# APPENDIX F
# WATER TEMPERATURE STANDARDS AND COORDINATION

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# THE STATE OF MONTANA'S WATER QUALITY LAWS AND REGULATIONS

The following laws and regulations were taken from Montana Code Annotated (MCA) or from state rule (ARM) at Environmental Quality, Chapter 30 – Water Quality, Sub-Chapter 6 – Surface Water Quality Standards and Procedures.

**Classification of the Missouri River below Fort Peck Dam**

- 17.30.610(6) [ARM] Missouri River drainage from Ft. Peck dam to Milk River…B-2
- 17.30.610(9)(a) [ARM] Missouri River (mainstem) from Milk River to North Dakota boundary…B-3

**Classification Standards for Temperature**

- 17.30.624 [ARM] B-2 CLASSIFICATION STANDARDS (1) Waters classified B-2 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

  (2) No person may violate the following specific water quality standards for waters classified B-2:

  (e) A 1°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 66°F; within the naturally occurring range of 66°F to 66.5°F, no discharge is allowed which will cause the water temperature to exceed 67°F; and where the naturally occurring water temperature is 66.5°F or greater, the maximum allowable increase in temperature is 0.5°F. A 2°F per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55°F, and a 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55°F to 32°F.

- 17.30.625 [ARM] B-3 CLASSIFICATION STANDARDS (1) Waters classified B-3 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

  (2) No person may violate the following specific water quality standards for waters classified B-3:

  (e) A 3°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F to 77°F; within the naturally occurring range of 77°F to 79.5°F, no thermal discharge is allowed which will cause the water temperature to exceed 80°F; and where the naturally occurring water temperature is 79.5°F or greater, the maximum allowable increase in temperature is 0.5°F. A 2°F per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55°F, and a 2°F maximum decrease below naturally occurring water temperature is allowed within the range of 55°F to 32°F.

**Note:** The Fort Peck spillway enters the Missouri River approximately one mile upstream from the confluence of the Milk River. The approximate one-mile distance from the spillway to the Milk River is classified as B-2. The remaining portion of the Missouri River from the confluence of the Milk River to the North Dakota state line is classified as B-3.

# Natural Conditions

- 75-5-306 [MCA] Purer than natural unnecessary – dams. (1) It is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under this chapter are met.
  (2) "Natural" refers to conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied. Conditions resulting from the reasonable operations of dams at July 1, 1971, are natural.

**Other Water Quality Regulatory Provisions**

- 17.30.636 [ARM] GENERAL OPERATION STANDARDS
  (1) Owners and operators of water impoundments that cause conditions harmful to prescribed beneficial uses of state water shall demonstrate to the satisfaction of the department that continued operations will be done in the best practicable manner to minimize harmful effects. New water impoundments must be designed to provide temperature variations in discharging water that maintain or enhance the existing propagating fishery and associated aquatic life. As a guide, the following temperature variations are recommended: continuously less than 40°F during the months of January and February, and continuously greater than 44°F during the months of June through September.

- 17.30.637 [ARM] GENERAL PROHIBITIONS
  (2) No wastes may be discharged and no activities conducted such that the wastes or activities, either alone or in combination with other wastes or activities, will violate, or can reasonably be expected to violate, any of the standards.

## THE FORT PECK TRIBE'S WATER QUALITY REGULATIONS

A copy of the Fort Peck Tribes water quality standards regulations, sent to the Corps' Omaha District Office September 20, 2001 by the Fort Peck Tribes. The following regulations were taken from the provided copy of the Tribes water quality standards.

### Classification of the Missouri River below Fort Peck Dam within the Tribal Jurisdiction

- Appendix B, Table 1
  Missouri River
  1. Southern border of Reservation to center of River
     Public Water Supply (Goal)
     Class 1 Cool Water Aquatic Life
     Primary Contact Recreation
     Industrial
     Navigation
     Agriculture

### Description of Class 1 Cool Water Aquatic Life Designated Use

- VIII. DESIGNATED USES
  (1) Designated Uses
  d) Class 1 Cool Water Aquatic Life – provides for protection and propagation of nonsalmonid fishes, marginal growth of salmonid fishes, growth and propagation of aquatic life normally found in water where the summer temperature does not often exceed 23° Celsius.

