), see M.R.]

25.18 (15) Silver, total, µg/L

25.19 1.0 2.0 4.1 -- -- --

25.20 Class 2B and 2D silver MS and FAV are hardness dependent. Silver values shown are for
25.21 a total hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other
25.22 hardness values and equations to calculate silver standards for any hardness value not to
25.23 exceed 400 mg/L.

25.24	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
25.25	CS	MS	FAV	IC	IR	LS	AN

25.26

25.27 [For text of subitem (16), see M.R.]

26.1 (17) Zinc, total, µg/L

26.2 106 117 234 -- -- --

26.3 Class 2B and 2D zinc standards are hardness dependent. Zinc values shown are for a total
26.4 hardness of 100 mg/L only. See part 7050.0222, subpart 4, for examples at other hardness
26.5 values and equations to calculate zinc standards for any hardness value not to exceed 400
26.6 mg/L.

26.7 C. ORGANIC POLLUTANTS OR CHARACTERISTICS

26.8	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
26.9	CS	MS	FAV	IC	IR	LS	AN

26.10

26.11 [For text of subitems (1) to (5), see M.R.]

26.12	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
26.13	CS	MS	FAV	IC	IR	LS	AN

26.14

26.15 [For text of subitems (6) to (10), see M.R.]

26.16	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
26.17	CS	MS	FAV	IC	IR	LS	AN

26.18

26.19 [For text of subitems (11) to (15), see M.R.]

26.20	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
26.21	CS	MS	FAV	IC	IR	LS	AN

26.22

26.23 [For text of subitems (16) to (20), see M.R.]

26.24	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
26.25	CS	MS	FAV	IC	IR	LS	AN

26.26

26.27 [For text of subitems (21) to (25), see M.R.]

27.1	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
27.2	CS	MS	FAV	IC	IR	LS	AN

27.3

27.4 [For text of subitems (26) to (30), see M.R.]

27.5	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
27.6	CS	MS	FAV	IC	IR	LS	AN

27.7

27.8 (31) Pentachlorophenol, µg/L

27.9	5.5	15	30	--	--	--	--
------	-----	----	----	----	----	----	----

27.10 Class 2B and 2D standards are pH dependent, except that the CS will not exceed 5.5 µg/L.
 27.11 Pentachlorophenol values shown are for a pH of 7.5 only. See part 7050.0222, subpart 4,
 27.12 for examples at other pH values and equations to calculate pentachlorophenol standards for
 27.13 any pH value.

27.14 [For text of subitems (32) to (35), see M.R.]

27.15	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
27.16	CS	MS	FAV	IC	IR	LS	AN

27.17

27.18 [For text of subitems (36) to (40), see M.R.]

27.19	2B&D	2B&D	2B&D	3A/3B/3C	4A	4B	5
27.20	CS	MS	FAV	IC	IR	LS	AN

27.21

27.22 [For text of subitems (41) to (43), see M.R.]

27.23 [For text of items D to F, see M.R.]

27.24 G. Temperature must not exceed:

27.25 (1) Class 2B standard: five degrees Fahrenheit above natural in streams and
 27.26 three degrees Fahrenheit above natural in lakes, based on monthly average of maximum

28.1 daily temperature, except in no case shall it exceed the daily average temperature of 86
28.2 degrees Fahrenheit; and

28.3 (2) Class 2D standard: maintain background as defined in part 7050.0222,
28.4 subpart 6.

28.5 Subp. 6. [Repealed, 24 SR 1105]

28.6 Subp. 6a. **Limited resource value waters and associated use classes.**

28.7 [For text of items A and B, see M.R.]

28.8 C. The level of dissolved oxygen must be maintained at concentrations:

28.9 (1) that will avoid odors or putrid conditions in the receiving water;

28.10 (2) at not less than one milligram per liter (daily average); and

28.11 (3) above zero milligrams per liter at all times.

28.12 [For text of items D and E, see M.R.]

28.13 [For text of subp 7, see M.R.]

28.14 **7050.0222 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 2 WATERS**
28.15 **OF THE STATE; AQUATIC LIFE AND RECREATION.**

28.16 [For text of subp 1, see M.R.]

28.17 Subp. 2. **Class 2A waters; aquatic life and recreation.** The quality of Class 2A
28.18 surface waters shall be such as to permit the propagation and maintenance of a healthy
28.19 community of cold water aquatic biota, and their habitats according to the definitions in
28.20 subpart 2c. These waters shall be suitable for aquatic recreation of all kinds, including
28.21 bathing, for which the waters may be usable. This class of surface waters is also protected
28.22 as a source of drinking water. Abbreviations, acronyms, and symbols are explained in subpart
28.23 1.

29.1	Substance,						Basis
29.2	Characteristic,						for
29.3	or Pollutant			Basis			MS,
29.4	(Class 2A)	Units	CS	for CS	MS	FAV	FAV

29.5

29.6	Acenaphthene	µg/L	20	HH	56	112	Tox
29.7	Acetochlor	µg/L	3.6	Tox	86	173	Tox
29.8	Acrylonitrile (c)	µg/L	0.38	HH	1,140*	2,281*	Tox
29.9	Alachlor (c)	µg/L	3.8	HH	800*	1,600*	Tox
29.10	Aluminum, total	µg/L	87	Tox	748	1,496	Tox
29.11	Ammonia un-ionized as N	µg/L	16	Tox	--	--	NA

29.12 The percent un-ionized ammonia can be calculated for any temperature and pH by
 29.13 using the following equation taken from Emerson, K., R.C. Russo, R.E. Lund, and R.V.
 29.14 Thurston, Aqueous ammonia equilibrium calculations; effect of pH and temperature.
 29.15 Journal of the Fisheries Research Board of Canada 32: 2379-2383 (1975):

$$f = \frac{1}{10^{(pk_a - pH)} + 1} \times 100$$

29.20 where: f = the percent of total ammonia in the un-ionized state
 29.21 $pk_a = 0.09 + (2730/T)$ (dissociation constant for ammonia)
 29.22 T = temperature in degrees Kelvin (273.16° Kelvin = 0° Celsius)

29.23	Substance,						Basis
29.24	Characteristic,						for
29.25	or Pollutant			Basis			MS,
29.26	(Class 2A)	Units	CS	for CS	MS	FAV	FAV

29.27

07/25/17

REVISOR

CKM/EP

AR4237

30.1	Anthracene	µg/L	0.035	Tox	0.32	0.63	Tox
30.2	Antimony, total	µg/L	5.5	HH	90	180	Tox
30.3	Arsenic, total	µg/L	2.0	HH	360	720	Tox
30.4	Atrazine (c)	µg/L	3.4	HH	323	645	Tox
30.5	Benzene (c)	µg/L	5.1	HH	4,487*	8,974*	Tox
30.6	Bromoform	µg/L	33	HH	2,900	5,800	Tox
30.7	Cadmium, total	µg/L	equation	Tox	equation	equation	Tox

30.8 The CS, MS, and FAV vary with total hardness and are calculated using the following
 30.9 equations:

30.10 The CS in µg/L shall not exceed: $\exp.(0.7852[\ln(\text{total hardness mg/L})]-3.490)$

30.11 The MS in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-3.828)$

30.12 The FAV in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-3.1349)$

30.13 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

30.14 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 30.15 standard.

30.16 Example of total cadmium standards for five hardness values:

30.17	TH in mg/L	50	100	200	300	400
-------	------------	----	-----	-----	-----	-----

30.18

30.19	Cadmium, total					
-------	----------------	--	--	--	--	--

30.20	CS µg/L	0.66	1.1	2.0	2.7	3.4
-------	---------	------	-----	-----	-----	-----

30.21	MS µg/L	1.8	3.9	8.6	14	19
-------	---------	-----	-----	-----	----	----

30.22	FAV µg/L	3.6	7.8	17	27	37
-------	----------	-----	-----	----	----	----

30.23	Substance, Characteristic, or Pollutant (Class 2A)						Basis for MS, FAV
30.24							
30.25							
30.26		Units	CS	Basis for CS	MS	FAV	

30.27

31.1	Carbon tetrachloride (c)	µg/L	1.9	HH	1750*	3500*	Tox
31.2	Chlordane (c)	ng/L	0.073	HH	1200*	2400*	Tox
31.3	Chloride	mg/L	230	Tox	860	1720	Tox
31.4	Chlorine, total residual	µg/L	11	Tox	19	38	Tox

31.5 Chlorine standard applies to conditions of continuous exposure, where continuous
 31.6 exposure refers to chlorinated effluents that are discharged for more than a total of two
 31.7 hours in any 24-hour period.

31.8	Chlorobenzene	µg/L	20	HH	423	846	Tox
31.9	(Monochlorobenzene)						
31.10	Chloroform (c)	µg/L	53	HH	1,392	2,784	Tox
31.11	Chlorpyrifos	µg/L	0.041	Tox	0.083	0.17	Tox
31.12	Chromium +3, total	µg/L	equation	Tox	equation	equation	Tox

31.13 The CS, MS, and FAV vary with total hardness and are calculated using the following
 31.14 equations:

31.15 The CS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+1.561)$

31.16 The MS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+3.688)$

31.17 The FAV in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+4.380)$

31.18 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

31.19 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 31.20 standard.

31.21 Example of total chromium +3 standards for five total hardness values:

31.22	TH in mg/L	50	100	200	300	400
31.23						
31.24	Chromium +3, total					
31.25	CS µg/L	117	207	365	509	644
31.26	MS µg/L	984	1,737	3,064	4,270	5,405
31.27	FAV µg/L	1,966	3,469	6,120	8,530	10,797

32.1	Substance,						Basis
32.2	Characteristic,						for
32.3	or Pollutant			Basis			MS,
32.4	(Class 2A)	Units	CS	for CS	MS	FAV	FAV

32.5

32.6	Chromium +6, total	µg/L	11	Tox	16	32	Tox
32.7	Cobalt, total	µg/L	2.8	HH	436	872	Tox
32.8	Color value	Pt/Co	30	NA	--	--	NA
32.9	Copper, total	µg/L	equation	Tox	equation	equation	Tox

32.10 The CS, MS, and FAV vary with total hardness and are calculated using the following
 32.11 equations:

32.12 The CS in µg/L shall not exceed: $\exp.(0.620[\ln(\text{total hardness mg/L})]-0.570)$

32.13 The MS in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-1.464)$

32.14 The FAV in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-0.7703)$

32.15 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

32.16 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 32.17 standard.

32.18 Example of total copper standards for five total hardness values:

32.19	TH in mg/L	50	100	200	300	400
-------	------------	----	-----	-----	-----	-----

32.20

32.21 Copper, total

32.22	CS µg/L	6.4	9.8	15	19	23
32.23	MS µg/L	9.2	18	34	50	65
32.24	FAV µg/L	18	35	68	100	131

32.25	Substance,						Basis
32.26	Characteristic,						for
32.27	or Pollutant			Basis			MS,
32.28	(Class 2A)	Units	CS	for CS	MS	FAV	FAV

32.29

33.1	Cyanide, free	µg/L	5.2	Tox	22	45	Tox
33.2	DDT (c)	ng/L	0.11	HH	550*	1100*	Tox
33.3	1,2-Dichloroethane (c)	µg/L	3.5	HH	45,050*	90,100*	Tox
33.4	Dieldrin (c)	ng/L	0.0065	HH	1,300*	2,500*	Tox
33.5	Di-2-ethylhexyl phthalate (c)	µg/L	1.9	HH	--*	--*	NA
33.6	Di-n-octyl phthalate	µg/L	30	Tox	825	1,650	Tox
33.7	Endosulfan	µg/L	0.0076	HH	0.084	0.17	Tox
33.8	Endrin	µg/L	0.0039	HH	0.090	0.18	Tox
33.9	<i>Escherichia (E.) coli</i>	See	See	HH	See	See	NA
33.10		below	below		below	below	

33.11 Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than
 33.12 five samples representative of conditions within any calendar month, nor shall more
 33.13 than ten percent of all samples taken during any calendar month individually exceed
 33.14 1,260 organisms per 100 milliliters. The standard applies only between April 1 and
 33.15 October 31.

33.16	Ethylbenzene	µg/L	68	Tox	1,859	3,717	Tox
-------	--------------	------	----	-----	-------	-------	-----

33.17	Substance, Characteristic, or Pollutant (Class 2A)		Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV
33.18								
33.19								
33.20								

33.21

33.22 Eutrophication standards for Class 2A lakes and reservoirs.

33.23 Designated lake trout lakes in all ecoregions (lake trout lakes support natural populations
 33.24 of lake trout, *Salvelinus namaycush*):

33.25	Phosphorus, total	µg/L	12	NA	--	--	NA
33.26	Chlorophyll-a	µg/L	3	NA	--	--	NA
33.27	Secchi disk transparency	meters	No less	NA	--	--	NA
33.28			than 4.8				

33.29 Designated trout lakes in all ecoregions, except lake trout lakes:

34.1	Phosphorus, total	µg/L	20	NA	--	--	NA
34.2	Chlorophyll-a	µg/L	6	NA	--	--	NA
34.3	Secchi disk transparency	meters	No less	NA	--	--	NA
34.4			than 2.5				
34.5	Additional narrative eutrophication standards for Class 2A lakes and reservoirs are found						
34.6	under subpart 2a.						
34.7	Eutrophication standards for Class 2A rivers and streams.						
34.8	North River Nutrient Region:						
34.9	Phosphorus, total			µg/L			less than or equal to 50
34.10	Chlorophyll-a (seston)			µg/L			less than or equal to 7
34.11	Diel dissolved oxygen flux			mg/L			less than or equal to 3.0
34.12	Biochemical oxygen demand (BOD ₅)			mg/L			less than or equal to 1.5
34.13	Central River Nutrient Region:						
34.14	Phosphorus, total			µg/L			less than or equal to 100
34.15	Chlorophyll-a (seston)			µg/L			less than or equal to 18
34.16	Diel dissolved oxygen flux			mg/L			less than or equal to 3.5
34.17	Biochemical oxygen demand (BOD ₅)			mg/L			less than or equal to 2.0
34.18	South River Nutrient Region:						
34.19	Phosphorus, total			µg/L			less than or equal to 150
34.20	Chlorophyll-a (seston)			µg/L			less than or equal to 35
34.21	Diel dissolved oxygen flux			mg/L			less than or equal to 4.5
34.22	Biochemical oxygen demand (BOD ₅)			mg/L			less than or equal to 3.0
34.23	Additional narrative eutrophication standards for Class 2A rivers and streams are found						
34.24	under subpart 2b.						

