

JUSTIFICATION

Idaho Rulemaking Docket 58-0102-1101T Site Specific Temperature Criteria for Salmonid Spawning and Application of Thermal Treatment Requirements in Lower Boise Subbasin; Statewide Revision of Thermal Treatment Requirements

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A. Site Specific Temperature Criteria for Salmonid Spawning (IDAPA 58.01.02 Water Quality Standards, Sections 278.05 and .06)

EPA's regionally recommended criterion of 13°C as a maximum weekly maximum temperature (MWMT), aka a maximum 7-day average of daily maximum temperatures (EPA 2003) is adopted for the three waterbodies in the Lower Boise River subbasin, 4th field HUC 17050114, designated for salmonid spawning. The criteria are specified in two subsections to deal with protection of different species and differences in timing of application of the criterion among waterbodies.

The species and time periods for applying spawning criteria are based on consultation with Idaho Department of Fish and Game (IDFG) fisheries biologist Jeff Dillon of the Nampa Regional Office (personal communication). For the Boise River (section 278.06) additional support is provided by an IDFG electrofishing survey (Attachment A) and analysis of ten years of ambient river temperature data collected by the City of Boise (Attachment B). The species and time periods are specific to Indian Creek and the Boise River, thus there are two site-specific criteria sections to address this specificity.

Protectiveness of EPA Region 10 Temperature Criteria for non-ESA species

EPA's region 10 temperature criteria recommendations were developed with ESA listed salmonids in mind. This unusual effort was undertaken in large part because of the widely acknowledged cold water dependence of listed species addressed by the regional guidance. From this it is reasonable to presume these criteria will be protective of other, cold water dependent salmonids as well.

Three non-ESA salmonids are of particular interest for this rule – native rainbow trout and mountain whitefish, and introduced German brown trout. Rainbow trout are the same species as steelhead trout explicitly addressed by the regional guidance. Mountain whitefish are a winter spawning species and a recognized cold water species (Simpson and Wallace, 1982) that DEQ has observed to be abundant and often the dominant salmonid in larger, typically warmer rivers throughout Idaho (Pappani, 2010). Protection of winter spawning is addressed below under application of spawning criteria. German brown trout are fall spawners that have been successfully introduced to some larger waters in southern Idaho thought to be less favorable for native trout. They have a reported thermal preference/tolerance almost identical to that for native rainbow trout (Hillman, 1999).

Health of lower Boise River Fishery

The IDFG conducts periodic fish surveys to estimate game fish populations and guide their management. Four sections of the Boise River through the City of Boise were surveyed in 1994, 2004, 2007, and most recently in 2010. Their ‘middle section’ is just above downtown Boise, while their Glenwood section is the furthest downstream, below Veteran’s Bridge and the City of Boise’s Lander Street wastewater treatment plant (WWTP). Results of these surveys were summarized and reported in 2011 (Attachment A).

IDFG found that fish populations in the ‘middle section’ of the Boise River have greatly improved in the past 17 years, in particular wild rainbow trout increased 17-fold from 1994 to 2010, and have increased over two-fold since 2007. Mountain whitefish were the predominant species, making up 54% to 93% of the catch among the four sections. Whitefish abundance “has remained relatively stable since 2004” after also increasing dramatically from 1994 levels. German brown trout are less numerous and their recent population more variable, but they have also increased substantially since 1994. The report concludes “The wild rainbow trout population still appears to be increasing in abundance in much of the lower Boise River”.

This large improvement in fish population is attributed by IDFG to the establishment of minimum winter flows that have provided increased and more dependable over winter habitat for juvenile fish. Germane to the site-specific criterion for salmonid spawning is that this improvement has occurred under the prevailing thermal regime in the Boise River.

Prevailing Thermal Regime in Lower Boise River

Ten years of ambient river temperature data were obtained from the City of Boise and analyzed with the aim of determining a supportive time frame for applying the 13°C MWMT salmonid spawning and incubation criterion, given the current health of the Boise River fishery has improved dramatically with current temperatures. Data collection began in 1999, but did not become year-round until 2000. Four sites were monitored, the most upstream site being Veteran’s Bridge, a location above the city’s two wastewater discharges and between IDFG’s Glenwood and Americana sections. Attachment B summarizes the analysis of water temperature at Veterans, Glenwood and Eagle Island as these locations bracket the City of Boise’s two WWTP discharges.

Water temperatures at the Veteran’s Bridge location are uninfluenced by the City’s two discharges. This site is also the closest to the IDFG’s fisheries survey’s ‘middle section’ and so was taken to best represent the thermal regime supportive of the observed increasing fish population. The analysis asked on what date, both in the spring and in the fall, do water temperatures cross over the 13°C MWMT threshold? This provided a date for each location, for each year (Attachment B). These average dates of meeting 13°C were rounded to month beginning or end for purposes of specifying a regulatory spawning period – that is, the average date of October 25th in the fall was shifted to November 1st, and the average date of May 27th in the spring was shifted to May 31st.

This provided a November 1st to May 31st time period for applying the 13° MWMT criterion to protect spawning and incubation of rainbow trout, mountain whitefish, and German brown trout in the two segments of the lower Boise River currently designated for salmonid spawning in the Idaho Water Quality Standards (WQS): specifically waterbodies SW-5 and SW-11a in subbasin 17050114.