### Temperature Water Quality Standards for Class 1 Cool Water Aquatic Life

- Appendix C, Table 2
  PHYSICAL
  Temperature (maximum values)
  Class 1 Cool Water Biota -- 23°C

  REFERENCES FOR TABLE 2: PHYSICAL AND BIOLOGICAL CRITERIA
  2. For those streams designated as Class 1 & Class 2 Cool Water, a 0.5°C increase above naturally occurring water temperature is allowed within the range of 0°C to 18.9°C; within the naturally occurring range of 18.9°C to 19.2°C, no discharge is allowed which will cause the water temperature to exceed 19.4°C; and where the naturally occurring water temperature is 19.2°C or greater, the maximum allowable increase in water temperature is 0.3°C. A 1.1°C-per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 12.8°C, and a 1.1°C maximum decrease below naturally occurring water temperature is allowed within the range 0f 12.8°C to 0°C.

**Naturally Occurring**

A definition of "naturally occurring" was not found in the provided copy of the Fort Peck Tribes' water quality standards. "Existing uses" is defined as follows:

III. DEFINITIONS
an) Existing uses are those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.

**Other Tribal Water Quality Standards Provisions**

- XI. STANDARDS IMPLEMENTATION
  1) All discharges from point sources, all instream activities, and all activities that generate nonpoint source pollution are to be conducted so as to achieve these water quality standards. The Tribes' anticipate that both regulatory and voluntary pollution control programs will be needed to address all current and future water quality problems on the Fort Peck Reservation.
  6) These water quality standards apply to all waters affected by nonpoint source pollution. At this time, the Tribes intend to rely on voluntary compliance for activities which result in nonpoint sources of pollution but do not require a federal license or permit. All appropriate combinations of individual best management practices should be applied to avoid violation of water quality standards.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
106 SOUTH 15TH STREET
OMAHA, NEBRASKA 68102-1618

DEC 2 0 2001

REPLY TO
ATTENTION OF:
District Engineer

Ms. Jan Sensibaugh, Director
Montana Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0901

Dear Ms. Sensibaugh:

As you may be aware, the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (Opinion) to the U.S. Army Corps of Engineers (Corps) on compliance with the Federal Endangered Species Act regarding the operation of the Missouri River main stem reservoir system. In particular, the Opinion stated that the current operation of the Corps' Fort Peck project has adversely impacted the endangered pallid sturgeon. The USFWS believes that regulated flows from the Fort Peck Dam coupled with a suppressed water temperature regime during the spring and early summer spawning period have failed to provide adequate spawning cues for pallid sturgeon. In addition, cold-water releases from Fort Peck Dam are believed to have limited the amount of riverine habitat suitable for pallid sturgeon spawning. The Corps has proposed to modify operations of the Fort Peck Dam following specifications outlined in the Opinion. Modified dam operations are proposed to increase discharge and enhance water temperatures during late May and June to provide spawning cues and enhance environmental conditions for pallid sturgeon and other native fish species. The USFWS has targeted a water temperature of 18°C (64.4°F) for the Missouri River at Frazier Rapids (approximately 25 miles downstream from the dam). In contrast to "normal" cold-water releases through the dam, it is proposed to release warmer surface water from Fort Peck Reservoir down the spillway to increase water temperatures in the Missouri River below the dam.