35.1	35.2	35.3	35.4	35.5			
Substance,	Characteristic,	or Pollutant					Basis
(Class 2A)			Units	CS	Basis	MS	for
					for CS	FAV	MS,
							FAV

35.6	Fluoranthene	µg/L	1.9	Tox	3.5	6.9	Tox
35.7	Heptachlor (c)	ng/L	0.10	HH	260*	520*	Tox
35.8	Heptachlor epoxide (c)	ng/L	0.12	HH	270*	530*	Tox
35.9	Hexachlorobenzene (c)	ng/L	0.061	HH	--*	--*	Tox
35.10	Lead, total	µg/L	equation	Tox	equation	equation	Tox

35.11 The CS, MS, and FAV vary with total hardness and are calculated using the following
 35.12 equations:

35.13 The CS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-4.705)$

35.14 The MS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-1.460)$

35.15 The FAV in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-0.7643)$

35.16 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

35.17 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 35.18 standard.

35.19 Example of total lead standards for five total hardness values:

35.20	TH in mg/L	50	100	200	300	400
-------	------------	----	-----	-----	-----	-----

35.21

35.22	Lead, total					
-------	-------------	--	--	--	--	--

35.23	CS µg/L	1.3	3.2	7.7	13	19
-------	---------	-----	-----	-----	----	----

35.24	MS µg/L	34	82	197	331	477
-------	---------	----	----	-----	-----	-----

35.25	FAV µg/L	68	164	396	663	956
-------	----------	----	-----	-----	-----	-----

35.26	35.27	Substance,	Units	CS	Basis	MS	FAV	Basis
		Characteristic,			for CS			for

36.1 **or Pollutant**
36.2 **(Class 2A)**

MS,
FAV

36.3							
36.4	Lindane (c)	µg/L	0.0087	HH	1.0*	2.0*	Tox
36.5	(Hexachlorocyclohexane,						
36.6	gamma-)						
36.7	Mercury, total in water	ng/L	6.9	HH	2,400*	4,900*	Tox
36.8	Mercury, total	mg/kg	0.2	HH	NA	NA	NA
36.9	in edible fish	ppm					
36.10	Methylene chloride (c)	µg/L	45	HH	13,875*	27,749*	Tox
36.11	Dichloromethane)						
36.12	Metolachlor	µg/L	23	Tox	271	543	Tox
36.13	Naphthalene	µg/L	65	HH	409	818	Tox
36.14	Nickel, total	µg/L	equation	Tox/HH	equation	equation	Tox

36.15 The CS, MS, and FAV vary with total hardness and are calculated using the following
36.16 equations:

36.17 The CS shall not exceed the human health-based standard of 297 µg/L. For waters with
36.18 total hardness values less than 212 mg/L, the CS in µg/L is toxicity-based and shall not
36.19 exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+1.1645)$

36.20 The MS in µg/L shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+3.3612)$

36.21 The FAV in µg/L shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+4.0543)$

36.22 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

36.23 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
36.24 standard.

36.25 Example of total nickel standards for five total hardness values:

36.26	TH in mg/L	50	100	200	300	400
36.27						
36.28	Nickel, total					
36.29	CS µg/L	88	158	283	297	297

37.1	MS µg/L	789	1,418	2,549	3,592	4,582
37.2	FAV µg/L	1,578	2,836	5,098	7,185	9,164

37.3	Substance, Characteristic, or Pollutant (Class 2A)						Basis for MS, FAV	
37.4								
37.5								
37.6		Units	CS	Basis for CS	MS	FAV		

37.7

37.8	Oil	µg/L	500	NA	5,000	10,000	NA
37.9	Oxygen, dissolved	mg/L	See	NA	--	--	NA
37.10			below				

37.11 7.0 mg/L as a daily minimum. This dissolved oxygen standard requires compliance
37.12 with the standard 50 percent of the days at which the flow of the receiving water is
37.13 equal to the 7Q₁₀.

37.14	Parathion	µg/L	0.013	Tox	0.07	0.13	Tox
37.15	Pentachlorophenol	µg/L	0.93	HH	equation	equation	Tox

37.16 The MS and FAV vary with pH and are calculated using the following equations:

37.17 The MS in µg/L shall not exceed: $\exp.(1.005[\text{pH}]-4.830)$

37.18 The FAV in µg/L shall not exceed: $\exp.(1.005[\text{pH}]-4.1373)$

37.19 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

37.20 For pH values less than 6.0, 6.0 shall be used to calculate the standard and for pH values
37.21 greater than 9.0, 9.0 shall be used to calculate the standard.

37.22 Example of pentachlorophenol standards for five pH values:

37.23	pH su	6.5	7.0	7.5	8.0	8.5
-------	-------	-----	-----	-----	-----	-----

37.24

37.25 Pentachlorophenol

37.26 CS µg/L 0.93 0.93 0.93 0.93 0.93

37.27 MS µg/L 5.5 9.1 15 25 41

37.28 FAV µg/L 11 18 30 50 82

38.1	38.2	38.3	38.4	38.5				
Substance, Characteristic, or Pollutant (Class 2A)	Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV		
38.6	pH, minimum	su	6.5	NA	--	--	NA	
38.7	pH, maximum	su	8.5	NA	--	--	NA	
38.8	Phenanthrene	µg/L	3.6	Tox	32	64	Tox	
38.9	Phenol	µg/L	123	Tox	2,214	4,428	Tox	
38.10	Polychlorinated biphenyls, total (c)	ng/L	0.014	HH	1,000*	2,000*	Tox	
38.12	Radioactive materials	NA	See below	NA	See below	See below	NA	
38.14	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as permitted by the appropriate authority having control over their use.							
38.16	Selenium, total	µg/L	5.0	Tox	20	40	Tox	
38.17	Silver, total	µg/L	0.12	Tox	equation	equation	Tox	
38.18	The MS and FAV vary with total hardness and are calculated using the following equations:							
38.20	The MS in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-7.2156)$							
38.21	The FAV in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-6.520)$							
38.22	Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.							
38.23	For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the standard.							
38.25	Example of silver standards for five total hardness values:							
38.26	TH in mg/L	50	100	200	300	400		
38.28	Silver, total							
38.29	CS µg/L	0.12	0.12	0.12	0.12	0.12		

39.1	MS µg/L	1.0	2.0	6.7	13	22	
39.2	FAV µg/L	1.2	4.1	13	27	44	
39.3	Substance, Characteristic, or Pollutant (Class 2A)						Basis for MS, FAV
39.4							
39.5							
39.6		Units	CS	Basis for CS	MS	FAV	
39.7							
39.8	Temperature	°C or	No	NA	--	--	NA
39.9		°F	material				
39.10			increase				
39.11	1,1,2,2-Tetrachloroethane (c)	µg/L	1.1	HH	1,127*	2,253*	Tox
39.12	Tetrachloroethylene (c)	µg/L	3.8	HH	428*	857*	Tox
39.13	Thallium, total	µg/L	0.28	HH	64	128	Tox
39.14	Toluene	µg/L	253	Tox	1,352	2,703	Tox
39.15	Toxaphene (c)	ng/L	0.31	HH	730*	1,500*	Tox
39.16	1,1,1-Trichloroethane	µg/L	329	Tox	2,957	5,913	Tox
39.17	1,1,2-Trichloroethylene (c)	µg/L	25	HH	6,988*	13,976*	Tox
39.18	2,4,6-Trichlorophenol	µg/L	2.0	HH	102	203	Tox
39.19	Total suspended solids (TSS)	mg/L	10	NA	--	--	NA
39.20	TSS standards for Class 2A						
39.21	may be exceeded for no more						
39.22	than ten percent of the time.						
39.23	This standard applies April 1						
39.24	through September 30						
39.25	Vinyl chloride (c)	µg/L	0.17	HH	--*	--*	NA
39.26	Xylene, total m,p,o	µg/L	166	Tox	1,407	2,814	Tox
39.27	Zinc, total	µg/L	equation	Tox	equation	equation	Tox
39.28	The CS, MS, and FAV vary with total hardness and are calculated using the following						
39.29	equations:						
39.30	The CS in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.7615)$						

The MS in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.8604)$

The FAV in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+1.5536)$

Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the standard.

Example of zinc standards for five total hardness values:

TH in mg/L	50	100	200	300	400
------------	----	-----	-----	-----	-----

Zinc, total

CS µg/L	59	106	191	269	343
---------	----	-----	-----	-----	-----

MS µg/L	65	117	211	297	379
---------	----	-----	-----	-----	-----

FAV µg/L	130	234	421	594	758
----------	-----	-----	-----	-----	-----

[For text of subps 2a and 2b, see M.R.]

Subp. 2c. **Beneficial use definitions for lotic cold water stream-and-river aquatic life and habitats (Class 2A).**

A. Subitems (1) to ~~(4)~~ (5) apply to the beneficial uses in items B and C:

(1) The designation and attainment of beneficial uses are based on the biological criteria in subpart 2d.

(2) The attributes of species composition, diversity, and functional organization are measured using:

(a) the ~~fish-based~~ fish IBI as defined in ~~Development of a Fish-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014)~~ Fish Data Collection Protocols for Lotic Waters in Minnesota (2017);

or

41.1 (b) the macroinvertebrate IBI as defined in ~~Development of a~~
41.2 ~~Macroinvertebrate-based Index of Biological Integrity for Minnesota's Rivers and Streams,~~
41.3 ~~Minnesota Pollution Control Agency (2014)~~ Macroinvertebrate Data Collection Protocols
41.4 for Lotic Waters in Minnesota (2017).

41.5 (3) Water body types for streams and rivers are defined in the documents
41.6 referenced in subitem (2).

41.7 (4) The following documents are incorporated by reference and are not subject
41.8 to frequent change:

41.9 (a) Calibration of the Biological Condition Gradient for Streams of
41.10 Minnesota, Gerritsen et al. (2012). The document is available on the agency's Web site at
41.11 www.pca.state.mn.us/regulations/minnesota-rulemaking;

41.12 (b) ~~Development of a Fish-based Index of Biological Integrity for~~
41.13 ~~Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014)~~ Fish Data
41.14 Collection Protocols for Lotic Waters in Minnesota, Minnesota Pollution Control Agency
41.15 (2017). The document is available on the agency's Web site at
41.16 www.pca.state.mn.us/regulations/minnesota-rulemaking;

41.17 (c) ~~Development of a Macroinvertebrate-based Index of Biological~~
41.18 ~~Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014)~~
41.19 Macroinvertebrate Data Collection Protocols for Lotic Waters in Minnesota, Minnesota
41.20 Pollution Control Agency (2017). The document is available on the agency's Web site at
41.21 www.pca.state.mn.us/regulations/minnesota-rulemaking; and

41.22 (d) Development of Biological Criteria for Tiered Aquatic Life Uses,
41.23 Minnesota Pollution Control Agency (2016). The document is available on the agency's
41.24 Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking.

(5) The beneficial use subclass designators "e" and "g" are added to the Class 2A designator as specific additional designators. The additional subclass designators do not replace the Class 2A designator. All requirements for Class 2A cold water stream and river habitats in parts 7050.0222 and 7052.0100 continue to apply in addition to requirements for Class 2Ae or Class 2Ag cold water stream and river habitats in part 7050.0222. These subclass designators are applied to lotic waters only.

B. "Exceptional cold water aquatic life and habitat" or "Class 2Ae" is a beneficial use that means waters capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of cold water aquatic organisms having a species composition, diversity, and functional organization comparable to the 75th percentile of biological condition gradient level 3 as established in Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

C. "General cold water aquatic life and habitat" or "Class 2Ag" is a beneficial use that means waters capable of supporting and maintaining a balanced, integrated, adaptive community of cold water aquatic organisms having a species composition, diversity, and functional organization comparable to the median of biological condition gradient level 4 as established in Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

Subp. 2d. **Biological criteria for lotic cold water stream and river aquatic life and habitats (Class 2A).**

Water Body Type	Tier	Class	Assemblage	Biocriterion
Southern cold water streams	Exceptional	2Ae	Fish	82
	General	2Ag	Fish	50
Northern cold water streams	Exceptional	2Ae	Fish	60
	General	2Ag	Fish	35

43.1	Northern cold water streams	Exceptional	2Ae	Macroinvertebrates	52
43.2		General	2Ag	Macroinvertebrates	32
43.3	Southern cold water streams	Exceptional	2Ae	Macroinvertebrates	72
43.4		General	2Ag	Macroinvertebrates	43

43.5 The biological criteria for lotic cold water aquatic life and habitats (Class 2A) are applicable
 43.6 to perennial and intermittent waters that allow for colonization of fish or macroinvertebrates.

