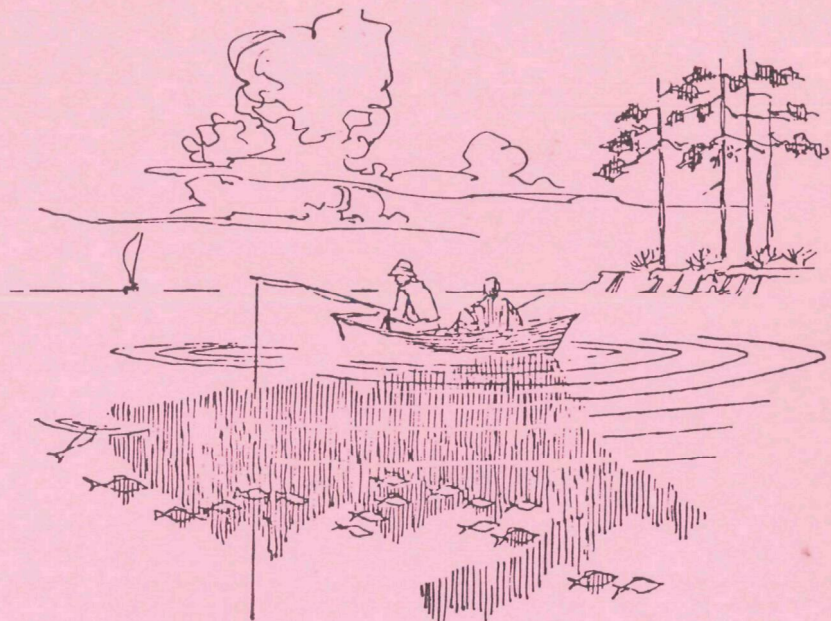




WATER QUALITY STANDARDS CRITERIA DIGEST
A COMPILATION OF FEDERAL/STATE CRITERIA ON
-TEMPERATURE-



ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

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INTRODUCTION

This digest was compiled in order to provide general information to the public as well as to Federal, State, and local officials. It contains excerpts from the individual Federal-State water quality standards establishing temperature criteria for interstate waters. The water quality standards program is directed by the Environmental Protection Agency an independent regulatory agency which has responsibility for approving State-adopted standards for interstate waters, evaluating adherence to the standards, and overseeing enforcement of standards compliance.

Standards, the first nationwide strategy for water quality management, contain four major elements: the use (recreation, drinking water, fish and wildlife propagation, industrial, or agricultural) to be made of the interstate water; criteria to protect those uses; implementation plans (for needed industrial-municipal waste treatment improvements, among others) and enforcement plans; and an antidegradation statement to protect existing high quality waters.

Minimum water quality criteria, or numerical specifications of physical, chemical, temperature, and biological levels, are stated in the National Technical Advisory Committee report to the Secretary of the Interior, Water Quality Criteria, dated April 1, 1968, and published by the Government Printing Office, Washington, D.C. Unavailability of the NTAC report before June 30, 1967--the date set by the Water Quality Act of 1965 for formal adoption of State standards--resulted in significant variations between the state-adopted and the NTAC minimum criteria. Some standards were adopted and approved before the NTAC report became available. Also, the Water Quality Criteria report is subject to updating in light of new scientific and technical information.

Temperature standards are set to control thermal pollution, or the amount of heated wastes discharged into the water. Thermal pollution creates adverse conditions for aquatic life; accelerates biological processes in the streams, reducing the dissolved oxygen content of the water; increases the growth of aquatic plants, contributing to taste and odor problems; or otherwise makes the water less suitable for fish and wildlife, domestic, industrial and recreational uses.

Water Quality Criteria, used by EPA in evaluating State standards, recommends a maximum water temperature of 90°F with a maximum permissible rise above the naturally existing temperatures of 5°F in streams and 3°F in lakes. It recommends that trout and salmon waters not be warmed in order to protect these resources. Because of the lesser temperature fluctuations in the marine and estuarine environment, the NTAC report recommends that monthly maximum daily temperatures recorded at any site, before the addition of artificial heat, not be raised by more than 4°F from September through May and by more than 1.5°F from June through August.

Since water quality standards experience revisions and upgrading from time to time, following procedures set forth in the Federal Water Pollution Control Act, individual entries in this digest may be superseded. As these revisions are accomplished, this digest will be updated and reissued. Because this publication is not intended for use other than as a general information resource, for the latest information, and for special purposes and applications, refer to the existing approved water quality standards which can be obtained from the State water pollution control agencies or EPA Washington, D.C. or regional offices.

Individual State-adopted criteria follow.