As a precursor to a full implementation of the proposed discharge modification to the operation of the Fort Peck project, the Corps plans to implement a "mini-test" this spring to evaluate the proposed modified operation of the project. The mini-test proposes to release up to 11,000 c.f.s. down the spillway for up to four weeks during the month of June, and is contingent upon there being sufficient water available in Fort Peck Lake. At least 4.000 c.f.s would be simultaneously released from the powerhouse, with a total discharge not to exceed 15,.000 c.f.s. The primary benefits of the mini-test will be: a) collection of data about the spillway integrity at various spillway discharges; b) collection of temperature information at various combinations of spillway/powerhouse discharges for use in future water temperature modeling; c) temporary increase in Missouri River water temperatures within a limited area to enhance pallid sturgeon habitat; and d) testing and standardization of methodologies to be used for monitoring conditions during full implementation.

As part of developing an Environmental Assessment for the proposed mini-test, the Corps briefly reviewed the State of Montana's water quality regulations and is seeking clarification on the state's application of the following provisions:

- The water-use classifications for the Missouri River downstream of the Fort Peck Dam are B-2 for the approximate one-mile distance from the spillway to the Milk River, and B-3 for the remaining portion of the river from the confluence of the Milk River to the Montana/North Dakota state line [17.30.610 (ARM)].

- Classification standards for temperature at 17.30.624 (ARM) and 17.30.625 (ARM) limit increases in water temperature above naturally occurring water temperatures to a maximum of 1°F for B-2 waters within the range of 32°F to 66°F, and a maximum of 3°F for B-3 waters within the range of 32°F to 77°F

- ARM 17.30.602 defines "Naturally occurring" as conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied. Conditions resulting from the reasonable operation of dams in existence as of July 1, 1971 are natural.

- General prohibitions at 17.30.637 (ARM) state that no wastes may be discharged and no activities conducted such that the wastes or activities, either alone or in combination with other wastes or activities, will violate, or can reasonably be expected to violate, any of the standards.

In view of ARM 17.30.602, the Corps considers the release of warmer water through the spillway, in order to positively influence the pallid sturgeons' spawning and overall environment, to be consistent with the reasonable operation of Fort Peck Dam. Please advise me as to whether this interpretation of the State's water temperature standards is appropriate in this matter of a test release of water through the spillway.

The collection of data from this test will be important as we make future decisions about the operation of Fort Peck Dam. If there is any additional information to further coordinate the proposed mini-test, please let me know.

Thank you for your assistance in this matter. If you have any mini-test questions, please contact Mr. Bill Miller at (402) 221-4022.

Sincerely,

Kenneth S. Cooper
Deputy District Engineer

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
106 SOUTH 15TH STREET
OMAHA, NEBRASKA 68102-1618
December 21, 2001

REPLY TO
ATTENTION OF:
District Engineer

Mr. Arlyn Headdress, Chairman
Fort Peck Tribes
P.O. Box 1027
Poplar, Montana 59255

Dear Mr. Headdress:

As you may be aware, the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (Opinion) to the U.S. Army Corps of Engineers (Corps) on compliance with the Federal Endangered Species Act regarding the operation of the Missouri River main stem reservoir system. In particular, the Opinion stated that the current operation of the Corps' Fort Peck project has adversely impacted the endangered pallid sturgeon. The USFWS believes that regulated flows from the Fort Peck Dam coupled with a suppressed water temperature regime during the spring and early summer spawning period have failed to provide adequate spawning cues for pallid sturgeon. In addition, cold-water releases from Fort Peck Dam are believed to have limited the amount of riverine habitat suitable for pallid sturgeon spawning. The Corps has proposed to modify operations of the Fort Peck Dam following specifications outlined in the Opinion. Modified dam operations are proposed to increase discharge and enhance water temperatures during late May and June to provide spawning cues and enhance environmental conditions for pallid sturgeon and other native fish species. The USFWS has targeted a water temperature of 18°C (64.4°F) for the Missouri River at Frazier Rapids (approximately 25 miles downstream from the dam). In contrast to "normal" cold-water releases through the dam, it is proposed to release warmer surface water from Fort Peck Reservoir down the spillway to increase water temperatures in the Missouri River below the dam.