43.7 Subp. 3. **Class 2Bd waters.** The quality of Class 2Bd surface waters shall be such as
 43.8 to permit the propagation and maintenance of a healthy community of cool or warm water
 43.9 aquatic biota and their habitats according to the definitions in subpart 3c. These waters shall
 43.10 be suitable for aquatic recreation of all kinds, including bathing, for which the waters may
 43.11 be usable. This class of surface waters is also protected as a source of drinking water. The
 43.12 applicable standards are given below. Abbreviations, acronyms, and symbols are explained
 43.13 in subpart 1.

43.14	Substance,						Basis
43.15	Characteristic,			Basis			for
43.16	or Pollutant			for			MS,
43.17	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV
43.18							
43.19	Acenaphthene	µg/L	20	HH	56	112	Tox
43.20	Acetochlor	µg/L	3.6	Tox	86	173	Tox
43.21	Acrylonitrile (c)	µg/L	0.38	HH	1,140*	2,281*	Tox
43.22	Alachlor (c)	µg/L	4.2	HH	800*	1,600*	Tox
43.23	Aluminum, total	µg/L	125	Tox	1,072	2,145	Tox
43.24	Ammonia un-ionized as N	µg/L	40	Tox	--	--	NA

43.25 The percent un-ionized ammonia can be calculated for any temperature and pH by
 43.26 using the following equation taken from Emerson, K., R.C. Russo, R.E. Lund, and R.V.
 43.27 Thurston, Aqueous ammonia equilibrium calculations; effect of pH and temperature.
 43.28 Journal of the Fisheries Research Board of Canada 32: 2379-2383 (1975):

$$f = 1 / (10^{(pK_a - pH)} + 1) \times 100$$

where: f = the percent of total ammonia in the un-ionized state

$pK_a = 0.09 + (2730/T)$ (dissociation constant for ammonia)

T = temperature in degrees Kelvin (273.16° Kelvin = 0° Celsius)

Substance, Characteristic, or Pollutant (Class 2Bd)	Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV
--	-------	----	--------------------	----	-----	----------------------------

Anthracene	µg/L	0.035	Tox	0.32	0.63	Tox
Antimony, total	µg/L	5.5	HH	90	180	Tox
Arsenic, total	µg/L	2.0	HH	360	720	Tox
Atrazine (c)	µg/L	3.4	HH	323	645	Tox
Benzene (c)	µg/L	6.0	HH	4,487*	8,974*	Tox
Bromoform	µg/L	41	HH	2,900	5,800	Tox
Cadmium, total	µg/L	equation	Tox	equation	equation	Tox

The CS, MS, and FAV vary with total hardness and are calculated using the following equations:

The CS in µg/L shall not exceed: $\exp.(0.7852[\ln(\text{total hardness mg/L})]-3.490)$

The MS in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-1.685)$

The FAV in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-0.9919)$

Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the standard.

Example of total cadmium standards for five hardness values:

TH in mg/L	50	100	200	300	400
------------	----	-----	-----	-----	-----

45.1	Cadmium, total						
45.2	CS µg/L	0.66	1.1	2.0	2.7	3.4	
45.3	MS µg/L	15	33	73	116	160	
45.4	FAV µg/L	31	67	146	231	319	
45.5	Substance,						Basis
45.6	Characteristic,			Basis			for
45.7	or Pollutant			for			MS,
45.8	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV
45.9							
45.10	Carbon tetrachloride (c)	µg/L	1.9	HH	1,750*	3,500*	Tox
45.11	Chlordane (c)	ng/L	0.29	HH	1,200*	2,400*	Tox
45.12	Chloride	mg/L	230	Tox	860	1,720	Tox
45.13	Chlorine, total residual	µg/L	11	Tox	19	38	Tox
45.14	Chlorine standard applies to conditions of continuous exposure, where continuous						
45.15	exposure refers to chlorinated effluents that are discharged for more than a total of two						
45.16	hours in any 24-hour period.						
45.17	Chlorobenzene	µg/L	20	HH	423	846	Tox
45.18	(Monochlorobenzene)						
45.19	Chloroform (c)	µg/L	53	HH	1,392	2,784	Tox
45.20	Chlorpyrifos	µg/L	0.041	Tox	0.083	0.17	Tox
45.21	Chromium +3, total	µg/L	equation	Tox	equation	equation	Tox
45.22	The CS, MS, and FAV vary with total hardness and are calculated using the following						
45.23	equations:						
45.24	The CS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+1.561)$						
45.25	The MS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+3.688)$						
45.26	The FAV in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+4.380)$						
45.27	Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.						

46.1 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
46.2 standard.

46.3 Example of total chromium +3 standards for five total hardness values:

46.4	TH in mg/L	50	100	200	300	400
46.5						
46.6	Chromium +3, total					
46.7	CS µg/L	117	207	365	509	644
46.8	MS µg/L	984	1,737	3,064	4,270	5,405
46.9	FAV µg/L	1,966	3,469	6,120	8,530	10,797

46.10	Substance, Characteristic, or Pollutant (Class 2Bd)						Basis for MS, FAV
46.11							
46.12							
46.13		Units	CS	Basis for CS	MS	FAV	
46.14							
46.15	Chromium +6, total	µg/L	11	Tox	16	32	Tox
46.16	Cobalt, total	µg/L	2.8	HH	436	872	Tox
46.17	Copper, total	µg/L	equation	Tox	equation	equation	Tox

46.18 The CS, MS, and FAV vary with total hardness and are calculated using the following
46.19 equations:

46.20 The CS in µg/L shall not exceed: $\exp.(0.620[\ln(\text{total hardness mg/L})]-0.570)$

46.21 The MS in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-1.464)$

46.22 The FAV in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-0.7703)$

46.23 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

46.24 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
46.25 standard.

46.26 Example of total copper standards for five total hardness values:

46.27	TH in mg/L	50	100	200	300	400
46.28						

47.1	Copper, total						
47.2	CS µg/L	6.4	9.8	15	19	23	
47.3	MS µg/L	9.2	18	34	50	65	
47.4	FAV µg/L	18	35	68	100	131	
47.5	Substance,						Basis
47.6	Characteristic,			Basis			for
47.7	or Pollutant			for			MS,
47.8	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV
47.9							
47.10	Cyanide, free	µg/L	5.2	Tox	22	45	Tox
47.11	DDT (c)	ng/L	1.7	HH	550*	1,100*	Tox
47.12	1,2-Dichloroethane (c)	µg/L	3.8	HH	45,050*	90,100*	Tox
47.13	Dieldrin (c)	ng/L	0.026	HH	1,300*	2,500*	Tox
47.14	Di-2-ethylhexyl phthalate (c)	µg/L	1.9	HH	--*	--*	NA
47.15	Di-n-octyl phthalate	µg/L	30	Tox	825	1,650	Tox
47.16	Endosulfan	µg/L	0.029	HH	0.28	0.56	Tox
47.17	Endrin	µg/L	0.016	HH	0.090	0.18	Tox
47.18	<i>Escherichia (E.) coli</i>	See	See	HH	See	See	NA
47.19		below	below		below	below	
47.20	Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than						
47.21	five samples representative of conditions within any calendar month, nor shall more						
47.22	than ten percent of all samples taken during any calendar month individually exceed						
47.23	1,260 organisms per 100 milliliters. The standard applies only between April 1 and						
47.24	October 31.						
47.25	Ethylbenzene	µg/L	68	Tox	1,859	3,717	Tox
47.26	Substance,						
47.27	Characteristic,			Basis			
47.28	or Pollutant			for			Basis
47.29	(Class 2Bd)	Units	CS	CS	MS	FAV	for

49.1	Phosphorus, total	µg/L	90	NA	--	--	NA
49.2	Chlorophyll-a	µg/L	30	NA	--	--	NA
49.3	Secchi disk transparency	meters	Not less	NA	--	--	NA
49.4			than 0.7				
49.5	Additional narrative eutrophication standards for Class 2Bd lakes, shallow lakes, and						
49.6	reservoirs are found under subpart 3a.						
49.7	Eutrophication standards for Class 2Bd rivers and streams.						
49.8	North River Nutrient Region						
49.9	Phosphorus, total		µg/L				less than or equal to 50
49.10	Chlorophyll-a (seston)		µg/L				less than or equal to 7
49.11	Diel dissolved oxygen flux		mg/L				less than or equal to 3.0
49.12	Biochemical oxygen demand (BOD ₅)		mg/L				less than or equal to 1.5
49.13	Central River Nutrient Region						
49.14	Phosphorus, total		µg/L				less than or equal to 100
49.15	Chlorophyll-a (seston)		µg/L				less than or equal to 18
49.16	Diel dissolved oxygen flux		mg/L				less than or equal to 3.5
49.17	Biochemical oxygen demand (BOD ₅)		mg/L				less than or equal to 2.0
49.18	South River Nutrient Region						
49.19	Phosphorus, total		µg/L				less than or equal to 150
49.20	Chlorophyll-a (seston)		µg/L				less than or equal to 35
49.21	Diel dissolved oxygen flux		mg/L				less than or equal to 4.5
49.22	Biochemical oxygen demand (BOD ₅)		mg/L				less than or equal to 3.0
49.23	Additional narrative eutrophication standards for Class 2Bd rivers and streams are found						
49.24	under subpart 3b.						

50.1	Substance,						Basis
50.2	Characteristic,			Basis			for
50.3	or Pollutant			for			MS,
50.4	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV

50.5

50.6	Fluoranthene	µg/L	1.9	Tox	3.5	6.9	Tox
50.7	Heptachlor (c)	ng/L	0.39	HH	260*	520*	Tox
50.8	Heptachlor epoxide (c)	ng/L	0.48	HH	270*	530*	Tox
50.9	Hexachlorobenzene (c)	ng/L	0.24	HH	--*	--*	Tox
50.10	Lead, total	µg/L	equation	Tox	equation	equation	Tox

50.11 The CS, MS, and FAV vary with total hardness and are calculated using the following
 50.12 equations:

50.13 The CS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-4.705)$

50.14 The MS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-1.460)$

50.15 The FAV in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-0.7643)$

50.16 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

50.17 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 50.18 standard.

50.19 Example of total lead standards for five total hardness values:

50.20	TH in mg/L	50	100	200	300	400
-------	------------	----	-----	-----	-----	-----

50.21

50.22	Lead, total					
-------	-------------	--	--	--	--	--

50.23	CS µg/L	1.3	3.2	7.7	13	19
-------	---------	-----	-----	-----	----	----

50.24	MS µg/L	34	82	197	331	477
-------	---------	----	----	-----	-----	-----

50.25	FAV µg/L	68	164	396	663	956
-------	----------	----	-----	-----	-----	-----

50.26	Substance,						
50.27	Characteristic,			Basis			
50.28	or Pollutant			for			Basis
50.29	(Class 2Bd)	Units	CS	CS	MS	FAV	for

51.1
51.2
51.3

**MS,
FAV**

51.4	Lindane (c)	µg/L	0.032	HH	4.4*	8.8*	Tox
51.5	(Hexachlorocyclohexane,						
51.6	gamma-)						
51.7	Mercury, total in water	ng/L	6.9	HH	2,400*	4,900*	Tox
51.8	Mercury, total	mg/kg	0.2	HH	NA	NA	NA
51.9	in edible fish tissue	ppm					
51.10	Methylene chloride (c)	µg/L	46	HH	13,875*	27,749*	Tox
51.11	(Dichloromethane)						
51.12	Metolachlor	µg/L	23	Tox	271	543	Tox
51.13	Naphthalene	µg/L	81	Tox	409	818	Tox
51.14	Nickel, total	µg/L	equation	Tox/HH	equation	equation	Tox

51.15 The CS, MS, and FAV vary with total hardness and are calculated using the following
51.16 equations:

51.17 The CS shall not exceed the human health-based standard of 297 µg/L. For waters with
51.18 total hardness values less than 212 mg/L, the CS in µg/L is toxicity-based and shall not
51.19 exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+1.1645)$

51.20 The MS in µg/L shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+3.3612)$

51.21 The FAV in µg/L shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+4.0543)$

51.22 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

51.23 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
51.24 standard.

51.25 Example of total nickel standards for five total hardness values:

51.26	TH in mg/L	50	100	200	300	400
51.27						
51.28	Nickel, total					
51.29	CS µg/L	88	158	283	297	297

52.1 MS µg/L 789 1,418 2,549 3,592 4,582

52.2 FAV µg/L 1,578 2,836 5,098 7,185 9,164

52.3 52.4 52.5 52.6	Substance, Characteristic, or Pollutant (Class 2Bd)	Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV
------------------------------	--	-------	----	--------------------	----	-----	----------------------------

52.7

52.8 Oil µg/L 500 NA 5,000 10,000 NA

52.9 Oxygen, dissolved mg/L See below NA -- -- NA

52.10

52.11 5.0 mg/L as a daily minimum. This dissolved oxygen standard may be modified on a
52.12 site-specific basis according to part 7050.0220, subpart 7, except that no site-specific
52.13 standard shall be less than 5 mg/L as a daily average and 4 mg/L as a daily minimum.
52.14 Compliance with this standard is required 50 percent of the days at which the flow of
52.15 the receiving water is equal to the 7Q₁₀.