WATER QUALITY STANDARDS SUMMARY

TEMPERATURE CRITERIA

KEY:	Max.	Maximum
	Min.	Minimum
	PWS	Public Water Supply
	Rec.	Recreation
	F&WL	Fish and Wildlife propagation
	Agric.	Agricultural water supply
	Ind.	Industrial (also may include power and cooling) water supply
	Nav.	Navigation
	Shell.	Shellfishing
	*	Not approved.
	RM	River Mile

Alabama: PWS - With respect to cooling water discharges only, the ambient temperature of receiving waters shall not be increased more than 10°F. by the discharge of such cooling waters, after reasonable mixing; nor shall the discharge of such cooling waters, after reasonable mixing, cause the temperature of the receiving waters to exceed 93°F.

Rec. - Same as PWS.

Agri & Ind. - Same as PWS.

Shell. - Same as PWS*

F&WL - Same as PWS*

Alaska: PWS - Below 60°F.; waste flows above 60°F. adjusted to ambient receiving water temperature.

Rec. - Numerical value not applicable.

F&WL - May not exceed temperature of natural conditions by more than 5% for salt water or 10% for fresh water. No change permitted for temperatures over 60°F. Maximum rate of change - 0.5°F./hr.

Shell. - Less than 68°F.

Stock and Irrigation - Between 60°F. and 70°F. for optimum growth to prevent physiological shock to plants.

Ind. - Less than 70°F.

- Arizona: 93°F. max; not more than 5°F. change.
- Cold water fish. - November-March-55°F. max.) not more
April-Oct.--70°F. max.) than 2°F.
change.
- Arkansas: 20°C. - max. in trout streams.
30°C. - max. in smallmouth bass streams.
35°C. - max. in other streams.
- California: The standards establish a complex set of thermal requirements. For many categories of receiving waters, requirements differ between "thermal waste" (herein "TW," defined as water used for transporting waste heat) and "elevated temperature waste" (herein "ETW," defined as any discharge, including thermal waste but excluding irrigation return water, which exceeds the natural temperature of the receiving water.
1. Cold interstate waters. ETW's are prohibited.
 2. Warm interstate waters.
 - A. TW's with temperature greater than 5°F. above receiving water temperature are prohibited.
 - B. ETW's shall not raise receiving water temperature by more than 5°
 - C. Colorado River. Maximum rise 5°F. in river, 3°F. in Lake Havasu. Maximum temperatures:

Jan	60°	Jul	90°
Feb	65	Aug	90
Mar	70	Sept	90
Apr	75	Oct	82
May	82	Nov	72
June	86	Dec	65
 - D. Lost River. Maximum rise 2° up to 62° maximum temperature.
 3. Coastal waters.
 - A. Existing discharges.
 - (1) ETW's must comply with limitations necessary to protect beneficial uses.
 - B. New discharges.
 - (1) ETW's must be to open ocean away from the shoreline, dispersion through the

vertical water column.

- (2) ETW's away from areas of special biological significance.
- (3) TW's must have a maximum temperature not exceeding water temperature by more than 20°.
- (4) ETW's must not increase water temperature more than 4° at (a) shoreline, (b) surface of ocean substrate or (c) ocean surface beyond 1000 feet from the discharge system. Surface limits must be maintained at least 50% of the tidal cycle. Alternate objectives may be specified if they assure full protection of the aquatic environment. (May be specified only with State Board and EPA concurrence.)
- (5) Additional limitations may be imposed when necessary to protect the aquatic environment.

4. Enclosed bays.

A. Existing discharges.

- (1) ETW's must comply with limitations necessary to protect beneficial uses.

B. New discharges.

- (1) ETW's must comply with limitations necessary to protect beneficial uses. Maximum discharge temperature must not exceed receiving water temperature by more than 20°.
- (2) TW's with temperature greater than 4° above receiving water temperature are prohibited.

5. Estuaries.

A. Existing discharges.

- (1) ETW's [a.] Temperature shall not exceed receiving water temperature by more than 20°. [b.] Must not, individually or combined, create zone (receiving water temperatures more than 1° above natural) which exceeds 25% of cross-sectional area of main channel;

[c.] No discharge shall cause a surface water temperature rise greater than 4°F above the natural temperature of the receiving waters at any time or place.

[d.] Additional limits necessary to protect beneficial uses.

- (2) TW's must comply with 5A(1) and their maximum temperature must not exceed 86°.

B. New discharges.

- (1) ETW's must comply with 5A(1).
- (2) TW's with temperature greater than 4° above receiving water temperature are prohibited.
- (3) Additional limits necessary to protect beneficial uses.

General Provisions. Standards also contain general provisions which include the following:

1. Authorization for additional individual limitations to confine heat dispersion to a 1 1/2° isotherm in a minimal, defined area;
2. Prohibition of cumulative heat effects in excess of the standards;
3. A requirement that the State Board designate biologically significant areas for special protection.
4. Authorization to make exceptions if:
 - A. The heat discharge will be beneficial;
 - B. Intermittent heat is the least harmful method to control fouling organisms in intake and discharge structures;
 - C. Compliance would cause a greater environmental impact than modification of the standards, or
 - D. Compliance by existing discharges would not be commensurate with the benefit to the aquatic environment.

