**Pollution Control Agency**

**Adopted Permanent Rules Relating to Water Quality**

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

[For text of subps 1 to 3, see M.R.]

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

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

C. "$BOD_5$" 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.

D. "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.

E. "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.

F. "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.

G. "Eutrophication" means the increased productivity of the biological community in water bodies in response to increased nutrient loading. Eutrophication is characterized by increased growth and abundance of algae and other aquatic plants, reduced water transparency, reduction or loss of dissolved oxygen, and other chemical and

biological changes. The acceleration of eutrophication due to excess nutrient loading from human sources and activities, called cultural eutrophication, causes a degradation of water quality and possible loss of beneficial uses.

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

~~H~~ I. "Fish and other biota" and "lower aquatic biota" mean the aquatic community including, but not limited to, 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, and microscopic organisms. "Other biota" includes aquatic or semiaquatic organisms that depend on aquatic systems for food or habitat such as amphibians and certain wildlife species.

~~I~~ J. "Hydraulic residence time" means the time water resides in a basin or, alternately, the time it would take to fill the basin if it were empty.

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

~~K~~ L. "Index of biological integrity" or "IBI" means an index developed by measuring attributes of an aquatic community that change in quantifiable and predictable ways in response to human disturbance, representing the health of that community.

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

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

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

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

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

~~Q~~ R. "Normal fishery" and "normally present" mean the fishery and other aquatic biota expected to be present in the water body in the absence of pollution of the water, consistent with any variability due to natural hydrological, substrate, habitat, or other physical and chemical characteristics. Expected presence is based on comparing the aquatic community in the water body of interest to the aquatic community in representative reference water bodies.

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

~~S~~ T. "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.

~~T~~ U. "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.

~~U~~ V. "Reference water body" means a water body least impacted by point or nonpoint sources of pollution that is representative of water bodies in the same ecoregion or watershed. Reference water bodies are used as a base for comparing the quality of similar water bodies in the same ecoregion or watershed.

~~V~~ W. "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 $122Q_{10}$ for the months of June through September.

~~W~~ X. "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 ~~(2010)~~ (2013), which is incorporated by reference. The document is not subject to frequent change and is available through the Minitex interlibrary loan system.

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

~~Y~~ Z. "Secchi disk transparency" means the transparency of water as measured by either a Secchi disk, a Secchi tube, or a transparency tube.

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

~~AA~~ BB. "Seston" means particulate matter suspended in water bodies and includes plankton and organic and inorganic matter.

~~BB~~ CC. "Shallow lake" means an enclosed basin filled or partially filled with standing fresh water with a maximum depth of 15 feet or less or with 80 percent or more of the lake area shallow enough to support emergent and submerged rooted aquatic plants (the littoral zone). It is uncommon for shallow lakes to thermally stratify during the summer. The quality of shallow lakes will permit the propagation and maintenance of a healthy indigenous aquatic community and they will be suitable for boating and other forms of 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.

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

~~DD~~ EE. "Summer season" means a period annually from June 1 through September 30.

~~EE~~ FF. "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.

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

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

Subp. 5. **Impairment of waters due to excess algae or plant growth.** In evaluating whether the narrative standards in subpart 3, which prohibit any material increase in undesirable slime growths or aquatic plants including algae, are being met, the commissioner will use all readily available and reliable data and information for the following factors of use impairment:

A. representative summer-average concentrations of total phosphorus and total nitrogen measured in the water body;

B. representative summer-average concentrations of chlorophyll-a seston measured in the water body;

C. representative summer-average measurements of Secchi disk transparency in the water body;

D. representative summer-average concentrations of five-day biochemical oxygen demand measured in rivers and streams;

E. representative diel dissolved oxygen flux measurements in rivers and streams as averaged over a minimum of four consecutive days during the summer season;

F. representative measurements of pH in the water body during the summer season;

G. representative measurements of chlorophyll-a (periphyton) on substrates on the beds of rivers and streams during the summer season; and

H. any other scientifically objective, credible, and supportable factor.

Subp. 5a. **Impaired condition; lakes, shallow lakes, and reservoirs.**

A. For lakes, shallow lakes, and reservoirs, a finding of an impaired condition must be supported by data showing:

(1) elevated levels of nutrients under subpart 5, item A; and

(2) at least one factor showing impaired conditions resulting from nutrient overenrichment under subpart 5, items B and C.

B. The trophic status data described in subpart 5, items A to C and H, must be assessed in light of the magnitude, duration, and frequency of nuisance algae blooms in the water body; and documented impaired recreational and aesthetic conditions observed

by the users of the water body due to excess algae or plant growth, reduced transparency, or other deleterious conditions caused by nutrient overenrichment.

C. Assessment of trophic status and the response of a given water body to nutrient enrichment will take into account the trophic status of reference water bodies; and all relevant factors that affect the trophic status of the given water body appropriate for its geographic region, such as the temperature, morphometry, hydraulic residence time, mixing status, watershed size, and location.

Subp. 5b. **Impaired condition; rivers and streams.** For rivers and streams, a finding of an impaired condition must be supported by data showing:

A. elevated levels of nutrients under subpart 5, item A, and at least one factor showing impaired conditions resulting from nutrient overenrichment under subpart 5, item B, D, E, F, or H; or

B. elevated levels of chlorophyll-a (periphyton) under subpart 5, item G.

Subp. 5c. **Impaired condition; navigational pools.** For navigational pools, a finding of impaired condition must be supported by data showing:

A. elevated levels of nutrients under subpart 5, item A; and

B. impaired conditions resulting from nutrient overenrichment under subpart 5, item B.

[For text of subps 6 to 8, see M.R.]

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

[For text of subps 1 to 3, see M.R.]

Subp. 3a. **Cold water sport fish, drinking water, and associated use classes.** Water quality standards applicable to use Classes 1B, 2A, 3A or 3B, 4A and 4B, and 5 surface waters.

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (1) Ammonia, un-ionized as N, µg/L | | | | | | | |
| 16 | – | – | – | – | – | – | – |
| (2) Asbestos, >10 µm (c), fibers/L | | | | | | | |
| – | – | – | 7.0e+06 | – | – | – | – |
| (3) Bicarbonates ($HCO_3$), meq/L | | | | | | | |
| – | – | – | – | – | 5 | – | – |
| (4) Bromate, µg/L | | | | | | | |
| – | – | – | 10 | – | – | – | – |
| (5) Chloride, mg/L | | | | | | | |
| 230 | 860 | 1,720 | 250(S) | 50/100 | – | – | – |



| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (6) Chlorine, total residual, µg/L | | | | | | | |
| 11 | 19 | 38 | – | – | – | – | – |
| (7) Chlorite, µg/L | | | | | | | |
| – | – | – | 1,000 | – | – | – | – |
| (8) Color, Pt-Co | | | | | | | |
| 30 | – | – | 15(S) | – | – | – | – |
| (9) Cyanide, free, µg/L | | | | | | | |
| 5.2 | 22 | 45 | 200 | – | – | – | – |

(10) *Escherichia (E.) coli* bacteria, organisms/100 mL

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item D | – | – | – | – | – | – | – |
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 2 and 2a | – | – | – | – | – | – | – |

(12) Eutrophication standards for rivers, streams, and navigational pools (phosphorus, total µg/L; chlorophyll-a (seston), µg/L; five-day biochemical oxygen demand ($BOD_5$), mg/L; diel dissolved oxygen flux, mg/L; chlorophyll-a (periphyton), $mg/m^2$)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 2 and 2b | – | – | – | – | – | – | – |

(13) Fluoride, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 4 | – | – | – | – |

(14) Fluoride, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 2(S) | – | – | – | – |

(15) Foaming agents, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 500(S) | – | – | – | – |

(16) Hardness, Ca+Mg as $CaCO_3$, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | 50/250 | – | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (17) Hydrogen sulfide, mg/L | | | | | | | |
| – | – | – | – | – | – | – | 0.02 |
| (18) Nitrate as N, mg/L | | | | | | | |
| – | – | – | 10 | – | – | – | – |
| (19) Nitrite as N, mg/L | | | | | | | |
| – | – | – | 1 | – | – | – | – |
| (20) Nitrate + Nitrite as N, mg/L | | | | | | | |
| – | – | – | 10 | – | – | – | – |
| (21) Odor, TON | | | | | | | |
| – | – | – | 3(S) | – | – | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (22) Oil, µg/L | | | | | | | |
| 500 | 5,000 | 10,000 | – | – | – | – | – |
| (23) Oxygen, dissolved, mg/L | | | | | | | |
| 7, as a daily minimum | – | – | – | – | – | – | – |
| (24) pH minimum, su | | | | | | | |
| 6.5 | – | – | 6.5(S) | 6.5/6.0 | 6.0 | 6.0 | 6.0 |
| (25) pH maximum, su | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8.5 | – | – | 8.5(S) | 8.5/9.0 | 8.5 | 9.0 | 9.0 |

(26) Radioactive materials

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item E | – | – | See item E | – | See item E | See item E | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|

(27) Salinity, total, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | – | 1,000 | – |

(28) Sodium, meq/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 60% of total cations | – | – |

(29) Specific conductance at 25°C, μmhos/cm

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 1,000 | – | – |

(30) Sulfate, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 250(S) | – | – | – | – |

(31) Sulfates, wild rice present, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 10 | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B IR** | **5 AN** |
|---|---|---|---|---|---|---|---|

(32) Temperature, °F

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| No material increase | – | – | – | – | – | – | – |

(33) Total dissolved salts, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 700 | – | – |

(34) Total dissolved solids, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 500(S) | – | – | – | – |

(35) Total suspended solids (TSS), mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subpart 2 | – | – | – | – | – | – | – |

B. METALS AND ELEMENTS

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|

(1) Aluminum, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 87 | 748 | 1,496 | 50-200(S) | – | – | – | – |

(2) Antimony, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.5 | 90 | 180 | 6 | – | – | – | – |

(3) Arsenic, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.0 | 360 | 720 | 10 | – | – | – | – |

(4) Barium, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 2,000 | – | – | – | – |

(5) Beryllium, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 4.0 | – | – | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|

(6) Boron, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 500 | – | – |

(7) Cadmium, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1 | 3.9 | 7.8 | 5 | – | – | – | – |

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

(8) Chromium +3, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 207 | 1,737 | 3,469 | – | – | – | – | – |

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

(9) Chromium +6, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11 | 16 | 32 | – | – | – | – | – |