52.16 Parathion µg/L 0.013 Tox 0.07 0.13 Tox

52.17 Pentachlorophenol µg/L 1.9 HH equation equation Tox

52.18 The MS and FAV vary with pH and are calculated using the following equations:

52.19 The MS in µg/L shall not exceed: $\exp.(1.005[\text{pH}]-4.830)$

52.20 The FAV in µg/L shall not exceed: $\exp.(1.005[\text{pH}]-4.1373)$

52.21 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

52.22 For pH values less than 6.0, 6.0 shall be used to calculate the standard and for pH values
52.23 greater than 9.0, 9.0 shall be used to calculate the standard.

52.24 Example of pentachlorophenol standards for five pH values:

52.25	pH su	6.5	7.0	7.5	8.0	8.5
-------	-------	-----	-----	-----	-----	-----

52.26

52.27 Pentachlorophenol

52.28	CS µg/L	1.9	1.9	1.9	1.9	1.9
-------	---------	-----	-----	-----	-----	-----

53.1	MS µg/L	5.5	9.1	15	25	41	
53.2	FAV µg/L	11	18	30	50	82	
53.3	Substance,						Basis
53.4	Characteristic,			Basis			for
53.5	or Pollutant			for			MS,
53.6	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV
53.7							
53.8	pH, minimum	su	6.5	NA	--	--	NA
53.9	pH, maximum	su	9.0	NA	--	--	NA
53.10	Phenanthrene	µg/L	3.6	Tox	32	64	Tox
53.11	Phenol	µg/L	123	Tox	2,214	4,428	Tox
53.12	Polychlorinated biphenyls, ng/L		0.029	HH	1,000*	2,000*	Tox
53.13	total (c)						
53.14	Radioactive materials	NA	See	NA	See	See	NA
53.15			below		below	below	
53.16	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled						
53.17	environment as permitted by the appropriate authority having control over their use.						
53.18	Selenium, total	µg/L	5.0	Tox	20	40	Tox
53.19	Silver, total	µg/L	1.0	Tox	equation	equation	Tox
53.20	The MS and FAV vary with total hardness and are calculated using the following						
53.21	equations:						
53.22	The MS in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-7.2156)$						
53.23	The FAV in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-6.520)$						
53.24	Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.						
53.25	For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the						
53.26	standard.						
53.27	Example of total silver standards for five total hardness values:						

54.1	TH in mg/L	50	100	200	300	400	
54.2							
54.3	Silver, total						
54.4	CS µg/L	1.0	1.0	1.0	1.0	1.0	
54.5	MS µg/L	1.0	2.0	6.7	13	22	
54.6	FAV µg/L	1.2	4.1	13	27	44	
54.7	Substance, Characteristic, or Pollutant (Class 2Bd)						
54.8				Basis			Basis
54.9				for			for
54.10		Units	CS	CS	MS	FAV	MS, FAV
54.11							
54.12	Temperature	°F	See	NA	--	--	NA
54.13			below				
54.14	5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperatures, except in no case shall it exceed the daily average temperature of 86°F.						
54.15							
54.16							
54.17	1,1,2,2-Tetrachloroethane	µg/L	1.5	HH	1,127*	2,253*	Tox
54.18	(c)						
54.19	Tetrachloroethylene (c)	µg/L	3.8	HH	428*	857*	Tox
54.20	Thallium, total	µg/L	0.28	HH	64	128	Tox
54.21	Toluene	µg/L	253	Tox	1,352	2,703	Tox
54.22	Toxaphene (c)	ng/L	1.3	HH	730*	1,500*	Tox
54.23	1,1,1-Trichloroethane	µg/L	329	Tox	2,957	5,913	Tox
54.24	1,1,2-Trichloroethylene (c)	µg/L	25	HH	6,988*	13,976*	Tox
54.25	2,4,6-Trichlorophenol	µg/L	2.0	HH	102	203	Tox
54.26	Total suspended solids						
54.27	(TSS)						
54.28	North River Nutrient						
54.29	Region	mg/L	15	NA	-	-	NA

07/25/17

REVISOR

CKM/EP

AR4237

55.1	Central River Nutrient						
55.2	Region	mg/L	30	NA	-	-	NA
55.3	South River Nutrient						
55.4	Region	mg/L	65	NA	-	-	NA
55.5	Red River mainstem -						
55.6	headwaters to border	mg/L	100	NA	-	-	NA
55.7	TSS standards for the Class						
55.8	2Bd North, Central, and						
55.9	South River Nutrient						
55.10	Regions and the Red River						
55.11	mainstem may be exceeded						
55.12	for no more than ten						
55.13	percent of the time. This						
55.14	standard applies April 1						
55.15	through September 30						
55.16	Total suspended solids						
55.17	(TSS), summer average						
55.18	Lower Mississippi River						
55.19	mainstem - Pools 2 through						
55.20	4	mg/L	32	NA	-	-	NA
55.21	Lower Mississippi River						
55.22	mainstem below Lake						
55.23	Pepin	mg/L	30	NA	-	-	NA
55.24	TSS standards for the Class						
55.25	2Bd Lower Mississippi						
55.26	River may be exceeded for						
55.27	no more than 50 percent of						
55.28	the time. This standard						
55.29	applies June 1 through						
55.30	September 30						
55.31	Substance,						Basis
55.32	Characteristic,			Basis			for
55.33	or Pollutant			for			MS,
55.34	(Class 2Bd)	Units	CS	CS	MS	FAV	FAV
55.35							

56.1	Vinyl chloride (c)	µg/L	0.18	HH	--*	--*	NA
56.2	Xylene, total m,p,o	µg/L	166	Tox	1,407	2,814	Tox
56.3	Zinc, total	µg/L	equation	Tox	equation	equation	Tox

56.4 The CS, MS, and FAV vary with total hardness and are calculated using the following
56.5 equations:

56.6 The CS in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.7615)$

56.7 The MS in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.8604)$

56.8 The FAV in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+1.5536)$

56.9 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

56.10 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
56.11 standard.

56.12 Example of total zinc standards for five total hardness values:

56.13	TH in mg/L	50	100	200	300	400
-------	------------	----	-----	-----	-----	-----

56.14

56.15	Zinc, total					
-------	-------------	--	--	--	--	--

56.16	CS µg/L	59	106	191	269	343
-------	---------	----	-----	-----	-----	-----

56.17	MS µg/L	65	117	211	297	379
-------	---------	----	-----	-----	-----	-----

56.18	FAV µg/L	130	234	421	594	758
-------	----------	-----	-----	-----	-----	-----

56.19 [For text of subps 3a and 3b, see M.R.]

56.20 Subp. 3c. **Beneficial use definitions for lotic warm or cool water ~~stream and river~~**
56.21 **aquatic life and habitats (Class 2Bd).**

56.22 A. Subitems (1) to ~~(4)~~ (5) apply to the beneficial uses in items B to D:

56.23 (1) The designation and attainment of beneficial uses are based on the
56.24 biological criteria in subpart 3d.

56.25 (2) The attributes of species composition, diversity, and functional
56.26 organization are measured using:

(a) the fish-based fish IBI as defined in Development of a Fish-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014) Fish Data Collection Protocols for Lotic Waters in Minnesota (2017);
or

(b) the macroinvertebrate IBI as defined in Development of a Macroinvertebrate-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014) Macroinvertebrate Data Collection Protocols for Lotic Waters in Minnesota (2017).

(3) Water body types for streams and rivers are defined in the documents referenced in subitem (2).

(4) The following documents are incorporated by reference and are not subject to frequent change:

(a) Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012). The document is available on the agency's Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking;

(b) Development of a Fish-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014) Fish Data Collection Protocols for Lotic Waters in Minnesota, Minnesota Pollution Control Agency (2017). The document is available on the agency's Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking;

(c) Development of a Macroinvertebrate-based Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014) Macroinvertebrate Data Collection Protocols for Lotic Waters in Minnesota, Minnesota Pollution Control Agency (2017). The document is available on the agency's Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking; and

(d) Development of Biological Criteria for Tiered Aquatic Life Uses, Minnesota Pollution Control Agency (2016). The document is available on the agency's Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking.

(5) The beneficial use subclass designators "e," "g," and "m" are added to the Class 2Bd designator as specific additional designators. The additional subclass designators do not replace the Class 2Bd designator. All requirements for Class 2Bd warm or cool water stream and river habitats in parts 7050.0222 and 7052.0100 continue to apply in addition to requirements for Class 2Bde, Class 2Bdg, or Class 2Bdm warm or cool water stream and river habitats in part 7050.0222. These subclass designators are applied to lotic waters only.

B. "Exceptional cool and warm water aquatic life and habitat, also protected as a source for drinking water" or "Class 2Bde" is a beneficial use that means waters capable of supporting and maintaining an exceptional and balanced, integrated, adaptive community of warm or cool water aquatic organisms having a species composition, diversity, and functional organization comparable to the 75th percentile of biological condition gradient level 3 as established in Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

C. "General cool and warm water aquatic life and habitat, also protected as a source for drinking water" or "Class 2Bdg" is a beneficial use that means waters capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool water aquatic organisms having a species composition, diversity, and functional organization comparable to the median of biological condition gradient level 4 as established in Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

D. "Modified cool and warm water aquatic life and habitat, also protected as a source for drinking water" or "Class 2Bdm" is a beneficial use that means waters capable of supporting and maintaining a balanced, integrated, adaptive community of warm or cool

water aquatic organisms having a species composition, diversity, and functional organization comparable to the median of biological condition gradient level 5 as established in Calibration of the Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

(1) To meet the definition in this item, waters must have been the subject of a use attainability analysis ~~and must have been found to be incapable of supporting and maintaining~~ where it is determined that attainment of the Class 2Bdg beneficial use is not feasible because of human-induced modifications of the physical habitat ~~that preclude the potential for recovery of the fauna~~. These modifications must be the result of direct alteration to the channel, such as drainageway maintenance, bank stabilization, and impoundments.

(2) Examples of Class 2Bdm waters are the stream channel modification activities regulated under:

(a) sections 401 and 404 of the Clean Water Act; or

(b) Minnesota Statutes, chapter 103E.

Subp. 3d. **Biological criteria for lotic warm or cool water stream and river aquatic life and habitats (Class 2Bd).**

Water Body Type	Tier	Class	Assemblage	Biocriterion
Southern rivers	Exceptional	2Bde	Fish	71
	General	2Bdg	Fish	49
Southern streams	Exceptional	2Bde	Fish	66
	General	2Bdg	Fish	50
	Modified	2Bdm	Fish	35
Southern headwaters	Exceptional	2Bde	Fish	74
	General	2Bdg	Fish	55
	Modified	2Bdm	Fish	33

60.1	Northern rivers	Exceptional	2Bde	Fish	67
60.2		General	2Bdg	Fish	38
60.3	Northern streams	Exceptional	2Bde	Fish	61
60.4		General	2Bdg	Fish	47
60.5		Modified	2Bdm	Fish	35
60.6	Northern headwaters	Exceptional	2Bde	Fish	68
60.7		General	2Bdg	Fish	42
60.8		Modified	2Bdm	Fish	23
60.9	Low gradient	Exceptional	2Bde	Fish	70
60.10		General	2Bdg	Fish	42
60.11		Modified	2Bdm	Fish	15
60.12	Northern forest rivers	Exceptional	2Bde	Macroinvertebrates	77
60.13		General	2Bdg	Macroinvertebrates	49
60.14	Prairie and southern forest				
60.15	rivers	Exceptional	2Bde	Macroinvertebrates	63
60.16		General	2Bdg	Macroinvertebrates	31
60.17	High-gradient northern				
60.18	forest streams	Exceptional	2Bde	Macroinvertebrates	82
60.19		General	2Bdg	Macroinvertebrates	53
60.20	Low-gradient northern				
60.21	forest streams	Exceptional	2Bde	Macroinvertebrates	76
60.22		General	2Bdg	Macroinvertebrates	51
60.23		Modified	2Bdm	Macroinvertebrates	37
60.24	High-gradient southern				
60.25	streams	Exceptional	2Bde	Macroinvertebrates	62
60.26		General	2Bdg	Macroinvertebrates	37
60.27		Modified	2Bdm	Macroinvertebrates	24
60.28	Low-gradient southern				
60.29	forest streams	Exceptional	2Bde	Macroinvertebrates	66

61.1	Low-gradient prairie streams	General	2Bdg	Macroinvertebrates	43
61.2		Modified	2Bdm	Macroinvertebrates	30
61.3		Exceptional	2Bde	Macroinvertebrates	69
61.4					
61.5					
61.6					
	General	2Bdg	Macroinvertebrates	41	
	Modified	2Bdm	Macroinvertebrates	22	

61.7 The biological criteria for lotic warm or cool water aquatic life and habitats (Class 2Bd) are
 61.8 applicable to perennial and intermittent waters that allow for colonization of fish or
 61.9 macroinvertebrates.