NOTE: Exceptions will be made only with EPA concurrence.

Colorado:

Class B₁ (cold water fish) - 70°F. max. No controllable temperature change will be permitted which will interfere with the spawning and other aspects of fish life. Abrupt changes in temperature must be avoided and the normal pattern of diurnal and seasonal fluctuations must be preserved. The maximum allowable rise in temperature resulting from waste discharges in streams and the epilimnion of lakes shall be 2°F. No warming discharge permitted in the hypolimnion of lakes.

Class B₂ (warm water fish) - 90°F. max. No controllable temperature change will be permitted which will interfere with spawning and other aspects of fish life. Abrupt changes in temperature must be avoided and the normal pattern of diurnal and seasonal fluctuations must be preserved. The maximum allowable temperature increase due to waste discharge in streams will be 5°F., and the maximum increase allowable from waste discharges to the epilimnion of lakes is 3°F. No warming discharges to the hypolimnion of lakes.

Class B₁ and B₂ - In temperature measurement, allowance shall be made for a mixing zone. Provisions shall be made for adequate mixing and no thermal barrier to migration and free movement of aquatic biota shall be permitted in any waters of the state.

Class C - (Industrial) - The temperature shall not exceed 93°F.

Class D - (irrigation) - No temperature criteria assigned.

Connecticut:

Class A (PWS)	- No increase other than natural origin.
Class B (Rec.)) No increase to exceed
Class C (F&WL)) recommended limits on
Class D (Nav. & Ind.)) most sensitive water
Class SA (Shell.)) use, and in no case to
Class SB (Restricted Shell.,)) exceed 4°F. over natural
Class SC (Shell, Habitat)) with a max. of 85°F.
Class SD (Nav.))

Delaware:

Criteria are assigned by basin and are as follows:

5° rise - Red Clay Creek, White Clay Creek, Christina River, Choptank River, Buntings Branch Creek, Assawoman Bay.

5° rise, 85° maximum - Brandywine River, Chesapeake and Delaware Canal, Nanticoke River, Delaware River and Delaware Bay.

5° rise, 87° maximum - Rehoboth Bay, Indian River and Bay.

5° rise, 75° maximum - Atlantic Ocean.

District of
Columbia:

Not to exceed 90°F., 5°F. change limit; no sudden or localized temperature changes which may adversely affect aquatic life.

Florida:

All waters - temperature shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

(EPA has requested changes in criteria)

Georgia:

PWS) Not to exceed 93.2°F. at any time and not
Rec.) to be increased more than 10°F. above in-
F&WL) take temperature. In streams designated by
Shell.) the State Fish and Game as trout waters,
there shall be no elevation or depression
of natural stream temperature.

(NOTE: Administrator has requested changes in criteria.)

Ind.-Not to exceed 93.2°F. at any time and not to
be increased more than 10°F. above intake temperature.

Guam:

PWS - 85°F. max.. 5°F. change limit, 1.5°F. hourly
change limit.

Rec. - 85°F.

F&WL - 1.5°F. change limit from natural conditions.

Hawaii:

Classes AA, A, B (all uses of coastal and tidal
waters) - Temperature of receiving waters shall not
change more than 1.5°F. from natural conditions.

Idaho:

No measurable temperature increase when stream
temperature is 68°F. or above, or more than 2°F.
increase when river temperature is 66°F. or less
(Except 70°F. and 68°F., respectively, for Snake
River - River Mile 407 to 247.)

Illinois:

General Standards.

Temperature.

(1) There shall be no abnormal temperature
changes that may adversely affect aquatic life
unless caused by natural conditions.

(2) The normal daily and seasonal temperature
fluctuations that existed before the addition
of heat due to other than natural causes shall

be maintained.

(3) The maximum temperature rise above natural temperatures shall not exceed 5° F.

(4) In addition, the water temperature at representative locations in the main river shall not exceed the maximum limits in the following table during more than one percent of the hours in the 12-month period ending with any month. More-over, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 3° F.