(10) Chromium, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 100 | – | – | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|

(11) Cobalt, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.8 | 436 | 872 | – | – | – | – | – |

(12) Copper, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9.8 | 18 | 35 | 1,000 (S) | – | – | – | – |

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

(13) Iron, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 300(S) | – | – | – | – |

(14) Lead, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3.2 | 82 | 164 | NA | – | – | – | – |

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

(15) Manganese, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 50(S) | – | – | – | – |

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|

(16) Mercury, total, in water, ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6.9 | 2,400* | 4,900* | 2,000 | – | – | – | – |

(17) Mercury, total in edible fish tissue, mg/kg or parts per million

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.2 | – | – | – | – | – | – | – |

(18) Nickel, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 158 | 1,418 | 2,836 | – | – | – | – | – |

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

(19) Selenium, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.0 | 20 | 40 | 50 | – | – | – | – |

(20) Silver, total, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.12 | 2.0 | 4.1 | 100(S) | – | – | – | – |

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

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (21) Thallium, total, µg/L | | | | | | | |
| 0.28 | 64 | 128 | 2 | – | – | – | – |
| (22) Zinc, total, µg/L | | | | | | | |
| 106 | 117 | 234 | 5,000 (S) | – | – | – | – |

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

C. ORGANIC POLLUTANTS OR CHARACTERISTICS

| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (1) Acenaphthene, µg/L | | | | | | | |
| 20 | 56 | 112 | – | – | – | – | – |
| (2) Acetochlor, µg/L | | | | | | | |
| 3.6 | 86 | 173 | – | – | – | – | – |
| (3) Acrylonitrile (c), µg/L | | | | | | | |
| 0.38 | 1,140* | 2,281* | – | – | – | – | – |
| (4) Alachlor (c), µg/L | | | | | | | |
| 3.8 | 800* | 1,600* | 2 | – | – | – | – |
| (5) Aldicarb, µg/L | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | – | – | – | 3 | – | – | – | – |
| | **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(6) Aldicarb sulfone, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 2 | – | – | – | – |

(7) Aldicarb sulfoxide, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 4 | – | – | – | – |

(8) Anthracene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.035 | 0.32 | 0.63 | – | – | – | – | – |

(9) Atrazine (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3.4 | 323 | 645 | 3 | – | – | – | – |

(10) Benzene (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.1 | 4,487* | 8,974* | 5 | – | – | – | – |
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(11) Benzo(a)pyrene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 0.2 | – | – | – | – |

(12) Bromoform, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 33 | 2,900 | 5,800 | See sub-item (73) | – | – | – | – |

(13) Carbofuran, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 40 | – | – | – | – |

(14) Carbon tetrachloride (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.9 | 1,750* | 3,500* | 5 | – | – | – | – |

(15) Chlordane (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.073 | 1,200* | 2,400* | 2,000 | – | – | – | – |
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

---

(16) Chlorobenzene, µg/L (Monochlorobenzene)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 | 423 | 846 | 100 | – | – | – | – |

(17) Chloroform (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 53 | 1,392 | 2,784 | See sub-item (73) | – | – | – | – |

(18) Chlorpyrifos, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.041 | 0.083 | 0.17 | – | – | – | – | – |

(19) Dalapon, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 200 | – | – | – | – |

(20) DDT (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.11 | 550* | 1,100* | – | – | – | – | – |
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

---

(21) 1,2-Dibromo-3-chloropropane (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 0.2 | – | – | – | – |

(22) Dichlorobenzene (ortho), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 600 | – | – | – | – |

(23) 1,4-Dichlorobenzene (para) (c), µg/L

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| – | – | – | 75 | – | – | – | – |
| (24) 1,2-Dichloroethane (c), µg/L | | | | | | | |
| 3.5 | 45,050* | 90,100* | 5 | – | – | – | – |
| (25) 1,1-Dichloroethylene, µg/L | | | | | | | |
| – | – | – | 7 | – | – | – | – |
| **2A** | **2A** | **2A** | **1B** | **3A/3B** | **4A** | **4B** | **5** |
| **CS** | **MS** | **FAV** | **DC** | **IC** | **IR** | **LS** | **AN** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (26) 1,2-Dichloroethylene (cis), µg/L | | | | | | | |
| – | – | – | 70 | – | – | – | – |
| (27) 1,2-Dichloroethylene (trans), µg/L | | | | | | | |
| – | – | – | 100 | – | – | – | – |
| (28) 2,4-Dichlorophenoxyacetic acid (2,4-D), µg/L | | | | | | | |
| – | – | – | 70 | – | – | – | – |
| (29) 1,2-Dichloropropane (c), µg/L | | | | | | | |
| – | – | – | 5 | – | – | – | – |
| (30) Dieldrin (c), ng/L | | | | | | | |
| 0.0065 | 1,300* | 2,500* | – | – | – | – | – |
| **2A** | **2A** | **2A** | **1B** | **3A/3B** | **4A** | **4B** | **5** |
| **CS** | **MS** | **FAV** | **DC** | **IC** | **IR** | **LS** | **AN** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (31) Di-2-ethylhexyl adipate, µg/L | | | | | | | |
| – | – | – | 400 | – | – | – | – |
| (32) Di-2-ethylhexyl phthalate (c), µg/L | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.9 | –* | –* | 6 | – | – | – | – |

(33) Di-n-Octyl phthalate, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 825 | 1,650 | – | – | – | – | – |

(34) Dinoseb, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 7 | – | – | – | – |

(35) Diquat, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 20 | – | – | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(36) Endosulfan, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0076 | 0.084 | 0.17 | – | – | – | – | – |

(37) Endothall, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 100 | – | – | – | – |

(38) Endrin, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0039 | 0.090 | 0.18 | 2 | – | – | – | – |

(39) Ethylbenzene (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 68 | 1,859 | 3,717 | 700 | – | – | – | – |

(40) Ethylene dibromide, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 0.05 | – | – | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(41) Fluoranthene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.9 | 3.5 | 6.9 | – | – | – | – | – |

(42) Glyphosate, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 700 | – | – | – | – |

(43) Haloacetic acids (c), µg/L (Bromoacetic acid, Dibromoacetic acid, Dichloroacetic acid, Monochloroacetic acid, and Trichloroacetic acid)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 60 | – | – | – | – |

(44) Heptachlor (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.10 | 260* | 520* | 400 | – | – | – | – |

(45) Heptachlor epoxide (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.12 | 270* | 530* | 200 | – | – | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2A** | **2A** | **2A** | **1B** | **3A/3B** | **4A** | **4B** | **5** |
| **CS** | **MS** | **FAV** | **DC** | **IC** | **IR** | **LS** | **AN** |

(46) Hexachlorobenzene (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.061 | –* | –* | 1,000 | – | – | – | – |

(47) Hexachlorocyclopentadiene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 50 | – | – | – | – |

(48) Lindane (c), µg/L (Hexachlorocyclohexane, gamma-)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0087 | 1.0* | 2.0* | 0.2 | – | – | – | – |

(49) Methoxychlor, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 40 | – | – | – | – |

(50) Methylene chloride (c), µg/L (Dichloromethane)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 45 | 13,875* | 27,749* | 5 | – | – | – | – |

| 2A CS | 2A MS | 2A FAV | 1B DC | 3A/3B IC | 4A IR | 4B LS | 5 AN |
|---|---|---|---|---|---|---|---|
| (51) Metolachlor | | | | | | | |
| 23 | 271 | 543 | – | – | – | – | – |
| (52) Naphthalene, µg/L | | | | | | | |
| 65 | 409 | 818 | – | – | – | – | – |
| (53) Oxamyl, µg/L (Vydate) | | | | | | | |
| – | – | – | 200 | – | – | – | – |
| (54) Parathion, µg/L | | | | | | | |
| 0.013 | 0.07 | 0.13 | – | – | – | – | – |
| (55) Pentachlorophenol, µg/L | | | | | | | |
| 0.93 | 15 | 30 | 1 | – | – | – | – |

Class 2A MS and FAV are pH dependent. Pentachlorophenol values shown are for a pH of 7.5 only. See part 7050.0222, subpart 2, for examples at other pH values and equations to calculate pentachlorophenol standards for any pH value.

| 2A CS | 2A MS | 2A FAV | 1B DC | 3A/3B IC | 4A IR | 4B LS | 5 AN |
|---|---|---|---|---|---|---|---|
| (56) Phenanthrene, µg/L | | | | | | | |
| 3.6 | 32 | 64 | – | – | – | – | – |
| (57) Phenol, µg/L | | | | | | | |
| 123 | 2,214 | 4,428 | – | – | – | – | – |
| (58) Picloram, µg/L | | | | | | | |
| – | – | – | 500 | – | – | – | – |
| (59) Polychlorinated biphenyls (c), ng/L (PCBs, total) | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.014 | 1,000* | 2,000* | 500 | – | – | – | – |

(60) Simazine, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 4 | – | – | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(61) Styrene (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 100 | – | – | – | – |

(62) 2,3,7,8-Tetrachlorodibenzo-p-dioxin, ng/L (TCDD-dioxin)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 0.03 | – | – | – | – |

(63) 1,1,2,2-Tetrachloroethane (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.1 | 1,127* | 2,253* | – | – | – | – | – |

(64) Tetrachloroethylene (c), µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3.8 | 428* | 857* | 5 | – | – | – | – |

(65) Toluene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 253 | 1,352 | 2,703 | 1,000 | – | – | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(66) Toxaphene (c), ng/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.31 | 730* | 1,500* | 3,000 | – | – | – | – |

(67) 2,4,5-TP, µg/L (Silvex)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 50 | – | – | – | – |

(68) 1,2,4-Trichlorobenzene, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 70 | – | – | – | – |
| (69) 1,1,1-Trichloroethane, µg/L | | | | | | | |
| 329 | 2,957 | 5,913 | 200 | – | – | – | – |
| (70) 1,1,2-Trichloroethane, µg/L | | | | | | | |
| – | – | – | 5 | – | – | – | – |
| **2A CS** | **2A MS** | **2A FAV** | **1B DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
| (71) 1,1,2-Trichloroethylene (c), µg/L | | | | | | | |
| 25 | 6,988 | 13,976* | 5 | – | – | – | – |
| (72) 2,4,6-Trichlorophenol, µg/L | | | | | | | |
| 2.0 | 102 | 203 | – | – | – | – | – |
| (73) Trihalomethanes, total (c), µg/L (Bromodichloromethane, Bromoform, Chlorodibromomethane, and Chloroform) | | | | | | | |
| – | – | – | 80 | – | – | – | – |
| (74) Vinyl chloride (c), µg/L | | | | | | | |
| 0.17 | –* | –* | 2 | – | – | – | – |
| (75) Xylenes, total, µg/L | | | | | | | |
| 166 | 1,407 | 2,814 | 10,000 | – | – | – | – |

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

Subp. 4. [Repealed, 24 SR 1105]

Subp. 4a. **Cool and warm water sport fish, drinking water, and associated use classes.** Water quality standards applicable to use Classes 1B or 1C, 2Bd, 3A or 3B, 4A and 4B, and 5 surface waters.