As a precursor to a full implementation of the proposed discharge modification to the operation of the Fort Peck project, the Corps plans to implement a "mini-test" this spring to evaluate the proposed modified operation of the project. The mini-test proposes to release up to 11,000 c.f.s. down the spillway for up to four weeks during the month of June and is contingent upon there being sufficient water available in Fort Peck Lake. At least 4,000 c.f.s. would be simultaneously released from the powerhouse, with a total discharge not to exceed 15,000 c.f.s.. The primary benefits of the mini-test will be: a) collection of data about the spillway integrity at various spillway discharges; b) collection of temperature information at various combinations of spillway/powerhouse discharges for use in future water temperature modeling; c) temporary increase in Missouri River water temperatures within a limited area to enhance pallid sturgeon habitat; and d) testing and standardization of methodologies to be used for monitoring conditions during full implementation.

As part of developing an Environmental Assessment for the proposed mini-test, the Corps briefly reviewed the Fort Peck Tribes' water quality standards and is seeking clarification on the application of the following provisions:

- A water-use classification for the north half of the Missouri River on the southern border of the Reservation is Class 1 Cool Water Aquatic (Appendix B, Table 1).

- For those streams designated as Class 1 and Class 2 Cool Water, a 0.5°C increase above naturally occurring water temperature is allowed within the range of 0°C to 18.9°C (Appendix C, References for Table 2: Physical and Biological Criteria).

- In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act (Antidegradation Policy and Review Process).

Please advise me as to the Tribes' interpretation of the above provisions concerning a test release of water from the spillway. The collection of data from this test will be important as we make future decisions about the operation of Fort Peck Dam. If there is any additional information to further coordinate the proposed mini-test, please let us know.

Thank you for your assistance in this matter. If you have any mini-test questions, please contact Mr. Bill Miller at (402) 221-4022.

Sincerely,

Kurt F. Ubbelohde
Colonel, Corps of Engineers
District Engineer

Montana Department of
ENVIRONMENTAL QUALITY
Judy Martz, Governor
P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • Website: www.deq.state.mt.us

February 1, 2002

Mr. Kenneth S. Cooper
Deputy District Engineer
Department of the Army
Corps of Engineers, Omaha District
106 South 15th Street
Omaha, Nebraska 68102-1618

Dear Mr. Cooper:

To respond to your concerns about how specific sections of the Administrative Rules of Montana (ARM) may effect the proposed mini-test of the "spring rise" flow regime from the Fort Peck Dam, each item will be addressed in the order they were asked.

1) The Missouri River, from just below the Fort Peck Dam to the Milk River, is classified B-2 (ARM 17.30.610(6)), and the river from the Milk River confluence to the North Dakota Border is classified B-3 (ARM 17.30.610(9)(a)). The B-2 reach of the Missouri River is about 10 miles long.

In general, there are two differences between the classifications. The B-2 classification is considered a transition between a salmonid fishery (growth and marginal propagation), with a small temperature change allowed, and a warm water fishery (B-3), with a slightly larger allowed temperature change. The "mini-test" spill will be affecting the transition reach, and the expected conditions in the river (temperature and suspended sediment) will be more like those that existed before construction of the dam.

2) The thermal limits you sited are correct.

3) Dams on large rivers have negative affects on downstream beneficial uses (see §303(d) listings). The ARM 17.30.636(1) expands on the requirement of "reasonable operation" in the definition of naturally occurring. If the operation of a dam impairs downstream uses, the operator of the dam must demonstrate to the department that continued operation will be done in a way that minimizes harmful effects. The rule also requires new facilities to provide temperature variations that maintain or enhance the existing fishery (i.e., pre-dam), which should be the goal of "reasonable operation" of an existing dam.

4) The general prohibition 17.30.637(2) ARM is a narrative standard protecting state waters from the cumulative effects of one or more activities. A dam operated in such a manner as to minimize re-suspension of reservoir sediment, shore erosion and downstream bank erosion, and promote stable riparian conditions, would meet, (at least in part), the general prohibition.