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUN.</u>	<u>JUL.</u>	<u>AUG.</u>	<u>SEPT.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
Mississippi River (Wisc. Border to Iowa Border) (°F)	45 °	45 °	57 °	68 °	78 °	85 °	86 °	86 °	85 °	75 °	65 °	52 °
Mississippi River (Iowa Border to Alton Lock and Dam) (°F)	45 °	45 °	57 °	68 °	78 °	86 °	88 °	88 °	86 °	75 °	65 °	52 °
Mississippi River (So. of Alton Lock & Dam) (°F)	50 °	50 °	60 °	70 °	80 °	87 °	89 °	89 °	87 °	78 °	70 °	57 °
Ohio River (°F)	50 °	50 °	60 °	70 °	80 °	87 °	89 °	89 °	87 °	78 °	70 °	57 °
Wabash River & Its inter-state Tributaries (°F)	50 °	50 °	60	70 °	80 °	90 °	90 °	90 °	90 °	78 °	70 °	57 °
Other Waters (°F)	60 °	60 °	60 °	90 °	90 °	90 °	90 °	90 °	90 °	90 °	90 °	60 °

Main river temperatures are temperature of those portions of the river essentially similar to and following the same thermal regime as the temperatures of the main flow of the river.

(5) The owner or operator of a source of heated effluent which discharges 0.5 billion British thermal units per hour or more shall demonstrate in a hearing before this Board not less than 5

for more than 6 years after the effective date of these regulations or, in the case of new sources, after the commencement of operation, that discharges from that source have not caused and cannot be reasonably expected to cause significant ecological damage to the receiving waters. If such proof is not made to the satisfaction of the Board appropriate corrective measures shall be ordered to be taken within a reasonable time as determined by the Board.

(6) Permits for heated effluent discharges, whether issued by the Board or the Environmental Protection Agency, shall be subject to revision in the event that reasonable future development creates a need for reallocation of the assimilative capacity of the receiving stream as defined in the regulation above.

(7) The owner or operator of a source of heated effluent shall maintain such records and conduct such studies of the effluents from such source and of their effects as may be required by the Environmental Protection Agency or in any permit granted under the Environmental Protection Act.

(8) Appropriate corrective measures will be required if, upon complaint filed in accordance with Board rules, it is found at any time that any heated effluent causes significant ecological damage to the receiving stream.

Lake Michigan:

Temperature

- (1) (A) All sources of heated effluents in existence as of January 1, 1971 shall meet the following restrictions outside of a mixing zone which shall be no greater than a circle with a radius of 1000 feet or an equal fixed area of simple form.
- (i) There shall be no abnormal temperature fluctuations that existed before the addition of heat shall be maintained.
 - (ii) The normal daily and seasonal temperature fluctuations that existed before the addition of heat shall be maintained.
 - (iii) The maximum temperature rise at any time above natural temperatures shall not exceed 3°F. In addition, the water temperature shall not exceed the maximum limits (°F) indicated in the following table:

<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUN.</u>	<u>JUL.</u>	<u>AUG.</u>	<u>SEPT.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
45	45	45	55	60	70	80	80	80	65	60	50

- (B) The owner or operator of a source of heated effluent which discharges 0.5 billion British Thermal Units per hour (BTU/HR.) or more shall demonstrate in a hearing before this Board not less than 5 nor more than six years after the adoption of this regulation, that discharges from that source have not caused and cannot be reasonably expected in future to cause significant ecological damage to the Lake. If such proof is not made to the satisfaction of the Board, backfitting of alternative cooling devices shall be accomplished within a reasonable time as determined by the Board.
 - (C) The owner or operator of a source of heated effluent shall maintain such records and conduct such studies of the effluents from such source and of their effects as may be required by the Environmental Protection Agency or in any permit granted under the Environmental Protection Act.
 - (D) Backfitting of alternative cooling facilities will be required if, upon complaint filed in accordance with Board rules, it is found at any time that any heated effluent causes significant ecological damage to the Lake.
- (2) Any effluent source under construction as of January 1, 1971, but not in operation, shall meet all the requirements of Section 1 of this regulation and in addition shall meet the following restrictions.
- (A) Neither the bottom, the shore, the hypolimnion, nor the thermocline shall be affected by any heated effluent.
 - (B) No heated effluent shall affect spawning grounds or fish migration routes.
 - (C) Discharge structures shall be so designed as to maximize short-term mixing and thus to reduce the area significantly raised in temperature.
 - (D) No discharge shall exceed ambient temperatures by more than 20°F.

- (E) Heated effluents from more than one source shall not interact.
 - (F) All reasonable steps shall be taken to reduce the number of organisms drawn into or against the intakes.
 - (G) Cleaning of condensers shall be accomplished by mechanical devices. If chemicals must be used to supplement mechanical devices, the concentration at the point of discharge shall not exceed the 96-hour TLM for fresh water organisms.
- (3) (A) No source of heated effluent which was not in operation or under construction as of January 1, 1971 shall discharge more than a daily average of 0.1 billion BTU/Hr.
- (B) Sources of heated effluents which discharge less than a daily average of 0.1 billion BTU/Hr. not in operation or under construction as of January 1, 1971 shall meet all requirements of sections 1 and 2 of this regulation.

Indiana:

Industrial classification - Temperature shall not exceed 95°F. at any time.