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

| | **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|---|
| (1) Ammonia, un-ionized as N, µg/L | 40 | – | – | – | – | – | – | – |
| (2) Asbestos, >10 µm (c), fibers/L | – | – | – | 7.0e+06 | – | – | – | – |
| (3) Bicarbonates ($HCO_3$), meq/L | – | – | – | – | – | 5 | – | – |
| (4) Bromate, µg/L | – | – | – | 10 | – | – | – | – |
| (5) Chloride, mg/L | 230 | 860 | 1,720 | 250(S) | 50/100 | – | – | – |

| | **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (6) Chlorine, total residual, µg/L | 11 | 19 | 38 | – | – | – | – | – |
| (7) Chlorite, µg/L | – | – | – | 1,000 | – | – | – | – |
| (8) Color, Pt-Co | – | – | – | 15(S) | – | – | – | – |
| (9) Cyanide, free, µg/L | 5.2 | 22 | 45 | 200 | – | – | – | – |

(10) *Escherichia (E.) coli* bacteria, organisms/100 mL

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item D | – | – | – | – | – | – | – |
| **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

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

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 3 and 3a | – | – | – | – | – | – | – |

(12) Eutrophication standards for rivers, streams, and navigational pools (phosphorus, total µg/L; chlorophyll-a (seston), µg/L; five-day biochemical oxygen demand ($BOD_5$), mg/L; diel dissolved oxygen flux, mg/L; chlorophyll-a (periphyton), $mg/m^2$)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 3 and 3b | – | – | – | – | – | – | – |

(13) Fluoride, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 4 | – | – | – | – |

(14) Fluoride, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 2(S) | – | – | – | – |

(15) Foaming agents, µg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 500(S) | – | – | – | – |

(16) Hardness, Ca+Mg as $CaCO_3$, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | 50/250 | – | – | – |

| **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (17) Hydrogen sulfide, mg/L | | | | | | | |
| – | – | – | – | – | – | – | 0.02 |
| (18) Nitrate as N, mg/L | | | | | | | |
| – | – | – | 10 | – | – | – | – |
| (19) Nitrite as N, mg/L | | | | | | | |
| – | – | – | 1 | – | – | – | – |
| (20) Nitrate + Nitrite as N, mg/L | | | | | | | |
| – | – | – | 10 | – | – | – | – |
| (21) Odor, TON | | | | | | | |
| – | – | – | 3(S) | – | – | – | – |

| **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|---|
| (22) Oil, µg/L | | | | | | | |
| 500 | 5,000 | 10,000 | – | – | – | – | – |
| (23) Oxygen, dissolved, mg/L | | | | | | | |
| See part 7050.0222, subpart 3 | – | – | – | – | – | – | – |
| (24) pH minimum, su | | | | | | | |
| 6.5 | – | – | 6.5(S) | 6.5/6.0 | 6.0 | 6.0 | 6.0 |
| (25) pH maximum, su | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9.0 | – | – | 8.5(S) | 8.5/9.0 | 8.5 | 9.0 | 9.0 |

(26) Radioactive materials

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item E | – | – | See item E | – | See item E | See item E | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(27) Salinity, total, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | – | 1,000 | – |

(28) Sodium, meq/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 60% of total cations | – | – |

(29) Specific conductance at 25°C, µmhos/cm

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 1,000 | – | – |

(30) Sulfate, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 250(S) | – | – | – | – |

(31) Sulfates, wild rice present, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 10 | – | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2Bd CS** | **2Bd MS** | **2Bd FAV** | **1B/1C DC** | **3A/3B IC** | **4A IR** | **4B LS** | **5 AN** |

(32) Temperature, °F

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item F | – | – | – | – | – | – | – |

(33) Total dissolved salts, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | 700 | – | – |

(34) Total dissolved solids, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| – | – | – | 500(S) | – | – | – | – |

(35) Total suspended solids (TSS), mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subpart 3 | – | – | – | – | – | – | – |

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

Subp. 5. [Repealed, 24 SR 1105]

Subp. 5a. **Cool and warm water sport fish and associated use classes.** Water quality standards applicable to use Classes 2B, 2C, 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.

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

| **2B,C&D CS** | **2B,C&D MS** | **2B,C&D FAV** | **3A/3B/3C IC** | **4A IR** | **4B LS** | **5 AN** |
|---|---|---|---|---|---|---|

(1) Ammonia, un-ionized as N, µg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| 40 | – | – | – | – | – | – |

(2) Bicarbonates ($HCO_3$), meq/L

| | | | | | | |
|---|---|---|---|---|---|---|
| – | – | – | – | 5 | – | – |

(3) Chloride, mg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| 230 | 860 | 1,720 | 50/100/250 | – | – | – |

(4) Chlorine, total residual, µg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 19 | 38 | – | – | – | – |

(5) Cyanide, free, µg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| 5.2 | 22 | 45 | – | – | – | – |
| **2B,C&D CS** | **2B,C&D MS** | **2B,C&D FAV** | **3A/3B/3C IC** | **4A IR** | **4B LS** | **5 AN** |

(6) *Escherichia (E.) coli* bacteria, organisms/100 mL

| | | | | | | |
|---|---|---|---|---|---|---|
| See item D | – | – | – | – | – | – |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 4, 4a, and 5 | – | – | – | – | – | – |

(8) Eutrophication standards for rivers, streams, and navigational pools (phosphorus, total µg/L; chlorophyll-a (seston), µg/L; five-day biochemical oxygen demand ($BOD_5$), mg/L; diel dissolved oxygen flux, mg/L; chlorophyll-a (periphyton), $mg/m^2$)

| | | | | | | |
|---|---|---|---|---|---|---|
| See part 7050.0222, subparts 4 and 4b | – | – | – | – | – | – |

(9) Hardness, Ca+Mg as $CaCO_3$, mg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| – | – | – | 50/250/500 | – | – | – |

(10) Hydrogen sulfide, mg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| – | – | – | – | – | – | 0.02 |

(11) Oil, µg/L

| | | | | | | |
|---|---|---|---|---|---|---|
| 500 | 5,000 | 10,000 | – | – | – | – |

| | 2B,C&D CS | 2B,C&D MS | 2B,C&D FAV | 3A/3B/3C IC | 4A IR | 4B LS | 5 AN |
|---|---|---|---|---|---|---|---|
| (12) Oxygen, dissolved, mg/L | | | | | | | |
| | See part 7050.0222, subparts 4 to 6 | – | – | – | – | – | – |
| (13) pH minimum, su | | | | | | | |
| | 6.5 See item E | – | – | 6.5/6.0/6.0 | 6.0 | 6.0 | 6.0 |
| (14) pH maximum, su | | | | | | | |
| | 9.0 See item E | – | – | 8.5/9.0/9.0 | 8.5 | 9.0 | 9.0 |
| (15) Radioactive materials | | | | | | | |
| | See item F | – | – | – | See item F | See item F | – |
| (16) Salinity, total, mg/L | | | | | | | |
| | – | – | – | – | – | 1,000 | – |
| | **2B,C&D CS** | **2B,C&D MS** | **2B,C&D FAV** | **3A/3B/3C IC** | **4A IR** | **4B LS** | **5 AN** |
| (17) Sodium, meq/L | | | | | | | |
| | – | – | – | – | 60% of total cations | – | – |
| (18) Specific conductance at 25°C, μ mhos/cm | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | – | – | – | – | 1,000 | – | – |

(19) Sulfates, wild rice present, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | – | – | – | – | 10 | – | – |

(20) Temperature, °F

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See item G | – | – | – | – | – | – | – |

(21) Total dissolved salts, mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | – | – | – | – | 700 | – | – |

(22) Total suspended solids (TSS), mg/L

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| See part 7050.0222, subpart 4 | – | – | – | – | – | – | – |

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

Subp. 6. [Repealed, 24 SR 1105]

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

A. WATER QUALITY STANDARDS APPLICABLE TO USE CLASSES 3C, 4A, 4B, 5, AND 7 SURFACE WATERS

| **7 LIMITED RESOURCE VALUE** | **3C 1C** | **4A 1R** | **4B LS** | **5 AN** |
|---|---|---|---|---|
| (1) Bicarbonates ($HCO_3$), meq/L | | | | |
| – | – | 5 | – | – |
| (2) Boron, µg/L | | | | |
| – | – | 500 | – | – |

(3) Chloride, mg/L

| | | | | |
|---|---|---|---|---|
| – | 250 | – | – | – |

(4) *Escherichia (E.) coli* bacteria, organisms/100 mL

| | | | | |
|---|---|---|---|---|
| See item B | – | – | – | – |

(5) Hardness, Ca+Mg as $CaCO_3$, mg/L

| | | | | |
|---|---|---|---|---|
| – | 500 | – | – | – |

| **7** | **3C** | **4A** | **4B** | **5** |
|---|---|---|---|---|
| **LIMITED** | **1C** | **1R** | **LS** | **AN** |
| **RESOURCE** | | | | |
| **VALUE** | | | | |

(6) Hydrogen sulfide, mg/L

| | | | | |
|---|---|---|---|---|
| – | – | – | – | 0.02 |

(7) Oxygen, dissolved, mg/L

| | | | | |
|---|---|---|---|---|
| See item C | – | – | – | – |

(8) pH minimum, su

| | | | | |
|---|---|---|---|---|
| 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |

(9) pH maximum, su

| | | | | |
|---|---|---|---|---|
| 9.0 | 9.0 | 8.5 | 9.0 | 9.0 |

(10) Radioactive materials

| | | | | |
|---|---|---|---|---|
| – | – | See item D | See item D | – |

| **7** | **3C** | **4A** | **4B** | **5** |
|---|---|---|---|---|
| **LIMITED** | **1C** | **1R** | **LS** | **AN** |
| **RESOURCE** | | | | |
| **VALUE** | | | | |

(11) Salinity, total, mg/L

| | | | | |
|---|---|---|---|---|
| – | – | – | 1,000 | – |

(12) Sodium, meq/L

| | | | | |
|---|---|---|---|---|
| – | – | 60% of total cations | – | – |

(13) Specific conductance at 25°C, µmhos/cm

| | | | | |
|---|---|---|---|---|
| – | – | 1,000 | – | – |

(14) Sulfates, wild rice present, mg/L

| | | | | |
|---|---|---|---|---|
| – | – | 10 | – | – |

(15) Total dissolved salts, mg/L

| | | | | |
|---|---|---|---|---|
| – | – | 700 | – | – |

(16) Toxic pollutants

| | | | | |
|---|---|---|---|---|
| See item E | – | – | – | – |

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

Subp. 7. **Site-specific modifications of standards.**

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

D. Through the procedures established in items A to C, the following site-specific reservoir eutrophication standards apply to Lake Pepin (25-0001-00) in lieu of the water quality standards listed in this part and part 7050.0222:

| | | |
|---|---|---|
| (1) Phosphorus, total | µg/L | less than or equal to 100 |
| (2) Chlorophyll-a (seston) | µg/L | less than or equal to 28 |

**7050.0221 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 1 WATERS OF THE STATE; DOMESTIC CONSUMPTION.**

Subpart 1. **General.**

[For text of item A, see M.R.]