61.10 Subp. 4. **Class 2B waters.** The quality of Class 2B surface waters shall be such as to
 61.11 permit the propagation and maintenance of a healthy community of cool or warm water
 61.12 aquatic biota, and their habitats according to the definitions in subpart 4c. These waters
 61.13 shall be suitable for aquatic recreation of all kinds, including bathing, for which the waters
 61.14 may be usable. This class of surface water is not protected as a source of drinking water.
 61.15 The applicable standards are given below. Abbreviations, acronyms, and symbols are
 61.16 explained in subpart 1.

61.17	Substance,			Basis			Basis
61.18	Characteristic,			for			for MS,
61.19	or Pollutant			CS	MS	FAV	FAV
61.20	(Class 2B)	Units	CS	CS	MS	FAV	FAV
61.21							
61.22	Acenaphthene	µg/l	20	HH	56	112	Tox
61.23	Acetochlor	µg/L	3.6	Tox	86	173	Tox
61.24	Acrylonitrile (c)	µg/l	0.89	HH	1,140*	2,281*	Tox
61.25	Alachlor (c)	µg/L	59	Tox	800	1,600	Tox
61.26	Aluminum, total	µg/L	125	Tox	1,072	2,145	Tox
61.27	Ammonia un-ionized as N	µg/L	40	Tox	--	--	NA

The percent un-ionized ammonia can be calculated for any temperature and pH by using the following equation taken from Emerson, K., R.C. Russo, R.E. Lund, and R.V. Thurston, Aqueous ammonia equilibrium calculations; effect of pH and temperature. Journal of the Fisheries Research Board of Canada 32: 2379-2383 (1975):

$$f = 1 / (10^{(pK_a - pH)} + 1) \times 100$$

where: f = the percent of total ammonia in the un-ionized state

$$pK_a = 0.09 + (2730/T) \text{ (dissociation constant for ammonia)}$$

T = temperature in degrees Kelvin (273.16° Kelvin = 0° Celsius)

**Substance,
Characteristic,
or Pollutant
(Class 2B)**

Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV
-------	----	--------------------	----	-----	-------------------------

Anthracene	µg/L	0.035	Tox	0.32	0.63	Tox
Antimony, total	µg/L	31	Tox	90	180	Tox
Arsenic, total	µg/L	53	HH	360	720	Tox
Atrazine (c)	µg/L	10	Tox	323	645	Tox
Benzene (c)	µg/L	98	HH	4,487	8,974	Tox
Bromoform	µg/L	466	HH	2,900	5,800	Tox
Cadmium, total	µg/L	equation	Tox	equation	equation	Tox

The CS, MS, and FAV vary with total hardness and are calculated using the following equations:

The CS in µg/L shall not exceed: $\exp.(0.7852[\ln(\text{total hardness mg/L})]-3.490)$

The MS in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-1.685)$

The FAV in µg/L shall not exceed: $\exp.(1.128[\ln(\text{total hardness mg/L})]-0.9919)$

Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the standard.

Example of total cadmium standards for five hardness values:

	TH in mg/L	50	100	200	300	400
63.1	TH in mg/L	50	100	200	300	400
63.2						
63.3	Cadmium, total					
63.4	CS µg/L	0.66	1.1	2.0	2.7	3.4
63.5	MS µg/L	15	33	73	116	160
63.6	FAV µg/L	31	67	146	231	319

Chlorine standard applies to conditions of continuous exposure, where continuous exposure refers to chlorinated effluents that are discharged for more than a total of two hours in any 24-hour period.

The CS, MS, and FAV vary with total hardness and are calculated using the following equations

The CS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+1.561)$

The MS in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+3.688)$

The FAV in µg/L shall not exceed: $\exp.(0.819[\ln(\text{total hardness mg/L})]+4.380)$

64.1 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.
 64.2 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 64.3 standard.

64.4 Example of total chromium +3 standards for five total hardness values:

64.5	TH in mg/L	50	100	200	300	400
64.6						
64.7	Chromium +3, total					
64.8	CS µg/L	117	207	365	509	644
64.9	MS µg/L	984	1,737	3,064	4,270	5,405
64.10	FAV µg/L	1,966	3,469	6,120	8,530	10,797

64.11	Substance, Characteristic, or Pollutant (Class 2B)						
64.12				Basis			Basis
64.13				for			for MS,
64.14		Units	CS	CS	MS	FAV	FAV
64.15							
64.16	Chromium +6, total	µg/L	11	Tox	16	32	Tox
64.17	Cobalt, total	µg/L	5.0	Tox	436	872	Tox
64.18	Copper, total	µg/L	equation	Tox	equation	equation	Tox

64.19 The CS, MS, and FAV vary with total hardness and are calculated using the following
 64.20 equations:

64.21 The CS in µg/L shall not exceed: $\exp.(0.6200[\ln(\text{total hardness mg/L})]-0.570)$

64.22 The MS in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-1.464)$

64.23 The FAV in µg/L shall not exceed: $\exp.(0.9422[\ln(\text{total hardness mg/L})]-0.7703)$

64.24 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

64.25 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
 64.26 standard.

64.27 Example of total copper standards for five total hardness values:

65.1	TH in mg/L	50	100	200	300	400	
65.2							
65.3	Copper, total						
65.4	CS µg/L	6.4	9.8	15	19	23	
65.5	MS µg/L	9.2	18	34	50	65	
65.6	FAV µg/L	18	35	68	100	131	
65.7	Substance,						
65.8	Characteristic,			Basis			Basis
65.9	or Pollutant			for			for MS,
65.10	(Class 2B)	Units	CS	CS	MS	FAV	FAV
65.11							
65.12	Cyanide, free	µg/L	5.2	Tox	22	45	Tox
65.13	DDT (c)	ng/L	1.7	HH	550*	1,100*	Tox
65.14	1,2-Dichloroethane (c)	µg/L	190	HH	45,050*	90,100*	Tox
65.15	Dieldrin (c)	ng/L	0.026	HH	1,300*	2,500*	Tox
65.16	Di-2-ethylhexyl phthalate	µg/L	2.1	HH	--*	--*	NA
65.17	(c)						
65.18	Di-n-octyl phthalate	µg/L	30	Tox	825	1,650	Tox
65.19	Endosulfan	µg/L	0.031	HH	0.28	0.56	Tox
65.20	Endrin	µg/L	0.016	HH	0.090	0.18	Tox
65.21	<i>Escherichia (E.) coli</i>	See	See	HH	See	See	NA
65.22		below	below		below	below	
65.23	Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than						
65.24	five samples representative of conditions within any calendar month, nor shall more						
65.25	than ten percent of all samples taken during any calendar month individually exceed						
65.26	1,260 organisms per 100 milliliters. The standard applies only between April 1 and						
65.27	October 31.						
65.28	Ethylbenzene	µg/L	68	Tox	1,859	3,717	Tox

66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	66.10	66.11	66.12	66.13	66.14	66.15	66.16	66.17	66.18	66.19	66.20	66.21	66.22	66.23	66.24	66.25	66.26	66.27		
Substance, Characteristic, or Pollutant (Class 2B)		Units	CS	Basis for CS	MS	FAV	Basis for MS, FAV																					
Eutrophication standards for Class 2B lakes, shallow lakes, and reservoirs.																												
Lakes, Shallow Lakes, and Reservoirs in Northern Lakes and Forest Ecoregions																												
Phosphorus, total		µg/L	30	NA	--	--	NA																					
Chlorophyll-a		µg/L	9	NA	--	--	NA																					
Secchi disk transparency		meters	Not less than 2.0	NA	--	--	NA																					
Lakes and Reservoirs in North Central Hardwood Forest Ecoregion																												
Phosphorus, total		µg/L	40	NA	--	--	NA																					
Chlorophyll-a		µg/L	14	NA	--	--	NA																					
Secchi disk transparency		meters	Not less than 1.4	NA	--	--	NA																					
Lakes and Reservoirs in Western Corn Belt Plains and Northern Glaciated Plains Ecoregions																												
Phosphorus, total		µg/L	65	NA	--	--	NA																					
Chlorophyll-a		µg/L	22	NA	--	--	NA																					
Secchi disk transparency		meters	Not less than 0.9	NA	--	--	NA																					
Shallow Lakes in North Central Hardwood Forest Ecoregion																												
Phosphorus, total		µg/L	60		NA	--	--	NA																				
Chlorophyll-a		µg/L	20		NA	--	--	NA																				
Secchi disk transparency		meters	Not less than 1.0		NA	--	--	NA																				
Shallow Lakes in Western Corn Belt Plains and Northern Glaciated Plains Ecoregions																												

07/25/17

REVISOR

CKM/EP

AR4237

67.1	Phosphorus, total	µg/L	90	NA	--	--	NA
67.2	Chlorophyll-a	µg/L	30	NA	--	--	NA
67.3	Secchi disk transparency	meters	Not less	NA	--	--	NA
67.4			than 0.7				

67.5 Additional narrative eutrophication standards for Class 2B lakes, shallow lakes, and reservoirs
 67.6 are found in subpart 4a.

67.7	Substance,			Basis			Basis
67.8	Characteristic,			for			for MS,
67.9	or Pollutant			CS	MS	FAV	FAV
67.10	(Class 2B)	Units	CS				
67.11							

67.12 Eutrophication standards for Class 2B rivers and streams.

67.13 North River Nutrient Region

67.14	Phosphorus, total	µg/L	less than or equal to 50
67.15	Chlorophyll-a (seston)	µg/L	less than or equal to 7
67.16	Diel dissolved oxygen flux	mg/L	less than or equal to 3.0
67.17	Biochemical oxygen demand (BOD ₅)	mg/L	less than or equal to 1.5

67.18 Central River Nutrient Region

67.19	Phosphorus, total	µg/L	less than or equal to 100
67.20	Chlorophyll-a (seston)	µg/L	less than or equal to 18
67.21	Diel dissolved oxygen flux	mg/L	less than or equal to 3.5
67.22	Biochemical oxygen demand (BOD ₅)	mg/L	less than or equal to 2.0

67.23 South River Nutrient Region

67.24	Phosphorus, total	µg/L	less than or equal to 150
67.25	Chlorophyll-a (seston)	µg/L	less than or equal to 40

68.1	Diel dissolved oxygen flux	mg/L	less than or equal to 5.0
68.2	Biochemical oxygen demand (BOD ₅)	mg/L	less than or equal to 3.5
68.3	Site-specific standards for specified river reaches or other waters are:		
68.4	Mississippi River Navigational Pool 1 (river miles 854.1 to 847.7 reach from Fridley to Ford Dam in St. Paul)		
68.5			
68.6	Phosphorus, total	µg/L	less than or equal to 100
68.7	Chlorophyll-a (seston)	µg/L	less than or equal to 35
68.8	Mississippi River Navigational Pool 2 (river miles 847.7 to 815.2 reach from Ford Dam to Hastings Dam)		
68.9			
68.10	Phosphorus, total	µg/L	less than or equal to 125
68.11	Chlorophyll-a (seston)	µg/L	less than or equal to 35
68.12	Mississippi River Navigational Pool 3 (river miles 815.2 to 796.9 reach from Hastings Dam to Red Wing Dam)		
68.13			
68.14	Phosphorus, total	µg/L	less than or equal to 100
68.15	Chlorophyll-a (seston)	µg/L	less than or equal to 35
68.16	Mississippi River Navigational Pool 4 (river miles 796.9 to 752.8 reach from Red Wing Dam to Alma Dam). Lake Pepin occupies majority of Pool 4 and Lake Pepin site-specific standards are used for this pool.		
68.17			
68.18			
68.19	Mississippi River Navigational Pools 5 to 8 (river miles 752.8 to 679.1 Alma Dam to Genoa Dam)		
68.20			
68.21	Phosphorus, total	µg/L	less than or equal to 100
68.22	Chlorophyll-a (seston)	µg/L	less than or equal to 35
68.23	Lake Pepin		
68.24	Phosphorus, total	µg/L	less than or equal to 100
68.25	Chlorophyll-a (seston)	µg/L	less than or equal to 28

69.1 Crow Wing River from confluence of Long Prairie River to the mouth of the Crow Wing
69.2 River at the Mississippi River

69.3	Phosphorus, total	µg/L	less than or equal to 75
69.4	Chlorophyll-a (seston)	µg/L	less than or equal to 13
69.5	Diel dissolved oxygen flux	mg/L	less than or equal to 3.5
69.6	Biochemical oxygen demand (BOD ₅)	mg/L	less than or equal to 1.7

69.7 Crow River from the confluence of the North Fork of the Crow River and South Fork of
69.8 the Crow River to the mouth of the Crow River at the Mississippi River

69.9	Phosphorus, total	µg/L	less than or equal to 125
69.10	Chlorophyll-a (seston)	µg/L	less than or equal to 27
69.11	Diel dissolved oxygen flux	mg/L	less than or equal to 4.0
69.12	Biochemical oxygen demand (BOD ₅)	mg/L	less than or equal to 2.5

69.13 Additional narrative eutrophication standards for Class 2B rivers and streams are found in
69.14 subpart 4b.

69.15	Substance,						
69.16	Characteristic,			Basis			Basis
69.17	or Pollutant			for			for MS,
69.18	(Class 2B)	Units	CS	CS	MS	FAV	FAV

69.19

69.20	Fluoranthene	µg/L	1.9	Tox	3.5	6.9	Tox
69.21	Heptachlor (c)	ng/L	0.39	HH	260*	520*	Tox
69.22	Heptachlor epoxide (c)	ng/L	0.48	HH	270*	530*	Tox
69.23	Hexachlorobenzene (c)	ng/L	0.24	HH	--*	--*	Tox
69.24	Lead, total	µg/L	equation	Tox	equation	equation	Tox

69.25 The CS, MS, and FAV vary with total hardness and are calculated using the following
69.26 equations:

69.27 The CS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-4.705)$

70.1 The MS in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-1.460)$

70.2 The FAV in µg/L shall not exceed: $\exp.(1.273[\ln(\text{total hardness mg/L})]-0.7643)$

70.3 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

70.4 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
70.5 standard.