Aquatic Life

1. Warm water species.

- a. There shall be ^{no} abnormal temperature changes that affect aquatic life unless caused by natural conditions.
- b. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.
- c. The maximum temperature rise at any time or place above natural temperature shall not exceed 5°F. In addition, the water temperature shall not exceed the maximum limits indicated in the following table:

	<u>Ohio River Main Stem</u>	<u>St. Joseph River Tributary to Lake Michigan</u>	<u>Other Indiana Streams</u>
January	50	50	50
February	50	50	50
March	60	55	60
April	70	65	70
May	80	75	80
June	87	85	90
July	89	85	90
August	89	85	90
September	87	85	90
October	78	70	78
November	70	60	70
December	57	50	57

2. Cold Water Species

- a. In trout and salmon streams where natural reproduction is to be protected, no heat shall be added.
- b. In put-and-take streams, temperature shall not exceed 65°F. or a 5°F. rise above natural, whichever is less.

Iowa:

Warm water fish - 90° maximum; 5° increase in streams and 3° increase in lakes.

Cold water fish - 68° maximum, 2°/hour maximum rate of change; 5° maximum rise.

Kansas:

Maximum temperature 90°F.

Allowable rise for streams and rivers is 5°F. Allowable rise for the epilimnion of lakes and reservoirs is 3°F. Temperature measurement is at the outfall and with the maximum temperature allowed at the outfall reflecting a reasonable mixing zone in the receiving waters so that the 5°F. or 3°F. rise specified is not violated in the contiguous receiving waters. Any barrier to migration and the free movement of the aquatic biota is prohibited.

Kentucky:

89°F. maximum. No abnormal temperature changes that may affect aquatic life unless caused by natural conditions. Normal daily and seasonal fluctuations. Temperature rise not to exceed 5°F. in streams or 3°F. in epilimnion of public water impoundments if stratification exists. Also, streams must not exceed:

Jan	50	July	89
Feb	50	Aug	89
Mar	60	Sept	87
Apr	70	Oct	78
May	80	Nov	70
June	87	Dec	57

Put-and-take trout streams - no artificial temperature increase.

Louisiana:

Not to be raised more than 3°C. above normal ambient water temperature, nor to exceed a max. of 36°C.

A few rivers - 2°C. rise, 35°C. max.

Maine:

Freshwater (rivers, streams, and lakes) - 84°F. max. for warm water fish and 68°F. max. for trout and salmon waters. Rise of 5°F. from heated effluent of artificial origin allowed to rivers and streams, and a 3°F. rise due to heated effluent for the epilimnion of lakes.

Narrative Statement: No heated effluent allowed to be discharged in the vicinity of, or so as to affect, waters designated as fish spawning beds by the State.

Tidal Waters: No discharge of heated effluent that will raise the monthly mean of the maximum daily temperature outside mixing zones of more than 4°F. or, where the necessity therefor in any specific location is shown to exist, more than 1.5°F. during the months of July, August, and September.

Maryland:

Nontidal Waters: Trout waters - not to exceed 72°F. at any time. All other waters - not to exceed 93°F., elevation of temperature not to exceed 20°F. or 10°F. depending whether the natural water temperature is below or above 50°F., respectively, with a maximum of 60°F. and 93°F., respectively.

Tidal Waters: 90°F. max.; same temperature change limit as above with absolute max. temperature of 60°F. and 90°F.

For all waters not classified for F&WL, no adverse temperature change and max. of 100°F.

Massachusetts:

Class A (excellent) - no increase other than natural origin.

Class B (Rec. F&WL) No increase except where temperature will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83°F. in warm water fish, and 68°F. in cold water fish, or in any case raise the normal temperature more than 4°F.

Class C (F&WL)

Class D (Ind.) - no increase to exceed limits on most sensitive use and in no case exceed 90°F.

All coastal and marine waters - no increase to exceed limits on most sensitive water use.

Michigan:

PWS - 10°F. allowable rise above natural temperatures.

Ind. - Same as PWS.

Rec. - 90°F. max.

F&WL - Cold water fish - 70°F. max., 10°F. change limit*

Nav. - Same as PWS.

Minnesota:

F&WL & Rec. - 2A - no material increase
2B - 86°F. max.
2C - 90°F. max.

Ind. - 3A - 75°F. max.
3B - 86°F. max.
3C - 90°F. max.

Mississippi:

Shall not be increased more than 10°F. above the natural prevailing background temperatures, not to exceed a max. of 93°F. after reasonable mixing.

(Temperature change not approved for F&WL)

Missouri:

Effluent shall not elevate or depress the average cross-sectional temperature of the stream more than 5°F. The stream temperature shall not exceed 90°F. due to effluents (for most streams--some to 93°F.).

Trout waters - Effluents shall not elevate or depress the average cross-sectional temperature of the stream more than 2°F.