B. The Class 1 standards in this part are the United States Environmental Protection Agency primary (maximum contaminant levels) and secondary drinking water standards, as contained in Code of Federal Regulations, title 40, parts 141 and 143, as amended. These Environmental Protection Agency drinking water standards are adopted and incorporated by reference with the exceptions in this item. The following standards are not applicable to Class 1 ground waters: the primary drinking water standards for acrylamide, epichlorohydrin, copper, and lead (treatment technique standards) and standards in the disinfectants and disinfection by-products categories. The following standards are not applicable to Class 1 surface waters: the primary drinking water standards for acrylamide, epichlorohydrin, copper, lead, and turbidity (treatment technique standards) and the standards in the disinfectants and microbiological organisms categories.

[For text of subps 2 to 6, see M.R.]

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

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

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

| Substance, Characteristic, or Pollutant (Class 2A) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Acenaphthene | µg/L | 20 | HH | 56 | 112 | Tox |
| Acetochlor | µg/L | 3.6 | Tox | 86 | 173 | Tox |
| Acrylonitrile (c) | µg/L | 0.38 | HH | 1,140* | 2,281* | Tox |
| Alachlor (c) | µg/L | 3.8 | HH | 800* | 1,600* | Tox |
| Aluminum, total | µg/L | 87 | Tox | 748 | 1,496 | Tox |
| Ammonia un-ionized as N | µg/L | 16 | 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):

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

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 2A) | 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 | 5.1 | HH | 4,487* | 8,974* | Tox |
| Bromoform | µg/L | 33 | 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(total hardness mg/L)]-3.490)

The MS in µg/L shall not exceed: exp.(1.128[ln(total hardness mg/L)]-3.828)

The FAV in µg/L shall not exceed: exp.(1.128[ln(total hardness mg/L)]-3.1349)

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 |
|---|---|---|---|---|---|
| Cadmium, total | | | | | |
| CS µg/L | 0.66 | 1.1 | 2.0 | 2.7 | 3.4 |
| MS µg/L | 1.8 | 3.9 | 8.6 | 14 | 19 |
| FAV µg/L | 3.6 | 7.8 | 17 | 27 | 37 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Carbon tetrachloride (c) | µg/L | 1.9 | HH | 1750* | 3500* | Tox |
| Chlordane (c) | ng/L | 0.073 | HH | 1200* | 2400* | Tox |
| Chloride | mg/L | 230 | Tox | 860 | 1720 | Tox |
| Chlorine, total residual | µg/L | 11 | Tox | 19 | 38 | Tox |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Chlorobenzene (Monochlorobenzene) | µg/L | 20 | HH | 423 | 846 | Tox |
| Chloroform (c) | µg/L | 53 | HH | 1,392 | 2,784 | Tox |
| Chlorpyrifos | µg/L | 0.041 | Tox | 0.083 | 0.17 | Tox |
| Chromium +3, 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.(0.819[ln(total hardness mg/L)]+1.561)

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

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

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 chromium +3 standards for five total hardness values:

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

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Chromium +6, total | µg/L | 11 | Tox | 16 | 32 | Tox |
| Cobalt, total | µg/L | 2.8 | HH | 436 | 872 | Tox |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Color value | Pt/Co | 30 | NA | – | – | NA |
| Copper, 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.(0.620[ln(total hardness mg/L)]-0.570)

The MS in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-1.464)

The FAV in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-0.7703)

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 copper standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Copper, total | | | | | |
| CS µg/L | 6.4 | 9.8 | 15 | 19 | 23 |
| MS µg/L | 9.2 | 18 | 34 | 50 | 65 |
| FAV µg/L | 18 | 35 | 68 | 100 | 131 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Cyanide, free | µg/L | 5.2 | Tox | 22 | 45 | Tox |
| DDT (c) | ng/L | 0.11 | HH | 550* | 1100* | Tox |
| 1,2-Dichloroethane (c) | µg/L | 3.5 | HH | 45,050* | 90,100* | Tox |
| Dieldrin (c) | ng/L | 0.0065 | HH | 1,300* | 2,500* | Tox |
| Di-2-ethylhexyl phthalate (c) | µg/L | 1.9 | HH | –* | –* | NA |
| Di-n-octyl phthalate | µg/L | 30 | Tox | 825 | 1,650 | Tox |
| Endosulfan | µg/L | 0.0076 | HH | 0.084 | 0.17 | Tox |

| | | | | | | |
|---|---|---|---|---|---|---|
| Endrin | µg/L | 0.0039 | HH | 0.090 | 0.18 | Tox |
| *Escherichia (E.) coli* | See below | See below | HH | See below | See below | NA |

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

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

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

Eutrophication standards for Class 2A lakes and reservoirs.

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

| | | | | | | |
|---|---|---|---|---|---|---|
| Phosphorus, total | µg/L | 12 | NA | – | – | NA |
| Chlorophyll-a | µg/L | 3 | NA | – | – | NA |
| Secchi disk transparency | meters | No less than 4.8 | NA | – | – | NA |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| Phosphorus, total | µg/L | 20 | NA | – | – | NA |
| Chlorophyll-a | µg/L | 6 | NA | – | – | NA |
| Secchi disk transparency | meters | No less than 2.5 | NA | – | – | NA |

Additional narrative eutrophication standards for Class 2A lakes and reservoirs are found under subpart 2a.

Eutrophication standards for Class 2A rivers and streams.

| | | | |
|---|---|---|---|
| North River Nutrient Region: | | | |
| Phosphorus, total | | µg/L | less than or equal to 50 |
| Chlorophyll-a (seston) | | µg/L | less than or equal to 7 |
| Diel dissolved oxygen flux | | mg/L | less than or equal to 3.0 |
| Biochemical oxygen demand ($BOD_5$) | | mg/L | less than or equal to 1.5 |
| Central River Nutrient Region: | | | |
| Phosphorus, total | | µg/L | less than or equal to 100 |
| Chlorophyll-a (seston) | | µg/L | less than or equal to 18 |
| Diel dissolved oxygen flux | | mg/L | less than or equal to 3.5 |
| Biochemical oxygen demand ($BOD_5$) | | mg/L | less than or equal to 2.0 |
| South River Nutrient Region: | | | |
| Phosphorus, total | | µg/L | less than or equal to 150 |
| Chlorophyll-a (seston) | | µg/L | less than or equal to 35 |
| Diel dissolved oxygen flux | | mg/L | less than or equal to 4.5 |
| Biochemical oxygen demand ($BOD_5$) | | mg/L | less than or equal to 3.0 |

Additional narrative eutrophication standards for Class 2A rivers and streams are found under subpart 2b.

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Fluoranthene | µg/L | 1.9 | Tox | 3.5 | 6.9 | Tox |
| Heptachlor (c) | ng/L | 0.10 | HH | 260* | 520* | Tox |
| Heptachlor epoxide (c) | ng/L | 0.12 | HH | 270* | 530* | Tox |
| Hexachlorobenzene (c) | ng/L | 0.061 | HH | –* | –* | Tox |
| Lead, 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.(1.273[ln(total hardness mg/L)]-4.705)

The MS in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-1.460)

The FAV in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-0.7643)

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 lead standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Lead, total | | | | | |
| CS µg/L | 1.3 | 3.2 | 7.7 | 13 | 19 |
| MS µg/L | 34 | 82 | 197 | 331 | 477 |
| FAV µg/L | 68 | 164 | 396 | 663 | 956 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Lindane (c) (Hexachlorocyclohexane, gamma-) | µg/L | 0.0087 | HH | 1.0* | 2.0* | Tox |
| Mercury, total in water | ng/L | 6.9 | HH | 2,400* | 4,900* | Tox |
| Mercury, total in edible fish | mg/kg ppm | 0.2 | HH | NA | NA | NA |
| Methylene chloride (c) Dichloromethane) | µg/L | 45 | HH | 13,875* | 27,749* | Tox |
| Metolachlor | µg/L | 23 | Tox | 271 | 543 | Tox |
| Naphthalene | µg/L | 65 | HH | 409 | 818 | Tox |
| Nickel, total | µg/L | equation | Tox/HH | equation | equation | Tox |

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

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

The MS in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/L)]+3.3612)

The FAV in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/L)]+4.0543)

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 nickel standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Nickel, total | | | | | |
| CS µg/L | 88 | 158 | 283 | 297 | 297 |
| MS µg/L | 789 | 1,418 | 2,549 | 3,592 | 4,582 |
| FAV µg/L | 1,578 | 2,836 | 5,098 | 7,185 | 9,164 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Oil | µg/L | 500 | NA | 5,000 | 10,000 | NA |
| Oxygen, dissolved | mg/L | See below | NA | – | – | NA |

7.0 mg/L as a daily minimum. This dissolved oxygen standard requires compliance with the standard 50 percent of the days at which the flow of the receiving water is equal to the $7Q_{10}$.

| | | | | | | |
|---|---|---|---|---|---|---|
| Parathion | µg/L | 0.013 | Tox | 0.07 | 0.13 | Tox |
| Pentachlorophenol | µg/L | 0.93 | HH | equation | equation | Tox |