Because the spill test is a necessary part of the demonstration called for by ARM 17.30.636 (1), it will not cause a violation of state water quality standards.

If you have further questions about the meaning or interpretation of Montana's water quality standards, you should contact Abe Horpestad at 406-444-2459 or ahorpestad@state.mt.us.

Sincerely,

Jan P. Sensibaugh
Director

cc: Art Compton

# WATER TEMPERATURE CALCULATIONS FOR MINI TEST

Definitions

T1 = Missouri River temperature below Fort Peck Dam tailwaters (RM 1766)
T2 = Temperature of water going down spillway ≈ average upper lake temperature (see A)
T3 = Milk River average June temperature (see B)
T4 = Missouri River temperature at Nickels (RM 1757.5), average June or calculated (see B)
T5 = Missouri River temperature at Frazier Rapids (RM 1744), average June or calculated (see B)
Q1 = Discharge from Fort Peck Dam
Q2 = Discharge down the spillway (see C)
Q3 = Discharge from the Milk River in June (see D)

all discharges are in cfs
all temperatures are in degrees F

## A Estimated Spillway Temperature

To calculate spillway temperature, we assume that spillway temperature = upper (top 5 meters) average lake temperature. To determine average upper lake temperature, lake temperature profile data from 1990 - 1997 were used.

{[(∑lake temp 0.1 m 1990 + lake temp 0.1 m 1991 + .....+ lake temp 0.1 m 1997) / 8] 0.1 + (∑lake temp 2.0 m 1990 + lake temp 2.0 m 1991 + .....+ lake temp 2.0 m 1997) / 8] 2 + (∑lake temp 5.0 m 1990 + lake temp 5.0 m 1991 + .....+ lake temp 5.0 m 1997) / 8] 5} / 5 = average lake temp, upper 5 m

n = 3 temp depths x 8 years = 24

assumption: average June lake temperature during the mini test ≈ 1990 - 1997 average

assumption: spillway discharge will consist of a mixture of water from the upper 5 m (≈15 feet) of the lake, depending on lake elevation

## B Average June Missouri River Temperatures

Average June Missouri River temperatures were determined from actual temperature measurements at identified locations during 2000 and 2001. Data was collected hourly by automated thermometers and downloaded for analysis. Some locations have data files for the left bank and the right bank, and if so, both were used.

[(day 1, left bank / ∑hourly temps + day 2, left bank / ∑hourly temps + ...+ day 30, left bank / / ∑hourly temps) + (day 1, right bank / ∑hourly temps + day 2, right bank / ∑hourly temps + ...+ day 30, right bank / / ∑hourly temps)] / 30 = average June river temp, by site

n = (24 hourly readings) (30 days) (1 bank) = 1440 or
n = (24 hourly readings) (30 days) (2 banks) = 2880

assumption: average June river temperatures during the mini test ≈ temperatures during 2000 and 2001

**C Average June Discharge from Fort Peck Dam**

Average June discharge data from Fort Peck dam = [∑ June 1 daily average + June 2 daily average....June 30 daily average / 30 for a given year] / n years

**D Average Milk River June Discharge**

Average June discharge = ∑ USGS average monthly discharge data for June, for the year / n years

Temperature projections do not take into account the effects of the following potential variables:

a) air temperature
b) wind speed
c) groundwater temperatures
d) shade along the banks
e) cloud cover
f) lack of lake ice (can result in a colder lake)

**EQUATION TEST - 2000 DATA**

T1 = 54.1 Q1 = 9700
T2 = N/A Q2 = 0
T3 = 66.4 Q3 = 420
T4 = 55.7
T5 = 55.5

$$\frac{Q1T1 + Q2T2 + Q3T3}{Q1 + Q2 + Q3} = T4$$

$$\frac{(9700)(54.1) + (0) + (420)(66.4)}{9700 + 0 + 420} = \frac{524{,}770 + 0 + 27{,}888}{10{,}120} = \frac{552{,}658}{10{,}120} = 54.6 \approx 55$$

calculated temperature at Nickels = 54.6 ≈ 55
actual temperature at Nickels = 55.7 ≈ 56