Lakes and reservoirs - no temperature increase due to any discharge which may be a source of heat.

Montana:

PWS - no allowable change to naturally occurring water temperature.

Salmonid fish - increases - 32°F. to 67°F. - 2°F. max.;
(Classes D1 and D2) - above 67°F. - 0.5°F. max.
decreases - over 55°F. - 2°F.
max./hr ; 55°F. to 32°F. - 2°F.
max., provided that water temperature must be below 40°F. in the winter season and above 44°F. in the summer season.

Non-salmonid fish -

(Class D3) - increase - 32°F. to 85°F. - 4°F. max.;
85°F. - 0.5 °F. max.
decreases - same as Salmonid fish.

Ind. - no allowable temperature change in sufficient quantities to adversely affect the use indicated.

Nebraska:

PWS - 5°F. change limit, May-Oct.; 10°F. change limit, Nov.-April; limit of 2°F./hr.

Rec. - same as PWS.

Trout Streams - 65°F. max., 5°F. change limit.

Warm water streams - 90°F. max. change limits same as PWS.

Missouri River (Gavins Point Dam to Sioux City, Iowa)-
85°F. max.; 4°F. change limit.

Nevada:

Max. summer values - 30°C. to 20°C. (varies with stream), Max. winter values - 14°C.

New Hampshire

Temperature criteria applicable to New Hampshire waters are those set forth in Section 3, page 28 through 110, of the National Technical Advisory Committee Report "Water Quality Criteria," and in the official standards of the New England Interstate Water Pollution Control Commission.

New Jersey

FW-1. Preserve natural conditions.

FW-2. (PWS) - Trout production - No change except 1° rise where treated effluents are discharged.

Trout maintenance streams - 68°F. maximum, 2° rise.

Trout maintenance lakes - No change unless shown beneficial.

Non-trout - 86°F. maximum. (82°F. max. in yellow perch areas.) Max. change 5° in streams, 3° in lakes.

FW-3. (F&WL, rec.) Same as FW-2.

TW-1. (Tidal: PWS, shellfish, rec.) Trout maintenance streams - Same as FW-2.

Non-trout waters - 85°F. max. (82° max. in yellow perch areas); max. rise (measured against monthly mean of daily max. temp.) 4° Sept-May, 1.5° June-Aug.

TW-2. (Secondary rec., fish maintenance.) - 85°F. max.; max. rise same as TW-1.

TW-3. (Nav., fish survival & passage) - Same as TW-2.

CW-1. (Ocean near shore: primary rec., F&WL) - No direct heat additions. 80° max. as a result of additions elsewhere. Max. rise same as TW-1.

CW-2. (Ocean beyond CW-1) - 80° max.; max. rise same as TW-1.

New Mexico

Warm water fish. - 93°F. max., 5°F. change limit.
Cold water fish. - 70°F. max., 2°F. change limit.
Allowable rise of 9°F. for the lower reach of the Pecos River.

New York

Trout waters - No thermal discharge which will cause adverse effects on trout.

New York:	Non-trout waters - 90°F. max., within mixing zone; 86°F. max., and 5°F. change limit outside mixing zone, plus a 2°F. max. change limit/hr., and/or 9°F. max. change limit for a 24 hr. period. (fresh waters).
	86°F. max. and 5°F. change limit outside mixing zone, plus a 1°F. max. change limit/hr. and/or 7°F. max. change limit for a 24 hr. period (tidal waters).
North Carolina:	Class A-II (PWS) 5° change limit, maximum of 84°F. Class B for the mountains and upper piedmont, Class C maximum of 90°F. for lower piedmont and coastal plain.
	Natural trout waters shall not exceed 68° and shall not be significantly increased as a result of the discharge of heated liquids. Put-and-take trout waters shall not exceed 70°F. and may be increased 3°.
	Class D Not to exceed 5°F. above natural, maximum of 84° in mountains and upper piedmont, and maximum of 90°F. in lower piedmont and coastal plain.
	Class SA (Shell.) Allowable rise of 1.5°F. during June, July and August, 4.0°F. remaining months.
	Not to exceed 90°F. due to the discharge of heated effluents.
North Dakota:	90°F. maximum, allowable rise 5°F. above natural, all waters except Missouri and Yellowstone Rivers, 85°F. max., 4°F. rise.
Ohio:	Aquatic Life A - not to exceed 93°F., May-Nov.; not to exceed 73°F., Dec-April*
	Aquatic Life B - not to exceed 95°F.
	Ind. - not to exceed 95°F.
Oklahoma:	5°F. change limit, provided the max. man-made temperature does not exceed 70°F. in trout streams, 75°F. in smallmouth bass streams, or 93°F. in warm water streams.