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

The MS in µg/L shall not exceed: exp.(1.005[pH]-4.830)

The FAV in µg/L shall not exceed: exp.(1.005[pH]-4.1373)

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

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

Example of pentachlorophenol standards for five pH values:

| pH su | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 |
|---|---|---|---|---|---|
| Pentachlorophenol | | | | | |
| CS µg/L | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| MS µg/L | 5.5 | 9.1 | 15 | 25 | 41 |
| FAV µg/L | 11 | 18 | 30 | 50 | 82 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| pH, minimum | su | 6.5 | NA | – | – | NA |
| pH, maximum | su | 8.5 | NA | – | – | NA |
| Phenanthrene | µg/L | 3.6 | Tox | 32 | 64 | Tox |
| Phenol | µg/L | 123 | Tox | 2,214 | 4,428 | Tox |
| Polychlorinated biphenyls, total (c) | ng/L | 0.014 | HH | 1,000* | 2,000* | Tox |
| Radioactive materials | NA | See below | NA | See below | See below | NA |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Selenium, total | µg/L | 5.0 | Tox | 20 | 40 | Tox |
| Silver, total | µg/L | 0.12 | Tox | equation | equation | Tox |

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

The MS in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-7.2156)

The FAV in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-6.520)

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 silver standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Silver, total | | | | | |
| CS µg/L | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |
| MS µg/L | 1.0 | 2.0 | 6.7 | 13 | 22 |
| FAV µg/L | 1.2 | 4.1 | 13 | 27 | 44 |

| **Substance, Characteristic, or Pollutant (Class 2A)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Temperature | °C or °F | No material increase | NA | – | – | NA |
| 1,1,2,2-Tetrachloroethane (c) | µg/L | 1.1 | HH | 1,127* | 2,253* | Tox |
| Tetrachloroethylene (c) | µg/L | 3.8 | HH | 428* | 857* | Tox |
| Thallium, total | µg/L | 0.28 | HH | 64 | 128 | Tox |
| Toluene | µg/L | 253 | Tox | 1,352 | 2,703 | Tox |
| Toxaphene (c) | ng/L | 0.31 | HH | 730* | 1,500* | Tox |
| 1,1,1-Trichloroethane | µg/L | 329 | Tox | 2,957 | 5,913 | Tox |
| 1,1,2-Trichloroethylene (c) | µg/L | 25 | HH | 6,988* | 13,976* | Tox |
| 2,4,6-Trichlorophenol | µg/L | 2.0 | HH | 102 | 203 | Tox |
| Total suspended solids (TSS) | mg/L | 10 | NA | – | – | NA |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TSS standards for Class 2A may be exceeded for no more than ten percent of the time. This standard applies April 1 through September 30 | | | | | | | |
| Vinyl chloride (c) | µg/L | 0.17 | HH | –* | –* | NA |
| Xylene, total m,p,o | µg/L | 166 | Tox | 1,407 | 2,814 | Tox |
| Zinc, 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.(0.8473[ln(total hardness mg/L)]+0.7615)

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

The FAV in µg/L shall not exceed: exp.(0.8473[ln(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 |

Subp. 2a. **Narrative eutrophication standards for lakes and reservoirs.**

A. Eutrophication standards for lakes and reservoirs are compared to summer-average data. Exceedance of the total phosphorus and either the chlorophyll-a or Secchi disk transparency standard is required to indicate a polluted condition.

[For text of item B, see M.R.]

C. Lakes and reservoirs with a baseline quality that is poorer than the numeric eutrophication standards in subpart 2 must be considered to be in compliance with the standards if the baseline quality is the result of natural causes. The commissioner shall determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

[For text of item D, see M.R.]

E. Eutrophication standards applicable to lakes and reservoirs that lie on the border between two ecoregions or that are in the Red River Valley (also referred to as Lake Agassiz Plains), Northern Minnesota Wetlands, or Driftless Area Ecoregion must be applied on a case-by-case basis. The commissioner shall use the standards applicable to adjacent ecoregions as a guide.

Subp. 2b. **Narrative eutrophication standards for rivers and streams.**

A. Eutrophication standards for rivers and streams are compared to summer-average data or as specified in subpart 2. Exceedance of the total phosphorus levels and chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels is required to indicate a polluted condition.

B. Rivers and streams that exceed the phosphorus levels but do not exceed the chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels meet the eutrophication standard.

C. For chlorophyll-a (periphyton), the standard is exceeded if concentrations exceed 150 $mg/m^2$ more than one year in ten.

D. It is the policy of the agency to protect all rivers and streams from the undesirable effects of cultural eutrophication. Rivers and streams with a baseline quality better than the numeric eutrophication standards in subpart 3 must be maintained in that condition through the strict application of all relevant federal, state, and local requirements

governing nondegradation, the discharge of nutrients from point and nonpoint sources, including:

(1) the nondegradation requirements in parts 7050.0180 and 7050.0185;

(2) the phosphorus effluent limits for point sources, where applicable, in chapter 7053;

(3) the requirements for feedlots in chapter 7020;

(4) the requirements for individual sewage treatment systems in chapter 7080;

(5) the requirements for control of storm water in chapter 7090;

(6) county shoreland ordinances; and

(7) implementation of mandatory and voluntary best management practices to minimize point and nonpoint sources of nutrients.

E. Rivers and streams with a baseline quality that does not meet the numeric eutrophication standards in part 7050.0150, subpart 5b, are in compliance with the standards if the baseline quality is the result of natural causes. The commissioner must determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

Subp. 3. **Class 2Bd waters.** The quality of Class 2Bd surface waters shall be such as to permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life and their habitats. These waters shall be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. This class of surface waters is also protected as a source of drinking water. The applicable standards are given below. Abbreviations, acronyms, and symbols are explained in subpart 1.

| Substance, Characteristic, or Pollutant (Class 2Bd) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Acenaphthene | µg/L | 20 | HH | 56 | 112 | Tox |
| Acetochlor | µg/L | 3.6 | Tox | 86 | 173 | Tox |
| Acrylonitrile (c) | µg/L | 0.38 | HH | 1,140* | 2,281* | Tox |
| Alachlor (c) | µg/L | 4.2 | HH | 800* | 1,600* | Tox |
| Aluminum, total | µg/L | 125 | Tox | 1,072 | 2,145 | Tox |
| 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):

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

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(total hardness mg/L)]-3.490)

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

The FAV in µg/L shall not exceed: exp.(1.128[ln(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 |
|---|---|---|---|---|---|
| Cadmium, total | | | | | |
| CS µg/L | 0.66 | 1.1 | 2.0 | 2.7 | 3.4 |
| MS µg/L | 15 | 33 | 73 | 116 | 160 |
| FAV µg/L | 31 | 67 | 146 | 231 | 319 |

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Carbon tetrachloride (c) | µg/L | 1.9 | HH | 1,750* | 3,500* | Tox |
| Chlordane (c) | ng/L | 0.29 | HH | 1,200* | 2,400* | Tox |
| Chloride | mg/L | 230 | Tox | 860 | 1,720 | Tox |
| Chlorine, total residual | µg/L | 11 | Tox | 19 | 38 | Tox |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Chlorobenzene (Monochlorobenzene) | µg/L | 20 | HH | 423 | 846 | Tox |
| Chloroform (c) | µg/L | 53 | HH | 1,392 | 2,784 | Tox |
| Chlorpyrifos | µg/L | 0.041 | Tox | 0.083 | 0.17 | Tox |
| Chromium +3, 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.(0.819[ln(total hardness mg/L)]+1.561)

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

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

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 chromium +3 standards for five total hardness values:

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

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Chromium +6, total | µg/L | 11 | Tox | 16 | 32 | Tox |
| Cobalt, total | µg/L | 2.8 | HH | 436 | 872 | Tox |
| Copper, 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.(0.620[ln(total hardness mg/L)]-0.570)

The MS in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-1.464)

The FAV in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-0.7703)

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 copper standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Copper, total | | | | | |
| CS µg/L | 6.4 | 9.8 | 15 | 19 | 23 |
| MS µg/L | 9.2 | 18 | 34 | 50 | 65 |
| FAV µg/L | 18 | 35 | 68 | 100 | 131 |

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Cyanide, free | µg/L | 5.2 | Tox | 22 | 45 | Tox |
| DDT (c) | ng/L | 1.7 | HH | 550* | 1,100* | Tox |
| 1,2-Dichloroethane (c) | µg/L | 3.8 | HH | 45,050* | 90,100* | Tox |
| Dieldrin (c) | ng/L | 0.026 | HH | 1,300* | 2,500* | Tox |
| Di-2-ethylhexyl phthalate (c) | µg/L | 1.9 | HH | –* | –* | NA |
| Di-n-octyl phthalate | µg/L | 30 | Tox | 825 | 1,650 | Tox |
| Endosulfan | µg/L | 0.029 | HH | 0.28 | 0.56 | Tox |
| Endrin | µg/L | 0.016 | HH | 0.090 | 0.18 | Tox |
| *Escherichia (E.) coli* | See below | See below | HH | See below | See below | NA |

Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually

exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31.

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

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Eutrophication standards for Class 2Bd lakes, shallow lakes, and reservoirs. | | | | | | |
| Lakes, Shallow Lakes, and Reservoirs in Northern Lakes and Forest Ecoregion | | | | | | |
| 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

| | | | | | | |
|---|---|---|---|---|---|---|
| Phosphorus, total | µg/L | 90 | NA | – | – | NA |
| Chlorophyll-a | µg/L | 30 | NA | – | – | NA |
| Secchi disk transparency | meters | Not less than 0.7 | NA | – | – | NA |

Additional narrative eutrophication standards for Class 2Bd lakes, shallow lakes, and reservoirs are found under subpart 3a.

Eutrophication standards for Class 2Bd rivers and streams.