70.6 Example of total lead standards for five total hardness values:

70.7 TH in mg/L 50 100 200 300 400

70.8

70.9 Lead, total

70.10 CS µg/L 1.3 3.2 7.7 13 19

70.11 MS µg/L 34 82 197 331 477

70.12 FAV µg/L 68 164 396 663 956

70.13 **Substance,**

70.14 **Characteristic,**

70.15 **or Pollutant**

70.16 **(Class 2B)**

Units

CS

**Basis
for
CS**

MS

FAV

**Basis
for MS,
FAV**

70.17

70.18 Lindane (c) µg/L 0.036 HH 4.4* 8.8* Tox
70.19 (Hexachlorocyclobenzene,
70.20 gamma-)

70.21 Mercury, total in water ng/L 6.9 HH 2,400* 4,900* Tox

70.22 Mercury, total mg/kg 0.2 HH NA NA NA
70.23 in edible fish tissue ppm

70.24 Methylene chloride (c) µg/L 1,940 HH 13,875 27,749 Tox
70.25 (Dichloromethane)

70.26 Metolachlor µg/L 23 Tox 271 543 Tox

70.27 Naphthalene µg/L 81 Tox 409 818 Tox

70.28 Nickel, total µg/L equation Tox equation equation Tox

71.1 The CS, MS, and FAV vary with total hardness and are calculated using the following
71.2 equations:

71.3 The CS in $\mu\text{g/L}$ shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+1.1645)$

71.4 The MS in $\mu\text{g/L}$ shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+3.3612)$

71.5 The FAV in $\mu\text{g/L}$ shall not exceed: $\exp.(0.846[\ln(\text{total hardness mg/L})]+4.0543)$

71.6 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

71.7 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
71.8 standard.

71.9 Example of total nickel standards for five total hardness values:

71.10 TH in mg/L 50 100 200 300 400

71.11

71.12 Nickel, total

71.13 CS $\mu\text{g/L}$ 88 158 283 399 509

71.14 MS $\mu\text{g/L}$ 789 1,418 2,549 3,592 4,582

71.15 FAV $\mu\text{g/L}$ 1,578 2,836 5,098 7,185 9,164

71.16 Substance,

71.17 Characteristic,

71.18 or Pollutant

71.19 (Class 2B)

Units

CS

Basis
for

CS

MS

FAV

Basis
for MS,

FAV

71.20

71.21 Oil $\mu\text{g/l}$ 500 NA 5,000 10,000 NA

71.22 Oxygen, dissolved mg/L See NA -- -- NA
71.23 below

71.24 5.0 mg/L as a daily minimum. This dissolved oxygen standard may be modified on a
71.25 site-specific basis according to part 7050.0220, subpart 7, except that no site-specific
71.26 standard shall be less than 5 mg/L as a daily average and 4 mg/L as a daily minimum.
71.27 Compliance with this standard is required 50 percent of the days at which the flow of
71.28 the receiving water is equal to the $7Q_{10}$. This standard applies to all Class 2B waters
71.29 except for:

72.1 (1) those portions of the Mississippi River from the outlet of the Metro Wastewater
 72.2 Treatment Works in Saint Paul (River Mile 835) to Lock and Dam No. 2 at Hastings
 72.3 (River Mile 815). For this reach of the Mississippi River, the standard is not less
 72.4 than 5 mg/L as a daily average from April 1 through November 30, and not less
 72.5 than 4 mg/L at other times; and

72.6 (2) the portion of the Minnesota River from the outlet of the Blue Lake wastewater
 72.7 treatment works (River Mile 21) to the mouth at Fort Snelling. For the specified
 72.8 reach of the Minnesota River, the standard is not less than 5 mg/L as a daily average
 72.9 year round.

72.10 Parathion $\mu\text{g/L}$ 0.013 Tox 0.07 0.13 Tox

72.11 Pentachlorophenol $\mu\text{g/L}$ equation Tox/HH equation equation Tox

72.12 The CS, MS, and FAV vary with pH and are calculated using the following equations:

72.13 For waters with pH values greater than 6.95, the CS shall not exceed the human
 72.14 health-based standard of 5.5 $\mu\text{g/L}$.

72.15 For waters with pH values less than 6.96, the CS in $\mu\text{g/L}$ shall not exceed the
 72.16 toxicity-based standard of $\exp.(1.005[\text{pH}]-5.290)$

72.17 The MS in $\mu\text{g/L}$ shall not exceed: $\exp.(1.005[\text{pH}]-4.830)$

72.18 The FAV in $\mu\text{g/L}$ shall not exceed: $\exp.(1.005[\text{pH}]-4.1373)$

72.19 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

72.20 For pH values less than 6.0, 6.0 shall be used to calculate the standard and for pH values
 72.21 greater than 9.0, 9.0 shall be used to calculate the standard.

72.22 Example of pentachlorophenol standards for five pH values:

72.23 pH su 6.5 7.0 7.5 8.0 8.5

72.24

72.25 Pentachlorophenol

72.26 CS $\mu\text{g/L}$ 3.5 5.5 5.5 5.5 5.5

73.1	MS µg/L	5.5	9.1	15	25	41	
73.2	FAV µg/L	11	18	30	50	82	
73.3	Substance,						
73.4	Characteristic,			Basis			Basis
73.5	or Pollutant			for			for MS,
73.6	(Class 2B)	Units	CS	CS	MS	FAV	FAV

73.7							
73.8	pH, minimum	su	6.5	NA	--	--	NA
73.9	pH, maximum	su	9.0	NA	--	--	NA
73.10	Phenanthrene	µg/L	3.6	Tox	32	64	Tox
73.11	Phenol	µg/L	123	Tox	2,214	4,428	Tox
73.12	Polychlorinated	ng/L	0.029	HH	1,000*	2,000*	Tox
73.13	biphenyls, total (c)						
73.14	Radioactive materials	NA	See	NA	See	See	NA
73.15			below		below	below	
73.16	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled						
73.17	environment as permitted by the appropriate authority having control over their use.						
73.18	Selenium, total	µg/L	5.0	Tox	20	40	Tox
73.19	Silver, total	µg/L	1.0	Tox	equation	equation	Tox
73.20	The MS and FAV vary with total hardness and are calculated using the following						
73.21	equations:						
73.22	The MS in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-7.2156)$						
73.23	The FAV in µg/L shall not exceed: $\exp.(1.720[\ln(\text{total hardness mg/L})]-6.520)$						
73.24	Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.						
73.25	For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the						
73.26	standard.						
73.27	Example of total silver standards for five total hardness values:						

74.1	TH in mg/L	50	100	200	300	400	
74.2							
74.3	Silver, total						
74.4	CS µg/L	1.0	1.0	1.0	1.0	1.0	
74.5	MS µg/L	1.0	2.0	6.7	13	22	
74.6	FAV µg/L	1.2	4.1	13	27	44	
74.7	Substance,						
74.8	Characteristic,			Basis			Basis
74.9	or Pollutant			for			for MS,
74.10	(Class 2B)	Units	CS	CS	MS	FAV	FAV
74.11							
74.12	Temperature	°F	See	NA	--	--	NA
74.13			below				
74.14	5°F above natural in streams and 3°F above natural in lakes, based on monthly average						
74.15	of the maximum daily temperatures, except in no case shall it exceed the daily average						
74.16	temperature of 86°F.						
74.17	1,1,2,2-Tetrachloroethane (c) µg/L	13	HH	1,127	2,253	Tox	
74.18	Tetrachloroethylene (c) µg/L	8.9	HH	428	857	Tox	
74.19	Thallium, total µg/L	0.56	HH	64	128	Tox	
74.20	Toluene µg/L	253	Tox	1,352	2,703	Tox	
74.21	Toxaphene (c) ng/L	1.3	HH	730*	1,500*	Tox	
74.22	1,1,1-Trichloroethane µg/L	329	Tox	2,957	5,913	Tox	
74.23	1,1,2-Trichloroethylene (c) µg/L	120	HH	6,988	13,976	Tox	
74.24	2,4,6-Trichlorophenol µg/L	2.0	HH	102	203	Tox	
74.25	Total suspended solids (TSS)						
74.26	North River Nutrient Region mg/L	15	NA	--	--	NA	
74.27	Central River Nutrient Region mg/L	30	NA	--	--	NA	
74.28	South River Nutrient Region mg/L	65	NA	--	--	NA	

75.1	Red River mainstem -						
75.2	headwaters to border	mg/L	100	NA	--	--	NA
75.3	TSS standards for the Class						
75.4	2B North, Central, and South						
75.5	River Nutrient Regions and						
75.6	the Red River mainstem may						
75.7	be exceeded for no more than						
75.8	ten percent of the time. This						
75.9	standard applies April 1						
75.10	through September 30						
75.11	Total suspended solids (TSS),						
75.12	summer average						
75.13	Lower Mississippi River						
75.14	mainstem - Pools 2 through 4	mg/L	32	NA	--	--	NA
75.15	Lower Mississippi River						
75.16	mainstem below Lake Pepin	mg/L	30	NA	--	--	NA
75.17	TSS standards for the Class						
75.18	2B Lower Mississippi River						
75.19	may be exceeded for no more						
75.20	than 50 percent of the time.						
75.21	This standard applies June 1						
75.22	through September 30						
75.23	Substance,						
75.24	Characteristic,			Basis			Basis
75.25	or Pollutant			for			for MS,
75.26	(Class 2B)	Units	CS	CS	MS	FAV	FAV
75.27							
75.28	Vinyl chloride (c)	µg/L	9.2	HH	--*	--*	NA
75.29	Xylene, total m,p,o	µg/L	166	Tox	1,407	2,814	Tox
75.30	Zinc, total	µg/L	equation	Tox	equation	equation	Tox
75.31	The CS, MS, and FAV vary with total hardness and are calculated using the following						
75.32	equations:						
75.33	The CS in µg/L shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.7615)$						

76.1 The MS in $\mu\text{g/L}$ shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+0.8604)$

76.2 The FAV in $\mu\text{g/L}$ shall not exceed: $\exp.(0.8473[\ln(\text{total hardness mg/L})]+1.5536)$

76.3 Where: exp. is the natural antilogarithm (base e) of the expression in parenthesis.

76.4 For hardness values greater than 400 mg/L, 400 mg/L shall be used to calculate the
76.5 standard.

76.6 Example of total zinc standards for five total hardness values:

76.7 TH in mg/L	50	100	200	300	400
-----------------	----	-----	-----	-----	-----

76.8

76.9 Zinc, total					
------------------	--	--	--	--	--

76.10 CS $\mu\text{g/L}$	59	106	191	269	343
--------------------------	----	-----	-----	-----	-----

76.11 MS $\mu\text{g/L}$	65	117	211	297	379
--------------------------	----	-----	-----	-----	-----

76.12 FAV $\mu\text{g/L}$	130	234	421	594	758
---------------------------	-----	-----	-----	-----	-----

76.13 [For text of subps 4a and 4b, see M.R.]

76.14 Subp. 4c. **Beneficial use definitions for lotic warm or cool water ~~stream and river~~**
76.15 **aquatic life and habitats (Class 2B).**

76.16 A. Subitems (1) to ~~(4)~~ (5) apply to the beneficial uses in items B to D:

76.17 (1) The designation and attainment of beneficial uses are based on the criteria
76.18 in subpart 4d.

76.19 (2) The attributes of species composition, diversity, and functional
76.20 organization are measured using:

76.21 (a) the ~~fish-based~~ fish IBI as defined in ~~Development of a Fish-based~~
76.22 ~~Index of Biological Integrity for Minnesota's Rivers and Streams, Minnesota Pollution~~
76.23 ~~Control Agency (2014)~~ Fish Data Collection Protocols for Lotic Waters in Minnesota (2017);
76.24 or

77.1 (b) the macroinvertebrate IBI as defined in ~~Development of a~~
77.2 ~~Macroinvertebrate-based Index of Biological Integrity for Minnesota's Rivers and Streams,~~
77.3 ~~Minnesota Pollution Control Agency (2014)~~ Macroinvertebrate Data Collection Protocols
77.4 for Lotic Waters in Minnesota (2017).

77.5 (3) Water body types for streams and rivers are defined in the documents
77.6 referenced in subitem (2).