Oregon:

General statement that no measurable increase in temperature allowed when the receiving water temperature is 64°F. or above, or more than 2°F. increase when the receiving water temperature is 62°F. or less. The exceptions follow:

Multnomah Channel and main stem Willamette River, from mouth to Newburg (RM 50): 70°F. and 68°F., respectively.

Main stem Willamette River from Newberg to confluence of Coastal and Middle Forks (R.M. 187): 64°F. and 62°F. respectively.

Main stem Columbia River, main stem Grande Ronde River, Walla Walla River: 68°F. and 66°F., respectively.

Goose Lake: 70°F. or the daily mean ambient air temperature, whichever is greater.

Klamath River: 72°F. and 70°F., respectively.

Marine waters: No significant increase above natural background temperature or water temperatures to be altered to a degree which creates or can reasonably be expected to create an adverse effect on fish or other aquatic life.

Pennsylvania:

Trout waters 58°F. max., 5°F. change limit.
Warm water fish - 5°F. change limit above natural or 87°F. max., whichever is less; 2°F. change limit per hour.

Delaware River Estuary - same as warm water fish, but with 86°F. max.

Mahoning River 93°F. max.; 2°F. change limit per hour.

Puerto Rico:

SA - No change
SB-(Shell.))
SC-(Rec.)) 93°F. max., 4°F. change limit.
SD-(F&WL))
SE-(Ind.))

Rhode Island

Class A (Excellent) - no increase from other than natural origin.

Class B (Rec.)) 68°F. and 83°F. max. for cold
Class C (F&WL)) and warm water fish, respectively;
4°F. change limit.

Class D (Nav. & Ind.) - 90°F. max., no increase
to exceed limits on most
sensitive use.

Class SA (Shell.)) No increase over the
Class SB (Bathing)) recommended limits for
Class SC (Shell, habitat)) the most sensitive use.
Class SD (Nav.))

South Carolina:

Upper Piedmont waters - 84°F. max., 5°F. rise.
All other fresh waters - 90°F max., 5°F. rise.
Tidal waters - 4° rise during fall, winter and
spring, 1.5°F. rise during summer. All fresh water
lakes limited to same maximum temperatures and 3°F.
rise.

South Dakota:

Cold water permanent fish - 68°F. max., 4°F. change
limit.
Warm water permanent fish - 85°F. max., 4°F. change
limit.
Warm water semi-permanent - 90°F. max., 5°F. change
limit.

Tennessee:

PWS) The maximum water temperature change shall not
Ind.) exceed 3°C relative to an upstream control point.
Rec.) The temperature of the water shall not exceed
30.5°C and the maximum rate of change shall not
exceed 2°C per hour. The temperature of impound-
ments where stratification occurs will be measured
at a depth of 5 feet or mid-depth whichever is
less, and the temperature in flowing streams shall
be measured at mid-depth.

Fish & Aquatic Life - Same as above with: The temp.
of recognized front waters shall not exceed 20°C.
There shall be no abnormal temp. changes that may
affect aquatic life unless caused by natural con-
ditions.

Irrigation: The temp. of the water shall not be raised
or lowered to such an extent as to interfere with
its use for irrigation purposes.

Livestock Watering and Wildlife and Nvigation - The
temp. of water shall not be raised or lowered
to such an extent as to interfere with its use for
"livestock watering and wildlife." (Same with
"navigation" substituted.

Texas:

Canadian River Basin - 93°F. max., 5°F. change limit.

Tidal waters - fall, winter, and spring - not to exceed
a 4°F. rise; summer - not to exceed a 1.5°F. rise.

All other waters - 96°F. max., 5°F. change limit (until
adequate stream study is made).

Utah: Cold water fish - 68°F. max., 2°F. change limit.
Warm water fish - 80°F. max., 4°F. change limit.

Vermont: Class A - (PWS) - No change.

Classes B and C (levels of rec. and F&WL) - temperature by "water type."

Type I (natural trout) - 1°F. max. rise.

Type II (trout) - 1°F. max. rise.

Type III (warmwater fish):

Max. River Temp.	Max. Rise
Above 66°F.	1°
63-66 F.	2°
59-62 F.	3°
55-58 F.	4°
Below 55 F.	5°

Type IV (trout lakes) - 1° max. rise. No withdrawal from or discharge to hypolimnion except withdrawals for PWS or water quality enhancement.

Type V (other lakes)

Max. Lake Temp.	Max. Rise
Above 60°F.	1°
60-50°	2°
Below 50°F.	3°

Provision for hypolimnion as Type IV.

Virginia: I (Open Ocean): 4.0 rise above natural, Sept-May
1.5 rise above natural, June-Aug.

II (Estuarine): Same as I.

III (Free flowing streams, coastal zone): 5° rise above natural, maximum 90°.

IV (Mountainous zone): 5° rise above natural, 87° maximum.