North River Nutrient Region

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 50 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 7 |
| Diel dissolved oxygen flux | mg/L | less than or equal to 3.0 |
| Biochemical oxygen demand ($BOD_5$) | mg/L | less than or equal to 1.5 |

Central River Nutrient Region

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 100 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 18 |
| Diel dissolved oxygen flux | mg/L | less than or equal to 3.5 |
| Biochemical oxygen demand ($BOD_5$) | mg/L | less than or equal to 2.0 |

South River Nutrient Region

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 150 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 35 |
| Diel dissolved oxygen flux | mg/L | less than or equal to 4.5 |
| Biochemical oxygen demand ($BOD_5$) | mg/L | less than or equal to 3.0 |

Additional narrative eutrophication standards for Class 2Bd rivers and streams are found under subpart 3b.

| Substance, Characteristic, or Pollutant (Class 2Bd) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Fluoranthene | µg/L | 1.9 | Tox | 3.5 | 6.9 | Tox |
| Heptachlor (c) | ng/L | 0.39 | HH | 260* | 520* | Tox |
| Heptachlor epoxide (c) | ng/L | 0.48 | HH | 270* | 530* | Tox |
| Hexachlorobenzene (c) | ng/L | 0.24 | HH | –* | –* | Tox |
| Lead, 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.(1.273[ln(total hardness mg/L)]-4.705)

The MS in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-1.460)

The FAV in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-0.7643)

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 lead standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Lead, total | | | | | |
| CS µg/L | 1.3 | 3.2 | 7.7 | 13 | 19 |
| MS µg/L | 34 | 82 | 197 | 331 | 477 |
| FAV µg/L | 68 | 164 | 396 | 663 | 956 |

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

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

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

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

The MS in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/L)]+3.3612)

The FAV in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/L)]+4.0543)

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 nickel standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Nickel, total | | | | | |
| CS µg/L | 88 | 158 | 283 | 297 | 297 |
| MS µg/L | 789 | 1,418 | 2,549 | 3,592 | 4,582 |
| FAV µg/L | 1,578 | 2,836 | 5,098 | 7,185 | 9,164 |

| Substance, Characteristic, or Pollutant (Class 2Bd) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Oil | µg/L | 500 | NA | 5,000 | 10,000 | NA |
| Oxygen, dissolved | mg/L | See below | NA | – | – | NA |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| Parathion | µg/L | 0.013 | Tox | 0.07 | 0.13 | Tox |
| Pentachlorophenol | µg/L | 1.9 | HH | equation | equation | Tox |

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

The MS in µg/L shall not exceed: exp.(1.005[pH]-4.830)

The FAV in µg/L shall not exceed: exp.(1.005[pH]-4.1373)

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

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

Example of pentachlorophenol standards for five pH values:

| pH su | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 |
|---|---|---|---|---|---|
| Pentachlorophenol | | | | | |
| CS µg/L | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| MS µg/L | 5.5 | 9.1 | 15 | 25 | 41 |
| FAV µg/L | 11 | 18 | 30 | 50 | 82 |

| Substance, Characteristic, or Pollutant (Class 2Bd) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| pH, minimum | su | 6.5 | NA | – | – | NA |
| pH, maximum | su | 9.0 | NA | – | – | NA |
| Phenanthrene | µg/L | 3.6 | Tox | 32 | 64 | Tox |
| Phenol | µg/L | 123 | Tox | 2,214 | 4,428 | Tox |
| Polychlorinated biphenyls, total (c) | ng/L | 0.029 | HH | 1,000* | 2,000* | Tox |
| Radioactive materials | NA | See below | NA | See below | See below | NA |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Selenium, total | µg/L | 5.0 | Tox | 20 | 40 | Tox |
| Silver, total | µg/L | 1.0 | Tox | equation | equation | Tox |

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

The MS in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-7.2156)

The FAV in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-6.520)

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 silver standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Silver, total | | | | | |
| CS µg/L | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MS µg/L | 1.0 | 2.0 | 6.7 | 13 | 22 | |
| FAV µg/L | 1.2 | 4.1 | 13 | 27 | 44 | |

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Temperature | °F | See below | NA | – | – | NA |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane (c) | µg/L | 1.5 | HH | 1,127* | 2,253* | Tox |
| Tetrachloroethylene (c) | µg/L | 3.8 | HH | 428* | 857* | Tox |
| Thallium, total | µg/L | 0.28 | HH | 64 | 128 | Tox |
| Toluene | µg/L | 253 | Tox | 1,352 | 2,703 | Tox |
| Toxaphene (c) | ng/L | 1.3 | HH | 730* | 1,500* | Tox |
| 1,1,1-Trichloroethane | µg/L | 329 | Tox | 2,957 | 5,913 | Tox |
| 1,1,2-Trichloroethylene (c) | µg/L | 25 | HH | 6,988* | 13,976* | Tox |
| 2,4,6-Trichlorophenol | µg/L | 2.0 | HH | 102 | 203 | Tox |
| Total suspended solids (TSS) | | | | | | |
| North River Nutrient Region | mg/L | 15 | NA | - | - | NA |
| Central River Nutrient Region | mg/L | 30 | NA | - | - | NA |
| South River Nutrient Region | mg/L | 65 | NA | - | - | NA |
| Red River mainstem - headwaters to border | mg/L | 100 | NA | - | - | NA |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TSS standards for the Class 2Bd North, Central, and South River Nutrient Regions and the Red River mainstem may be exceeded for no more than ten percent of the time. This standard applies April 1 through September 30 | | | | | | | |
| Total suspended solids (TSS), summer average | | | | | | | |
| Lower Mississippi River mainstem - Pools 2 through 4 | mg/L | 32 | NA | - | - | NA |
| Lower Mississippi River mainstem below Lake Pepin | mg/L | 30 | NA | - | - | NA |
| TSS standards for the Class 2Bd Lower Mississippi River may be exceeded for no more than 50 percent of the time. This standard applies June 1 through September 30 | | | | | | | |

| **Substance, Characteristic, or Pollutant (Class 2Bd)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Vinyl chloride (c) | µg/L | 0.18 | HH | –* | –* | NA |
| Xylene, total m,p,o | µg/L | 166 | Tox | 1,407 | 2,814 | Tox |
| Zinc, 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.(0.8473[ln(total hardness mg/L)]+0.7615)

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

The FAV in µg/L shall not exceed: exp.(0.8473[ln(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 total 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 |

Subp. 3a. **Narrative eutrophication standards for Class 2Bd lakes, shallow lakes, and reservoirs.**

A. Eutrophication standards applicable to lakes, shallow lakes, and reservoirs that lie on the border between two ecoregions or that are in the Red River Valley (also referred to as Lake Agassiz Plains), Northern Minnesota Wetlands, or Driftless Area Ecoregion must be applied on a case-by-case basis. The commissioner shall use the standards applicable to adjacent ecoregions as a guide.

B. Eutrophication standards are compared to summer-average data. Exceedance of the total phosphorus and either the chlorophyll-a or Secchi disk transparency standard is required to indicate a polluted condition.

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

D. Lakes, shallow lakes, and reservoirs with a baseline quality that is poorer than the numeric eutrophication standards in subpart 3 must be considered to be in compliance with the standards if the baseline quality is the result of natural causes. The

commissioner shall determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

[For text of item E, see M.R.]

Subp. 3b. **Narrative eutrophication standards for rivers, streams, and navigational pools.**

A. Eutrophication standards for rivers, streams, and navigational pools are compared to summer-average data or as specified in subpart 3. Exceedance of the total phosphorus levels and chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels is required to indicate a polluted condition.

B. Rivers, streams, and navigational pools that exceed the phosphorus levels but do not exceed the chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels meet the eutrophication standard.

C. A polluted condition also exists when the chlorophyll-a (periphyton) concentration exceeds 150 $mg/m^2$ more than one year in ten.

D. It is the policy of the agency to protect all rivers, streams, and navigational pools from the undesirable effects of cultural eutrophication. Rivers, streams, and navigational pools with a baseline quality better than the numeric eutrophication standards in subpart 3 must be maintained in that condition through the strict application of all relevant federal, state, and local requirements governing nondegradation, the discharge of nutrients from point and nonpoint sources including:

(1) the nondegradation requirements in parts 7050.0180 and 7050.0185;

(2) the phosphorus effluent limits for point sources, where applicable, in chapter 7053;

(3) the requirements for feedlots in chapter 7020;

(4) the requirements for individual sewage treatment systems in chapter 7080;

(5) the requirements for control of storm water in chapter 7090;

(6) county shoreland ordinances; and

(7) implementation of mandatory and voluntary best management practices to minimize point and nonpoint sources of nutrients.

E. Rivers, streams, and navigational pools with a baseline quality that does not meet the numeric eutrophication standards in part 7050.0150, subpart 5b, are in compliance with the standards if the baseline quality is the result of natural causes. The commissioner must determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

Subp. 4. **Class 2B waters.** The quality of Class 2B surface waters shall be such as to permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life, and their habitats. These waters shall be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. This class of surface water is not protected as a source of drinking water. The applicable standards are given below. Abbreviations, acronyms, and symbols are explained in subpart 1.

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Acenaphthene | µg/l | 20 | HH | 56 | 112 | Tox |
| Acetochlor | µg/L | 3.6 | Tox | 86 | 173 | Tox |
| Acrylonitrile (c) | µg/l | 0.89 | HH | 1,140* | 2,281* | Tox |
| Alachlor (c) | µg/L | 59 | Tox | 800 | 1,600 | Tox |

| | | | | | | |
|---|---|---|---|---|---|---|
| Aluminum, total | µg/L | 125 | Tox | 1,072 | 2,145 | Tox |
| 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):

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

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 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(total hardness mg/L)]-3.490)

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

The FAV in µg/L shall not exceed: exp.(1.128[ln(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 |
|---|---|---|---|---|---|
| Cadmium, total | | | | | |
| CS µg/L | 0.66 | 1.1 | 2.0 | 2.7 | 3.4 |
| MS µg/L | 15 | 33 | 73 | 116 | 160 |
| FAV µg/L | 31 | 67 | 146 | 231 | 319 |

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Carbon tetrachloride (c) | µg/L | 5.9 | HH | 1,750* | 3,500* | Tox |
| Chlordane (c) | ng/L | 0.29 | HH | 1,200* | 2,400* | Tox |
| Chloride | mg/L | 230 | Tox | 860 | 1,720 | Tox |
| Chlorine, total residual | µg/L | 11 | Tox | 19 | 38 | Tox |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Chlorobenzene (Monochlorobenzene) | µg/L | 20 | HH | 423 | 846 | Tox |
| Chloroform (c) | µg/L | 155 | Tox | 1,392 | 2,784 | Tox |
| Chlorpyrifos | µg/L | 0.041 | Tox | 0.083 | 0.17 | Tox |
| Chromium +3, 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.(0.819[ln(total hardness mg/L)]+1.561)