77.7 (4) The following documents are incorporated by reference and are not subject
77.8 to frequent change:

77.9 (a) Calibration of the Biological Condition Gradient for Streams of
77.10 Minnesota, Gerritsen et al. (2012). The document is available on the agency's Web site at
77.11 www.pca.state.mn.us/regulations/minnesota-rulemaking;

77.12 (b) ~~Development of a Fish-based Index of Biological Integrity for~~
77.13 ~~Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014)~~ Fish Data
77.14 Collection Protocols for Lotic Waters in Minnesota, Minnesota Pollution Control Agency
77.15 (2017). The document is available on the agency's Web site at
77.16 www.pca.state.mn.us/regulations/minnesota-rulemaking;

77.17 (c) ~~Development of a Macroinvertebrate-based Index of Biological~~
77.18 ~~Integrity for Minnesota's Rivers and Streams, Minnesota Pollution Control Agency (2014)~~
77.19 Macroinvertebrate Data Collection Protocols for Lotic Waters in Minnesota, Minnesota
77.20 Pollution Control Agency (2017). The document is available on the agency's Web site at
77.21 www.pca.state.mn.us/regulations/minnesota-rulemaking; and

77.22 (d) Development of Biological Criteria for Tiered Aquatic Life Uses,
77.23 Minnesota Pollution Control Agency (2016). The document is available on the agency's
77.24 Web site at www.pca.state.mn.us/regulations/minnesota-rulemaking.

78.1 (5) The beneficial use subclass designators "e," "g," and "m" are added to
78.2 the Class 2B designator as specific additional designators. The additional subclass designators
78.3 do not replace the Class 2B designator. All requirements for Class 2B warm or cool water
78.4 stream and river habitats in parts 7050.0222 and 7052.0100 continue to apply in addition
78.5 to requirements for Class 2Be, Class 2Bg, or Class 2Bm warm or cool water stream and
78.6 river habitats in part 7050.0222. These subclass designators are applied to lotic waters only.

78.7 B. "Exceptional cool and warm water aquatic life and habitat" or "Class 2Be" is
78.8 a beneficial use that means waters capable of supporting and maintaining an exceptional
78.9 and balanced, integrated, adaptive community of warm or cool water aquatic organisms
78.10 having a species composition, diversity, and functional organization comparable to the 75th
78.11 percentile of biological condition gradient level 3 as established in Calibration of the
78.12 Biological Condition Gradient for Streams of Minnesota, Gerritsen et al. (2012).

78.13 C. "General cool and warm water aquatic life and habitat" or "Class 2Bg" is a
78.14 beneficial use that means waters capable of supporting and maintaining a balanced, integrated,
78.15 adaptive community of warm or cool water aquatic organisms having a species composition,
78.16 diversity, and functional organization comparable to the median of biological condition
78.17 gradient level 4 as established in Calibration of the Biological Condition Gradient for Streams
78.18 of Minnesota, Gerritsen et al. (2012).

78.19 D. "Modified cool and warm water aquatic life and habitat" or "Class 2Bm" is a
78.20 beneficial use that means waters capable of supporting and maintaining a balanced, integrated,
78.21 adaptive community of warm or cool water aquatic organisms having a species composition,
78.22 diversity, and functional organization comparable to the median of biological condition
78.23 gradient level 5 as established in Calibration of the Biological Condition Gradient for Streams
78.24 of Minnesota, Gerritsen et al. (2012).

78.25 (1) To meet the definition in this item, waters must have been the subject of
78.26 a use attainability analysis ~~and must have been found to be incapable of supporting and~~

79.1 ~~maintaining~~ where it is determined that attainment of the Class 2Bg beneficial use is not
 79.2 feasible because of human-induced modifications of the physical habitat ~~that preclude the~~
 79.3 ~~potential for recovery of the fauna~~. These modifications must be the result of direct alteration
 79.4 to the channel, such as drainageway maintenance, bank stabilization, and impoundments.

79.5 (2) Examples of Class 2Bm waters are the stream channel modification
 79.6 activities regulated under:

79.7 (a) sections 401 and 404 of the Clean Water Act; or

79.8 (b) Minnesota Statutes, chapter 103E.

79.9 Subp. 4d. **Biological criteria for lotic warm or cool water ~~stream and river~~ aquatic**
 79.10 **life and habitats (Class 2B).**

79.11	Water Body Type	Tier	Class	Assemblage	Biocriterion
79.12					
79.13	Southern rivers	Exceptional	2Be	Fish	71
79.14		General	2Bg	Fish	49
79.15		Modified	2Bm	Fish	35
79.16	Southern streams	Exceptional	2Be	Fish	66
79.17		General	2Bg	Fish	50
79.18		Modified	2Bm	Fish	33
79.19	Southern headwaters	Exceptional	2Be	Fish	74
79.20		General	2Bg	Fish	55
79.21		Modified	2Bm	Fish	33
79.22	Northern rivers	Exceptional	2Be	Fish	67
79.23		General	2Bg	Fish	38
79.24		Modified	2Bm	Fish	35
79.25	Northern streams	Exceptional	2Be	Fish	61
79.26		General	2Bg	Fish	47
		Modified	2Bm	Fish	35
	Northern headwaters	Exceptional	2Be	Fish	68
		General	2Bg	Fish	47
		Modified	2Bm	Fish	35

80.1		General	2Bg	Fish	42
80.2		Modified	2Bm	Fish	23
80.3	Low gradient	Exceptional	2Be	Fish	70
80.4		General	2Bg	Fish	42
80.5		Modified	2Bm	Fish	15
80.6	Northern forest rivers	Exceptional	2Be	Macroinvertebrates	77
80.7		General	2Bg	Macroinvertebrates	49
80.8	Prairie and southern forest				
80.9	rivers	Exceptional	2Be	Macroinvertebrates	63
80.10		General	2Bg	Macroinvertebrates	31
80.11	High-gradient northern				
80.12	forest streams	Exceptional	2Be	Macroinvertebrates	82
80.13		General	2Bg	Macroinvertebrates	53
80.14	Low-gradient northern				
80.15	forest streams	Exceptional	2Be	Macroinvertebrates	76
80.16		General	2Bg	Macroinvertebrates	51
80.17		Modified	2Bm	Macroinvertebrates	37
80.18	High-gradient southern				
80.19	streams	Exceptional	2Be	Macroinvertebrates	62
80.20		General	2Bg	Macroinvertebrates	37
80.21		Modified	2Bm	Macroinvertebrates	24
80.22	Low-gradient southern				
80.23	forest streams	Exceptional	2Be	Macroinvertebrates	66
80.24		General	2Bg	Macroinvertebrates	43
80.25		Modified	2Bm	Macroinvertebrates	30
80.26	Low-gradient prairie				
80.27	streams	Exceptional	2Be	Macroinvertebrates	69
80.28		General	2Bg	Macroinvertebrates	41
80.29		Modified	2Bm	Macroinvertebrates	22

81.1 The biological criteria for lotic warm or cool water aquatic life and habitats (Class 2B) are
 81.2 applicable to perennial and intermittent waters that allow for colonization of fish or
 81.3 macroinvertebrates.

81.4 Subp. 5. [See repealer.]

81.5 [For text of subps 6 to 9, see M.R.]

81.6 **7050.0227 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 7 WATERS**
 81.7 **OF THE STATE; LIMITED RESOURCE VALUE WATERS.**

81.8 [For text of subp 1, see M.R.]

81.9 Subp. 2. **Class 7 waters; limited resource value waters.** The quality of Class 7 waters
 81.10 of the state shall be such as to protect aesthetic qualities, secondary body contact use, and
 81.11 groundwater for use as a potable water supply. Standards for substances, characteristics, or
 81.12 pollutants given below shall not be exceeded in the waters:

81.13 Substance, Characteristic, or
 81.14 Pollutant

Class 7 Standard

81.15 *Escherichia (E.) coli*
 81.16 Not to exceed 630 organisms per 100 milliliters as a
 81.17 geometric mean of not less than five samples
 81.18 representative of conditions within any calendar month,
 81.19 nor shall more than ten percent of all samples taken
 81.20 during any calendar month individually exceed 1,260
 81.21 organisms per 100 milliliters. The standard applies
 only between May 1 and October 31.

81.22 Oxygen, dissolved
 81.23 The level of dissolved oxygen must be maintained at
 concentrations:

81.24 i. that will avoid odors or putrid conditions in the
 81.25 receiving water;

81.26 ii. at not less than 1 mg/L (daily average); and

81.27 iii. above 0 mg/L at all times.

81.28 pH, minimum value 6.0

82.1 pH, maximum value 9.0

82.2 Toxic pollutants Toxic pollutants shall not be allowed in such quantities
82.3 or concentrations that will impair the specified uses.

82.4 **7050.0430 UNLISTED WATERS.**

82.5 Subpart 1. **Statewide surface waters.** Except as provided in subparts 2 and 3, all
82.6 surface waters of the state that are not listed in part 7050.0470 and that are not wetlands as
82.7 defined in part 7050.0186, subpart 1a, are hereby classified as Class ~~2Bg~~ 2B, 3C, 4A, 4B,
82.8 5, and 6 waters. Unlisted lotic waters are also assigned the beneficial use subclass designator
82.9 "g" to the Class 2B designator.

82.10 Subp. 2. **Boundary Waters Canoe Area Wilderness.**

82.11 A. All streams in the Boundary Waters Canoe Area Wilderness [11/5/84P] not
82.12 listed in part 7050.0470 are classified as Class 1B, 2Bdg, 3B.

82.13 B. All lakes in the Boundary Waters Canoe Area Wilderness [11/5/84P] not listed
82.14 in part 7050.0470 are classified as Class 1B, 2Bd, 3B.

82.15 C. All wetlands in the Boundary Waters Canoe Area Wilderness [11/5/84P] are
82.16 classified as Class 2D.

82.17 Subp. 3. **Voyageurs National Park.**

82.18 A. All streams in Voyageurs National Park [11/5/84P] not listed in part 7050.0470
82.19 are classified as Class 2Bg, 3B.

82.20 B. All lakes in Voyageurs National Park [11/5/84P] not listed in part 7050.0470
82.21 are classified as Class 2B, 3B.

82.22 C. All wetlands in Voyageurs National Park [11/5/84P] are classified as Class
82.23 2D.

7050.0460 WATERS SPECIFICALLY CLASSIFIED; EXPLANATION OF LISTINGS IN PART 7050.0470.

Subpart 1. **Explanation of listings.** The waters of the state listed in part 7050.0470 are classified as specified. The location of lakes, wetlands, calcareous fens, and scientific and natural areas are described by township, range, and section. Specific stream stretches are described by township, range, and section; stream confluence; geographic coordinates; road crossing; some other recognizable landmark; or a combination of these descriptors. Streams and rivers are listed by the eight-digit hydrologic unit code (HUC) of the major watersheds in part 7050.0469 in which the streams and rivers are located. The tables that specify the applicable beneficial uses for the stream and river reaches are incorporated by reference in part 7050.0470. Any community listed in part 7050.0470 is the community nearest the water classified, and is included solely to assist in identifying the water. Most waters of the state are not specifically listed in part 7050.0470. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed.

[For text of subps 2 and 3, see M.R.]

84.1 **7050.0469 MAP: MINNESOTA'S MAJOR WATERSHEDS.**



84.2 **7050.0470 CLASSIFICATIONS FOR SURFACE WATERS IN MAJOR DRAINAGE**
 84.3 **BASINS.**

84.4 Subpart 1. **Lake Superior Basin.** The water use classifications for the stream reaches
 84.5 within each of the major watersheds in the Lake Superior Basin listed in item A are found
 84.6 in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web
 84.7 site of the Minnesota Pollution Control Agency at

www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Lake Superior Basin are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

(1) 04010101 Lake Superior - North (August 9, 2016);

(2) 04010102 Lake Superior - South (August 9, 2016);

(3) 04010201 St. Louis River (August 9, 2016);

(4) 04010202 Cloquet River (August 9, 2016); and

(5) 04010301 Nemadji River (August 9, 2016).

B. Lakes:

[For text of subitems (1) to (151), see M.R.]

(152) White Pine Lake, 16-0369-00, [WR] (T.61, R.3W, S.19, 20, 29, 30):

2B, 3B; and

(153) *Winchell Lake, 16-0354-00, [11/5/84P] (T.64, R.2, 3): 1B, 2A, 3B.

[For text of items C and D, see M.R.]

Subp. 2. Lake of the Woods Basin. The water use classifications for the stream reaches within each of the major watersheds in the Lake of the Woods Basin listed in item A are found in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at

www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Lake of the Woods Basin are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

- (1) 09030001 Rainy River - Headwaters (August 9, 2016);
- (2) 09030002 Vermilion River (August 9, 2016);
- (3) 09030003 Rainy River - Rainy Lake (August 9, 2016);
- (4) 09030005 Little Fork River (August 9, 2016);
- (5) 09030006 Big Fork River (August 9, 2016);
- (6) 09030007 Rapid River (August 9, 2016);
- (7) 09030008 Rainy River - Lower (August 9, 2016); and
- (8) 09030009 Lake of the Woods (August 9, 2016).

B. Lakes:

[For text of subitems (1) to (182), see M.R.]

- (183) *Wisini Lake, 38-0361-00, [11/5/84P] (T.64, R.7): 1B, 2A, 3B; and
- (184) Woods, Lake of the, 39-0002-00, (see Lake of the Woods).

[For text of items C and D, see M.R.]