V (Put and take trout): No rise; 70° maximum.

VI (Natural trout): No rise; 70° maximum.

b. (Special standard.) Lakes and reservoirs: epilimnion shall not be raised more than 3°, based on monthly average of maximum daily temperature. Unless a special study shows that discharge of heated effluent into the hypolimnion (or pumping water from hypolimnion for discharging to same) will be desirable, such practice shall not be approved.

C. (Special standard.) Where applicable, maximum temperature shall be 81°, with 5° rise over natural limit.

Virgin Islands

Class A (preservation of natural phenomena) - no change.
 Class B (Rec. & F&WL) - 90°F. max., fall, winter,
 spring - 4°F. allowable rise; summer 1.5°F. allowable
 rise.

Washington:

Class AA (extraordinary waters) - No measurable in-
 creases in temperature permitted within the waters
 designated which result in water temperature exceeding
 60°F. (Fresh water) or 55°F. (Marine water) nor
 shall the cumulative total of all such increases arising
 from nonnatural causes be permitted in excess of $t=75/$
 $(T-22)$ (Fresh water) or $t=24/(T-39)$ (Marine water);
 for purposes hereof "t" represents the permissible in-
 crease and "T" represents the resulting water
 temperature.

Class A (excellent waters) - 65°F. and 61°F. max.
 for fresh and marine waters, respectively. $t=90/$
 $(T-19)$ and $t=40/(T-35)$ for fresh and marine waters,
 respectively.

Class B (good waters) - 70°F. and 66°F. max. for
 fresh and marine waters, respectively. $t=110/(T-15)$
 and $t=52/(T-32)$ for fresh and marine waters, respectively.

Class C (fair waters) - 75°F. and 72°F max. for fresh
 and marine waters, respectively. $t=125/(T-12)$ and
 $t=64/(T-29)$ for fresh and marine waters, respectively.

NOTE: This formula works as follows:

If contemplating a 2° temperature increase above
 natural ambient stream temperature,

- I. Divide 75 by the natural ambient temperature,
 plus 2°, minus 22°.
- II. If the answer is 2° or more, the increase is
 permitted.
- III. If the answer is less than 2°, the increase
 is prohibited.

EXAMPLE:

A. Is a 4° rise permissible in 40° water?

$$t = \frac{75}{(40+4)-22} = \frac{75}{22} = 3.41$$

3.41 is less than 4° therefore 4° is not
 permitted.

Wisconsin

F&WL - in waters where this is of primary importance-84°F. max., 5°F. change limit, 2°F. change limit per hour. Where fishing is an additional use - 89°F. max., 5°F. change limit. In addition, authorization is required for proposed installations where thermal discharges may increase natural temperature by 3°F.

Trout streams - no temperature change that will adversely affect trout.

West Virginia

Temperature criteria are established for each major river basin, as follows:

- (1) 87° max. May-Nov.; 73° max., Dec-Apr., 5° max. rise: Potomac River and branches, Kanawha (zone 1), Big Sandy River, Tug Fork, Ohio River (future), Ohio River tributaries, Monogahela River, West Fork River, Tygart Valley River, Cheat River, Youghiogheny River.
- (2) 81° max. May-Nov.; 73° max. Dec-Apr., 5° max. rise: Bluestone River, East River, New River, Bluestone Reservoir, Gauley River.
- (3) 93° max., 10° rise - Kanawha River (zone 2), Ohio.
- (4) 93° max., May-Nov., 73° max., Dec-Apr., Ohio River (present).
- (5) Trout streams. Trout streams, headwaters of streams, trout lakes and reservoirs and the hypolimnion of lakes and reservoirs should not be warmed. No heated effluents should be discharged in the vicinity of spawning areas. Heat should not be added which will raise water temperature more than 5°F. (monthly low flow) nor raise the epilimnion of lakes more than 3°F. Normal daily and seasonal fluctuations. Maximum temperatures:

	Daily Mean °F.	Hourly Max. °F.
Oct-Apr	50	55
Sept & May transition period	58	62
June-Aug	66	70

Present uses and criteria are those that now exist or will exist for a maximum of 5 years. Future uses and criteria are those which will exist after abatement is effected.

Wyoming

For streams where natural temperatures do not exceed 70°F, wastes of other than natural origin shall not be discharged in amounts which will result in an increase of more than 2°F over existing temperatures.

For streams where natural temperatures exceed 70°F, wastes of other than natural origin shall not be discharged in amounts which will result in an increase of more than 4°F over existing temperatures.

Maximum allowable temperatures will be established for individual streams as data becomes available. As an interim policy, the maximum allowable stream temperatures will be the maximum daily stream temperatures plus the allowable rise; provided that this temperature is not lethal to existing fish life, which is considered to be 78°F in the case of cold water fish.