T4 £ = T5
55.7 £ = 55.5
£ = 55.5 / 55.7
£ ≈ 1
T4 ≈ T5

**EQUATION TEST - 2001 DATA**

T1 = 53.9 Q1 = 5,900
T2 = N/A Q2 = 0
T3 = 65.1 Q3 = 600
T4 = 55.0
T5 = 55.5

$$\frac{Q1T1 + Q2T2 + Q3T3}{Q1 + Q2 + Q3} = T4$$

$$\frac{(5900)(53.9) + 0 + (600)(65.1)}{5900 + 0 + 600} = \frac{318{,}010 + 0 + 39{,}000}{6500} = \frac{357{,}070}{6500} = 54.9 \approx 55$$

calculated temperature at Nickels = 54.9 ≈ 55
actual temperature at Nickels = 55

T4 £ = T5
55£ = 55.5
£ = 55.5 / 55
£ ≈ 1
T4 ≈ T5

**MINI TEST TEMPERATURE PROJECTIONS - MAXIMUM AVERAGE** (during 11 KCFS)

T1 = 54[1]
T2 = 60[3]
T3 = 65[5]
T4 = calculated
T5 = calculated

Q1 = 4,000[2]
Q2 = 11,000[4]
Q3 = 960[6]

$$\frac{Q1T1 + Q2T2 + Q3T3}{Q1 + Q2 + Q3} = T4 \approx T5$$

$$\frac{(54)(4000) + (60)(11{,}000) + (65)(960)}{4000 + 11{,}000 + 960} = \frac{216{,}000 + 660{,}000 + 62{,}400}{15{,}960} = \frac{938{,}400}{15{,}960} = 58.8 \approx 59$$

T5 = calculated temperature at Frazier Rapids ≈ 59

Δ T during mini test = T5 - June average at Frazier Rapids during 2000, 2001
Δ T during mini test = 59 - 55

**Δ T during mini test (maximum) = 4° F**

[1] assumes same temp for this location as in 2000, 2001
[2] predicted discharge from the dam during this combination ofthe mini test
[3] June average lake temp, top 5 meters
[4] predicted discharge down spillway during this combination of the mini test
[5] assumes same temp for this location as in 2000, 2001
[6] 1940 - 2000 June average for the Milk

**MINI TEST TEMPERATURE PROJECTIONS - MINIMUM AVERAGE** (during 4 KCFS)

T1 = 54[7]
T2 = 60[9]
T3 = 65[11]
T4 = calculated
T5 = calculated

Q1 = 11,000[8]
Q2 = 4,000[10]
Q3 = 960[12]

$$\frac{Q1T1 + Q2T2 + Q3T3}{Q1 + Q2 + Q3} = T4 \approx T5$$

$$\frac{(54)(11{,}000) + (60)(4{,}000) + (65)(960)}{11{,}000 + 4{,}000 + 960} = \frac{594{,}000 + 240{,}000 + 62{,}400}{15{,}960} = \frac{896{,}400}{15{,}960} = 56.2 \approx 56$$

T5 = calculated temperature at Frazier Rapids ≈ 56

Δ T during mini test = T5 - June average at Frazier Rapids during 2000, 2001
Δ T during mini test = 56 - 55

**Δ T during mini test (minimum) = 1° F**

[7] assumes same temp for this location as in 2000, 2001
[8] predicted discharge from the dam during this combination ofthe mini test
[9] June average lake temp, top 5 meters
[10] predicted discharge down spillway during this combination of the mini test
[11] assumes same temp for this location as in 2000, 2001
[12] 1940 - 2000 June average for the Milk

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