Subp. 3. **Red River of the North Basin.** The water use classifications for the stream reaches within each of the major watersheds in the Red River of the North Basin listed in item A are found in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Red River of the North Basin are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

- (1) 09020101 Bois de Sioux River (August 9, 2016);
- (2) 09020102 Mustinka River (August 9, 2016);
- (3) 09020103 Otter Tail River (August 9, 2016);
- (4) 09020104 Upper Red River of the North (August 9, 2016);
- (5) 09020106 Buffalo River (August 9, 2016);
- (6) 09020107 Red River of the North - Marsh River (August 9, 2016);
- (7) 09020108 Wild Rice River (August 9, 2016);
- (8) 09020301 Red River of the North - Sandhill River (August 9, 2016);
- (9) 09020302 Upper/Lower Red Lake (August 9, 2016);
- (10) 09020303 Red Lake River (August 9, 2016);
- (11) 09020304 Thief River (August 9, 2016);

- 88.1 (12) 09020305 Clearwater River (August 9, 2016);
- 88.2 (13) 09020306 Red River of the North - Grand Marais Creek (August 9,
- 88.3 2016);
- 88.4 (14) 09020309 Snake River (August 9, 2016);
- 88.5 (15) 09020311 Red River of the North - Tamarac River (August 9, 2016);
- 88.6 (16) 09020312 Two Rivers (August 9, 2016); and
- 88.7 (17) 09020314 Roseau River (August 9, 2016).

88.8 [For text of items B to D, see M.R.]

88.9 Subp. 4. **Upper Mississippi River Basin** (headwaters to the confluence with the

88.10 **St. Croix River**). The water use classifications for the stream reaches within each of the

88.11 major watersheds in the Upper Mississippi River Basin from the headwaters to the confluence

88.12 with the St. Croix River listed in item A are found in tables entitled "Beneficial Use

88.13 Designations for Stream Reaches" published on the Web site of the Minnesota Pollution

88.14 Control Agency at www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are

88.15 incorporated by reference and are not subject to frequent change. The date after each

88.16 watershed listed in item A is the publication date of the applicable table. The water use

88.17 classifications for the other listed waters in the Upper Mississippi River Basin from the

88.18 headwaters to the confluence with the St. Croix River are as identified in items B to D. See

88.19 parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use

88.20 information for water bodies can also be accessed through the agency's Environmental Data

88.21 Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

88.22 A. Streams (by eight-digit hydrologic unit code):

- 88.23 (1) 07010101 Mississippi River - Headwaters (August 9, 2016);
- 88.24 (2) 07010102 Leech Lake River (August 9, 2016);

- 89.1 (3) 07010103 Mississippi River - Grand Rapids (August 9, 2016);
- 89.2 (4) 07010104 Mississippi River - Brainerd (August 9, 2016);
- 89.3 (5) 07010105 Pine River (August 9, 2016);
- 89.4 (6) 07010106 Crow Wing River (August 9, 2016);
- 89.5 (7) 07010107 Redeye River (August 9, 2016);
- 89.6 (8) 07010108 Long Prairie River (August 9, 2016);
- 89.7 (9) 07010201 Mississippi River - Sartell (August 9, 2016);
- 89.8 (10) 07010202 Sauk River (August 9, 2016);
- 89.9 (11) 07010203 Mississippi River - St. Cloud (August 9, 2016);
- 89.10 (12) 07010204 North Fork Crow River (August 9, 2016);
- 89.11 (13) 07010205 South Fork Crow River (August 9, 2016);
- 89.12 (14) 07010206 Mississippi River - Twin Cities (August 9, 2016); and
- 89.13 (15) 07010207 Rum River (August 9, 2016).

89.14 [For text of items B to D, see M.R.]

89.15 Subp. 5. **Minnesota River Basin.** The water use classifications for the stream reaches
89.16 within each of the major watersheds in the Minnesota River Basin listed in item A are found
89.17 in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web
89.18 site of the Minnesota Pollution Control Agency at
89.19 www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by
89.20 reference and are not subject to frequent change. The date after each watershed listed in
89.21 item A is the publication date of the applicable table. The water use classifications for the
89.22 other listed waters in the Minnesota River Basin are as identified in items B to D. See parts
89.23 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use

information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

- (1) 07020001 Minnesota River - Headwaters (August 9, 2016);
- (2) 07020002 Pomme de Terre River (August 9, 2016);
- (3) 07020003 Lac qui Parle River (August 9, 2016);
- (4) 07020004 Minnesota River - Yellow Medicine River (August 9, 2016);
- (5) 07020005 Chippewa River (August 9, 2016);
- (6) 07020006 Redwood River (August 9, 2016);
- (7) 07020007 Minnesota River - Mankato (August 9, 2016);
- (8) 07020008 Cottonwood River (August 9, 2016);
- (9) 07020009 Blue Earth River (August 9, 2016);
- (10) 07020010 Watonwan River (August 9, 2016);
- (11) 07020011 Le Sueur River (August 9, 2016); and
- (12) 07020012 Lower Minnesota River (August 9, 2016).

[For text of items B to D, see M.R.]

Subp. 6. Saint Croix River Basin. The water use classifications for the stream reaches within each of the major watersheds in the Saint Croix River Basin listed in item A are found in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in

item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Saint Croix River Basin are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

(1) 07030001 Upper St. Croix River (August 9, 2016);

(2) 07030003 Kettle River (August 9, 2016);

(3) 07030004 Snake River (August 9, 2016); and

(4) 07030005 Lower St. Croix River (August 9, 2016).

[For text of items B to D, see M.R.]

Subp. 7. Lower Mississippi River Basin (from the confluence with the St. Croix River to the Iowa border). The water use classifications for the stream reaches within each of the major watersheds in the Lower Mississippi River Basin from the confluence with the Saint Croix River to the Iowa border listed in item A are found in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Lower Mississippi River Basin from the confluence with the St. Croix River to the Iowa border are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

- (1) 07040001 Mississippi River - Lake Pepin (August 9, 2016);
- (2) 07040002 Cannon River (August 9, 2016);
- (3) 07040003 Mississippi River - Winona (August 9, 2016);
- (4) 07040004 Zumbro River (August 9, 2016);
- (5) 07040006 Mississippi River - La Crescent (August 9, 2016);
- (6) 07040008 Root River (August 9, 2016);
- (7) 07060001 Mississippi River - Reno (August 9, 2016); and
- (8) 07060002 Upper Iowa River (August 9, 2016).

[For text of items B to D, see M.R.]

Subp. 8. **Cedar-Des Moines Rivers Basin.** The water use classifications for the stream reaches within each of the major watersheds in the Cedar-Des Moines Rivers Basin listed in item A are found in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web site of the Minnesota Pollution Control Agency at www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by reference and are not subject to frequent change. The date after each watershed listed in item A is the publication date of the applicable table. The water use classifications for the other listed waters in the Cedar-Des Moines Rivers Basin are as identified in items B to D. See parts 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use information for water bodies can also be accessed through the agency's Environmental Data Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

A. Streams (by eight-digit hydrologic unit code):

- (1) 07080102 Upper Wapsipinicon River (August 9, 2016);

- 93.1 (2) 07080201 Cedar River (August 9, 2016);
- 93.2 (3) 07080202 Shell Rock River (August 9, 2016);
- 93.3 (4) 07080203 Winnebago River (August 9, 2016);
- 93.4 (5) 07100001 Des Moines River - Headwaters (August 9, 2016);
- 93.5 (6) 07100002 Lower Des Moines River (August 9, 2016); and
- 93.6 (7) 07100003 East Fork Des Moines River (August 9, 2016).

93.7 [For text of items B to D, see M.R.]

93.8 Subp. 9. **Missouri River Basin.** The water use classifications for the stream reaches
93.9 within each of the major watersheds in the Missouri River Basin listed in item A are found
93.10 in tables entitled "Beneficial Use Designations for Stream Reaches" published on the Web
93.11 site of the Minnesota Pollution Control Agency at
93.12 www.pca.state.mn.us/regulations/minnesota-rulemaking. The tables are incorporated by
93.13 reference and are not subject to frequent change. The date after each watershed listed in
93.14 item A is the publication date of the applicable table. The water use classifications for the
93.15 other listed waters in the Missouri River Basin are as identified in items B to D. See parts
93.16 7050.0425 and 7050.0430 for the classifications of waters not listed. Designated use
93.17 information for water bodies can also be accessed through the agency's Environmental Data
93.18 Access (<http://www.pca.state.mn.us/quick-links/eda-surface-water-data>).

93.19 A. Streams (by eight-digit hydrologic unit code):

- 93.20 (1) 10170202 Upper Big Sioux River (August 9, 2016);
- 93.21 (2) 10170203 Lower Big Sioux River (August 9, 2016);
- 93.22 (3) 10170204 Rock River (August 9, 2016); and
- 93.23 (4) 10230003 Little Sioux River (August 9, 2016).

94.1 [For text of items B to D, see M.R.]

94.2 **7052.0100 WATER QUALITY STANDARDS.**

94.3 [For text of subps 1 to 4, see M.R.]

94.4 **Subp. 5. Water quality standards applicable to Class 2B and 2D waters.**

94.5	Substance	Units	Aquatic	Aquatic	Aquatic	Human	Wildlife	Applicable
94.6			Life	Life	Life	Health	Chronic	Chronic
94.7			Chronic	Maximum	Final	Chronic	Standard	Standard
94.8			Standard	Standard	Acute	Standard		
94.9					Value			
94.10								
94.11	Arsenic, total	ug/l	148	340	680	53†		53
94.12	Benzene	ug/l	114†	4487†	8974†	237		114
94.13	Cadmium, total	ug/l	subp 6	subp 6	subp 6			subp 6
94.14	(TH)							
94.15	Chlordane	pg/l				225		225
94.16	Chlorobenzene	ug/l	10†	423†	846†	2916		10
94.17	Chromium III, total	ug/l	subp 6	subp 6	subp 6			subp 6
94.18	(TH)							
94.19	Chromium VI, total	ug/l	11	16	32			11
94.20	Copper, total (TH)	ug/l	subp 6	subp 6	subp 6			subp 6
94.21	Cyanide, free	ug/l	5.2	22	44	30240		5.2
94.22	DDT	pg/l				142	11	11
94.23	Dieldrin	pg/l	56000	240000	480000	6.5		6.5
94.24	2,4-Dimethylphenol	ug/l	21	137	274	7182		21

07/25/17

REVISOR

CKM/EP

AR4237

95.1	2,4-Dinitrophenol	ug/l	71	379	758	1982		71
95.2	Endrin	ug/l	0.036	0.086	0.17	0.016†		0.016
95.3	Hexachlorobenzene	pg/l				419		419
95.4	Hexachloroethane	ug/l				6.2		6.2
95.5	Lindane	ug/l		0.95	1.9	0.46		0.46
95.6	Mercury, total	ug/l	0.91	1.7	3.4	0.00153	0.0013	0.0013
95.7	Methylene Chloride	ug/l	1561†	9600†	19200†	1994		1561
95.8	Nickel, total (TH)	ug/l	subp 6	subp 6	subp 6			subp 6
95.9	Parathion	ug/l	0.013	0.065	0.13			.013
95.10	PCBs (class)	pg/l				25.2	122	25.2
95.11	Pentachlorophenol	ug/l	subp 6	subp 6	subp 6	5.5†		subp 6
95.12	(pH)							
95.13	Selenium, total	ug/l	5.0	20†	40†			5.0
95.14	2,3,7,8-TCDD	pg/l				0.0080	0.0031	0.0031
95.15	Toluene	ug/l	253†	1352†	2703†	45679		253
95.16	Toxaphene	pg/l				62		62
95.17	Trichloroethylene	ug/l				330		330
95.18	Zinc, total (TH)	ug/l	subp 6	subp 6	subp 6			subp 6

95.19 †this standard or FAV was derived under chapter 7050.

95.20 Subp. 6. Water quality standards that vary with water quality characteristics.

95.21 [For text of items A and B, see M.R.]

C. Standards that vary with pH applicable to Class 2B and 2D waters in the Lake Superior Basin are listed in this subpart. Exp. is the base e exponential function.

		Example standards at pH of:				
Pentachlorophenol Formula, results in ug/l		6.5	7.0	7.5	8.0	8.5
Chronic standard	exp.(1.005[pH]-5.134) not to exceed 5.5 ug/l	4.0	5.5	5.5	5.5	5.5
Maximum standard	exp.(1.005[pH]-4.869)	5.3	8.7	14	24	39
Final acute value	exp.(1.005[pH]-4.175)	11	17	29	48	79

7052.0110 METHODOLOGIES FOR DEVELOPMENT OF STANDARDS AND CRITERIA, AND BIOACCUMULATION FACTORS.

[For text of subps 1 and 2, see M.R.]

Subp. 3. **Bioaccumulation factors.** Bioaccumulation factors (BAFs) for calculating human health and wildlife standards were developed and BAFs for calculating criteria must be developed using the methodology provided by Code of Federal Regulations, title 40, part 132, Appendix B, entitled "Great Lakes Water Quality Methodology for Deriving Bioaccumulation Factors," as amended through March 12, 1997, which is adopted and incorporated by reference in part 7052.0015, item B, except that for human health standards and criteria, the baseline BAF is multiplied by the following lipid fractions which apply to fish in both trophic levels 3 (TL₃) and 4 (TL₄), except as noted in item C:

[For text of items A and B, see M.R.]

C. 0.015 for TL₄ and 0.020 for TL₃ for Class 2B, 2Bd, and 2D waters.

[For text of subps 4 and 5, see M.R.]

REPEALER. Minnesota Rules, part 7050.0222, subpart 5, is repealed.