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

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

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 chromium +3 standards for five total hardness values:

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

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Chromium +6, total | µg/L | 11 | Tox | 16 | 32 | Tox |
| Cobalt, total | µg/L | 5.0 | Tox | 436 | 872 | Tox |
| Copper, 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.(0.6200[ln(total hardness mg/L)]-0.570)

The MS in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-1.464)

The FAV in µg/L shall not exceed: exp.(0.9422[ln(total hardness mg/L)]-0.7703)

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 copper standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Copper, total | | | | | |
| CS µg/L | 6.4 | 9.8 | 15 | 19 | 23 |

| | | | | | |
|---|---|---|---|---|---|
| MS µg/L | 9.2 | 18 | 34 | 50 | 65 |
| FAV µg/L | 18 | 35 | 68 | 100 | 131 |

| Substance, Characteristic, or Pollutant (Class 2B) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Cyanide, free | µg/L | 5.2 | Tox | 22 | 45 | Tox |
| DDT (c) | ng/L | 1.7 | HH | 550* | 1,100* | Tox |
| 1,2-Dichloroethane (c) | µg/L | 190 | HH | 45,050* | 90,100* | Tox |
| Dieldrin (c) | ng/L | 0.026 | HH | 1,300* | 2,500* | Tox |
| Di-2-ethylhexyl phthalate (c) | µg/L | 2.1 | HH | –* | –* | NA |
| Di-n-octyl phthalate | µg/L | 30 | Tox | 825 | 1,650 | Tox |
| Endosulfan | µg/L | 0.031 | HH | 0.28 | 0.56 | Tox |
| Endrin | µg/L | 0.016 | HH | 0.090 | 0.18 | Tox |
| *Escherichia (E.) coli* | See below | See below | HH | See below | See below | NA |

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

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

| 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

| | | | | | | |
|---|---|---|---|---|---|---|
| Phosphorus, total | µg/L | 90 | NA | – | – | NA |
| Chlorophyll-a | µg/L | 30 | NA | – | – | NA |
| Secchi disk transparency | meters | Not less than 0.7 | NA | – | – | NA |

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

| Substance, Characteristic, or Pollutant (Class 2B) | Units | CS | Basis for CS | MS | FAV | Basis for MS, FAV |
|---|---|---|---|---|---|---|
| Eutrophication standards for Class 2B rivers and streams. | | | | | | |
| North River Nutrient Region | | | | | | |
| Phosphorus, total | µg/L | | | less than or equal to 50 | | |
| Chlorophyll-a (seston) | µg/L | | | less than or equal to 7 | | |
| Diel dissolved oxygen flux | mg/L | | | less than or equal to 3.0 | | |
| Biochemical oxygen demand ($BOD_5$) | mg/L | | | less than or equal to 1.5 | | |
| Central River Nutrient Region | | | | | | |
| Phosphorus, total | µg/L | | | less than or equal to 100 | | |
| Chlorophyll-a (seston) | µg/L | | | less than or equal to 18 | | |
| Diel dissolved oxygen flux | mg/L | | | less than or equal to 3.5 | | |
| Biochemical oxygen demand ($BOD_5$) | mg/L | | | less than or equal to 2.0 | | |
| South River Nutrient Region | | | | | | |
| Phosphorus, total | µg/L | | | less than or equal to 150 | | |
| Chlorophyll-a (seston) | µg/L | | | less than or equal to 40 | | |
| Diel dissolved oxygen flux | mg/L | | | less than or equal to 5.0 | | |
| Biochemical oxygen demand ($BOD_5$) | mg/L | | | less than or equal to 3.5 | | |
| Site-specific standards for specified river reaches or other waters are: | | | | | | |
| Mississippi River Navigational Pool 1 (river miles 854.1 to 847.7 reach from Fridley to Ford Dam in St. Paul) | | | | | | |
| Phosphorus, total | µg/L | | | less than or equal to 100 | | |
| Chlorophyll-a (seston) | µg/L | | | less than or equal to 35 | | |

Mississippi River Navigational Pool 2 (river miles 847.7 to 815.2 reach from Ford Dam to Hastings Dam)

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 125 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 35 |

Mississippi River Navigational Pool 3 (river miles 815.2 to 796.9 reach from Hastings Dam to Red Wing Dam)

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 100 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 35 |

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.

Mississippi River Navigational Pools 5 to 8 (river miles 752.8 to 679.1 Alma Dam to Genoa Dam)

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 100 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 35 |

Lake Pepin

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 100 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 28 |

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

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 75 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 13 |
| Diel dissolved oxygen flux | mg/L | less than or equal to 3.5 |
| Biochemical oxygen demand ($BOD_5$) | mg/L | less than or equal to 1.7 |

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

| | | |
|---|---|---|
| Phosphorus, total | µg/L | less than or equal to 125 |
| Chlorophyll-a (seston) | µg/L | less than or equal to 27 |
| Diel dissolved oxygen flux | mg/L | less than or equal to 4.0 |
| Biochemical oxygen demand ($BOD_5$) | mg/L | less than or equal to 2.5 |

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

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Fluoranthene | µg/L | 1.9 | Tox | 3.5 | 6.9 | Tox |
| Heptachlor (c) | ng/L | 0.39 | HH | 260* | 520* | Tox |
| Heptachlor epoxide (c) | ng/L | 0.48 | HH | 270* | 530* | Tox |
| Hexachlorobenzene (c) | ng/L | 0.24 | HH | –* | –* | Tox |
| Lead, 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.(1.273[ln(total hardness mg/L)]-4.705)

The MS in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-1.460)

The FAV in µg/L shall not exceed: exp.(1.273[ln(total hardness mg/L)]-0.7643)

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 lead standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Lead, total | | | | | |
| CS µg/L | 1.3 | 3.2 | 7.7 | 13 | 19 |

| | | | | | |
|---|---|---|---|---|---|
| MS µg/L | 34 | 82 | 197 | 331 | 477 |
| FAV µg/L | 68 | 164 | 396 | 663 | 956 |

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Lindane (c) (Hexachlorocyclobenzene, gamma-) | µg/L | 0.036 | HH | 4.4* | 8.8* | Tox |
| Mercury, total in water | ng/L | 6.9 | HH | 2,400* | 4,900* | Tox |
| Mercury, total in edible fish tissue | mg/kg ppm | 0.2 | HH | NA | NA | NA |
| Methylene chloride (c) (Dichloromethane) | µg/L | 1,940 | HH | 13,875 | 27,749 | Tox |
| Metolachlor | µg/L | 23 | Tox | 271 | 543 | Tox |
| Naphthalene | µg/L | 81 | Tox | 409 | 818 | Tox |
| Nickel, 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.(0.846[ln(total hardness mg/L)]+1.1645)

The MS in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/L)]+3.3612)

The FAV in µg/L shall not exceed: exp.(0.846[ln(total hardness mg/l)]+4.0543)

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 nickel standards for five total hardness values:

| | | | | | |
|---|---|---|---|---|---|
| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
| Nickel, total | | | | | |
| CS µg/L | 88 | 158 | 283 | 399 | 509 |

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

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Oil | µg/l | 500 | NA | 5,000 | 10,000 | NA |
| Oxygen, dissolved | mg/L | See below | NA | – | – | NA |

5.0 mg/L as a daily minimum. This dissolved oxygen standard may be modified on a site-specific basis according to part 7050.0220, subpart 7, except that no site-specific standard shall be less than 5 mg/L as a daily average and 4 mg/L as a daily minimum. Compliance with this standard is required 50 percent of the days at which the flow of the receiving water is equal to the $7Q_{10}$. This standard applies to all Class 2B waters except for those portions of the Mississippi River from the outlet of the Metro Wastewater Treatment Works in Saint Paul (River Mile 835) to Lock and Dam No. 2 at Hastings (River Mile 815). For this reach of the Mississippi River, the standard is not less than 5 mg/L as a daily average from April 1 through November 30, and not less than 4 mg/L at other times.

| | | | | | | |
|---|---|---|---|---|---|---|
| Parathion | µg/L | 0.013 | Tox | 0.07 | 0.13 | Tox |
| Pentachlorophenol | µg/L | equation | Tox/HH | equation | equation | Tox |

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

For waters with pH values greater than 6.95, the CS shall not exceed the human health-based standard of 5.5 µg/L.

For waters with pH values less than 6.96, the CS in µg/L shall not exceed the toxicity-based standard of exp.(1.005[pH]-5.290)

The MS in µg/L shall not exceed: exp.(1.005[pH]-4.830)

The FAV in µg/L shall not exceed: exp.(1.005[pH]-4.1373)

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

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

Example of pentachlorophenol standards for five pH values:

| pH su | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 |
|---|---|---|---|---|---|
| Pentachlorophenol | | | | | |
| CS µg/L | 3.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| MS µg/L | 5.5 | 9.1 | 15 | 25 | 41 |
| FAV µg/L | 11 | 18 | 30 | 50 | 82 |

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| pH, minimum | su | 6.5 | NA | – | – | NA |
| pH, maximum | su | 9.0 | NA | – | – | NA |
| Phenanthrene | µg/L | 3.6 | Tox | 32 | 64 | Tox |
| Phenol | µg/L | 123 | Tox | 2,214 | 4,428 | Tox |
| Polychlorinated biphenyls, total (c) | ng/L | 0.029 | HH | 1,000* | 2,000* | Tox |
| Radioactive materials | NA | See below | NA | See below | See below | NA |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| Selenium, total | µg/L | 5.0 | Tox | 20 | 40 | Tox |
| Silver, total | µg/L | 1.0 | Tox | equation | equation | Tox |

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

The MS in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-7.2156)

The FAV in µg/L shall not exceed: exp.(1.720[ln(total hardness mg/L)]-6.520

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 silver standards for five total hardness values:

| TH in mg/L | 50 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|
| Silver, total | | | | | |
| CS µg/L | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MS µg/L | 1.0 | 2.0 | 6.7 | 13 | 22 |
| FAV µg/L | 1.2 | 4.1 | 13 | 27 | 44 |

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Temperature | °F | See below | NA | – | – | NA |

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.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane (c) | µg/L | 13 | HH | 1,127 | 2,253 | Tox |
| Tetrachloroethylene (c) | µg/L | 8.9 | HH | 428 | 857 | Tox |
| Thallium, total | µg/L | 0.56 | HH | 64 | 128 | Tox |
| Toluene | µg/L | 253 | Tox | 1,352 | 2,703 | Tox |
| Toxaphene (c) | ng/L | 1.3 | HH | 730* | 1,500* | Tox |
| 1,1,1-Trichloroethane | µg/L | 329 | Tox | 2,957 | 5,913 | Tox |
| 1,1,2-Trichloroethylene (c) | µg/L | 120 | HH | 6,988 | 13,976 | Tox |
| 2,4,6-Trichlorophenol | µg/L | 2.0 | HH | 102 | 203 | Tox |
| Total suspended solids (TSS) | | | | | | |
| North River Nutrient Region | mg/L | 15 | NA | – | – | NA |
| Central River Nutrient Region | mg/L | 30 | NA | – | – | NA |
| South River Nutrient Region | mg/L | 65 | NA | – | – | NA |

| | | | | | | |
|---|---|---|---|---|---|---|
| Red River mainstem - headwaters to border | mg/L | 100 | NA | – | – | NA |
| TSS standards for the Class 2B North, Central, and South River Nutrient Regions and the Red River mainstem may be exceeded for no more than ten percent of the time. This standard applies April 1 through September 30 | | | | | | |
| Total suspended solids (TSS), summer average | | | | | | |
| Lower Mississippi River mainstem - Pools 2 through 4 | mg/L | 32 | NA | – | – | NA |
| Lower Mississippi River mainstem below Lake Pepin | mg/L | 30 | NA | – | – | NA |
| TSS standards for the Class 2B Lower Mississippi River may be exceeded for no more than 50 percent of the time. This standard applies June 1 through September 30 | | | | | | |

| **Substance, Characteristic, or Pollutant (Class 2B)** | **Units** | **CS** | **Basis for CS** | **MS** | **FAV** | **Basis for MS, FAV** |
|---|---|---|---|---|---|---|
| Vinyl chloride (c) | µg/L | 9.2 | HH | –* | –* | NA |
| Xylene, total m,p,o | µg/L | 166 | Tox | 1,407 | 2,814 | Tox |
| Zinc, 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.(0.8473[ln(total hardness mg/L)]+0.7615)

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

The FAV in µg/L shall not exceed: exp.(0.8473[ln(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 total 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 |

Subp. 4a. **Narrative eutrophication standards for Class 2B lakes, shallow lakes, and reservoirs.**

A. Eutrophication standards applicable to lakes, shallow lakes, and reservoirs that lie on the border between two ecoregions or that are in the Red River Valley (also referred to as Lake Agassiz Plains), Northern Minnesota Wetlands, or Driftless Area Ecoregion must be applied on a case-by-case basis. The commissioner shall use the standards applicable to adjacent ecoregions as a guide.

B. Eutrophication standards are compared to summer-average data. Exceedance of the total phosphorus and either the chlorophyll-a or Secchi disk transparency standard is required to indicate a polluted condition.

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

D. Lakes, shallow lakes, and reservoirs with a baseline quality that is poorer than the numeric eutrophication standards in subpart 4 must be considered to be in compliance with the standards if the baseline quality is the result of natural causes. The commissioner shall determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

[For text of item E, see M.R.]

Subp. 4b. **Narrative eutrophication standards for Class 2B rivers and streams.**

A. Eutrophication standards for rivers and streams are compared to summer-average data or as specified in subpart 4. Exceedance of the total phosphorus levels and chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels is required to indicate a polluted condition.

B. Rivers and streams that exceed the phosphorus levels but do not exceed the chlorophyll-a (seston), five-day biochemical oxygen demand ($BOD_5$), diel dissolved oxygen flux, or pH levels meet the eutrophication standard.

C. A polluted condition also exists when the chlorophyll-a (periphyton) concentration exceeds 150 $mg/m^2$ more than one year in ten

D. It is the policy of the agency to protect all rivers, streams, and navigational pools from the undesirable effects of cultural eutrophication. Rivers, streams, and navigational pools with a baseline quality better than the numeric eutrophication standards in subpart 4 must be maintained in that condition through the strict application of all relevant federal, state, and local requirements governing nondegradation, the discharge of nutrients from point and nonpoint sources, including:

(1) the nondegradation requirements in parts 7050.0180 and 7050.0185;

(2) the phosphorus effluent limits for point sources, where applicable in chapter 7053;

(3) the requirements for feedlots in chapter 7020;

(4) the requirements for individual sewage treatment systems in chapter 7080;

(5) the requirements for control of storm water in chapter 7090;

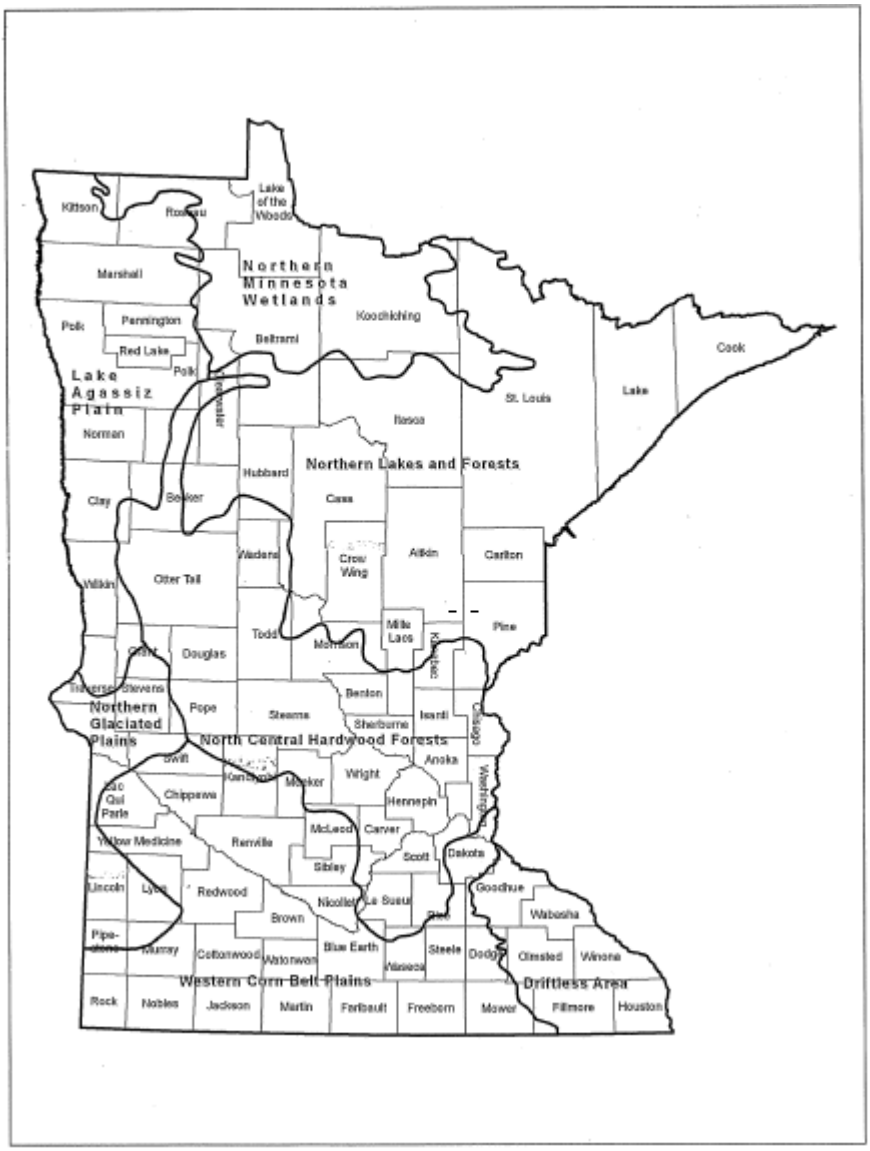
(6) county shoreland ordinances; and

(7) implementation of mandatory and voluntary best management practices to minimize point and nonpoint sources of nutrients.

E. Rivers, streams, and navigational pools with a baseline quality that does not meet the numeric eutrophication standards in subpart 4 are in compliance with the standards if the baseline quality is the result of natural causes. The commissioner must determine baseline quality and compliance with these standards using data and the procedures in part 7050.0150, subpart 5.

[For text of subps 5 to 9, see M.R.]

**7050.0468 MAP: MINNESOTA ECOREGIONS.**




**7053.0205 GENERAL REQUIREMENTS FOR DISCHARGES TO WATERS OF THE STATE.**

[For text of subps 1 to 6, see M.R.]

Subp. 7. **Minimum stream flow.**

A. Except as provided in items B and C, discharges of sewage, industrial waste, or other wastes must be controlled so that the water quality standards are maintained at all stream flows that are equal to or greater than the $7Q_{10}$ for the critical month or months.

B. Discharges of ammonia in sewage, industrial waste, or other wastes must be controlled so that the ammonia water quality standard is maintained at all stream flows that are equal to or exceeded by the $30Q_{10}$ for the critical month or months.

C. Discharges of total phosphorus in sewage, industrial waste, or other wastes must be controlled so that the eutrophication water quality standard is maintained for the long-term summer concentration of total phosphorus, when averaged over all flows, except where a specific flow is identified in chapter 7050. When setting the effluent limit for total phosphorus, the commissioner shall consider the discharger's efforts to control phosphorus as well as reductions from other sources, including nonpoint and runoff from permitted municipal storm water discharges.

D. Allowance must not be made in the design of treatment works for low stream flow augmentation unless the flow augmentation of minimum flow is dependable and controlled under applicable laws or regulations.

[For text of subps 8 and 9, see M.R.]

Subp. 9a. **Water quality standard-based TSS effluent limits.**

A. When the agency establishes effluent limits to meet a total suspended solids (TSS) water quality standard and the water quality standard of the receiving water is:

(1) less than 30 mg/L and a continuous discharger is involved; or

(2) less than 45 mg/L and either an aerated pond or a controlled discharger is involved,

the agency shall establish an appropriate water quality-based effluent limit (WQBEL) considering the discharger's nonvolatile suspended solids (NVSS) concentration.

B. The WQBEL shall be determined by considering all of the individual suspended solids data points collected during the period for which the standard is designed to be protective. WQBEL calculations shall also consider the flow and TSS concentrations

observed in the receiving water during the corresponding time period. WQBEL is expressed as long-term, 90th percentile values (for example, April to September) to ensure protection during the time period the standard is designed to protect.

[For text of subps 10 to 13, see M.R.]

**REPEALER.** Minnesota Rules, part 7050.0467, is repealed.