Indian Creek Species and Spawning

In the process of developing a temperature TMDL for Indian Creek DEQ communicated with IDFG to determine which species and what time frame was appropriate for applying Idaho's current statewide criteria for protection of salmonid spawning and incubation for those species inhabiting Indian Creek. This was done in accordance with Idaho WQS section 250.f and Waterbody Assessment Guidance, 2nd Edition, Appendix F (Grafe and others, 2001).

Jeff Dillon, fisheries biologist with the IDFG's Nampa Regional Office (Indian Creek runs through the City of Nampa) has concluded that mountain whitefish do not spawn in Indian Creek as it is too small of a tributary (Jeff Dillon, personal communication). Mr. Dillon has also stated that a spawning period starting on October 15th, was appropriate for fall spawning German brown trout that IDFG is trying to establish in Indian Creek, and that ending the application of the criteria on June 30th in the spring would be protective of spring spawning rainbow trout in Indian Creek.

Application of Salmonid Spawning Temperature Criteria

Salmonid spawning and incubation is a seasonal use during which water temperatures normally experience weather driven seasonal trends, i.e. cooling in the fall and warming in the spring (see Attachment C). As salmonids respond to seasonal changes in temperature they typically begin spawning activity before temperatures are optimum – either cooler or warmer than best depending on the time of year. Water temperatures continue to change, progressing through optimum conditions until incubation tails off as temperatures again become sub-optimum – too cool or too warm depending on the season. The rate of cooling or warming is variable but one to which fish inhabiting a particular stream 'tune' in to. A stream's thermal cycle is important in the timing of, and ultimate success in, fish reproduction.

In order to maintain the thermal cycles fish are accustomed to, DEQ recommends that subdivision of regulatory spawning periods stated in the water quality standards be evaluated cautiously, e.g. for purpose of developing seasonal, monthly or flow-tiered thermal effluent limits. In most situations it will likely be best to take the whole spawning and incubation period as one time period, and develop a single thermal effluent limit based on meeting temperature criteria at the warmer end of this period. In this way normally cooler temperatures that occur within the spawning and incubation period will be maintained. This will be especially important to the protection of species, such as mountain whitefish, which require cooler mid-winter temperatures to be most successful in reproduction.

B. Thermal Treatment Requirements in Lower Boise Subbasin (IDAPA 58.01.02 Water Quality Standards, Section 278.07)

The Idaho WQS have, since at least 1980, included a treatment requirement that limited the increase in water temperature, outside any authorized mixing zone. These limits are not more than a 1°C increase for water designated for cold water aquatic life, seasonal cold aquatic life, or salmonid spawning. There is an additional limit of not more than a 2°C increase for waters designated for warmwater aquatic life. Thermal effluent limitations based on these thermal treatment requirements have never been incorporated in an NPDES permit to date. Furthermore the basis for these limitations is unknown and questionable. DEQ has no information that a 1-2°C increase in water temperatures less than numeric criteria has an adverse effect on aquatic life. These increases are far lower than sudden temperature increase of 11-15°C which can induce thermal shock (Coutant, 1973 as cited in EPA 2003).

Impact to dischargers

The 1°C and 2°C increase caps are very stringent limitations that would impose enormous chilling requirements on point sources if incorporated in NPDES discharge permits, with little or no known benefit to aquatic life uses. Case in point is that it has been estimated that the City of Nampa would have to remove nearly six times more heat from their effluent in order to limit the effect of their effluent to a 1°C increase in temperature in Indian Creek throughout the winter, as opposed to heat removal required to meet Idaho's 19°C daily average during the summer (Attachment D).

The impact to the City of Boise would be less, as their two WWTP discharges would also be constrained by needing to meet salmonid spawning criteria applied through the winter as described above. Still the 1°C treatment requirement would have a significant impact. For the Lander Street discharge limiting instream temperature change to 1°C at the edge of a 25% mixing zone would require chilling effluent to less than 9°C from winter time temperatures that now range from 17-20°C. Impact on the West Boise discharge is smaller as wintertime effluent temperatures are lower, in the 10-18°C range.

Meeting spawning criteria temperatures without the 1°C treatment limitation on temperature increase will require a more moderately cooled effluent. These effluent limitations are still under development as this is written, but in the worst case the effluent would have to be cooled to the criterion temperature of 13°C. At times no winter cooling of the effluent would be required at the West Boise facility absent the 1°C thermal treatment requirement.

Effect on Water Temperatures and Aquatic Life Use Protection

The immediate effect of warm effluent in increasing stream temperatures depends on the dilution ratio and difference in temperature between the effluent and receiving stream. In winter receiving stream temperatures are quite cold and these colder instream temperatures cause the rise in temperature caused by the effluent to increase markedly absent any change in effluent flow or temperature. However, if dilution ratios are reasonable, this greater winter effect of the effluent on the receiving stream will not eliminate or overwhelm the receiving stream's natural winter cooling. If receiving stream dilution is great even very hot effluent may be discharged without raising receiving stream temperature more than 1°C. Thus, requirements impose no set level of thermal treatment and are really a water quality based, i.e. instream, requirement.

Fortunately we have more than ten years of ambient water temperature data quantifying the effect the presence of the two City of Boise discharges has on Boise River, under the present absence of thermal effluent limitations.

This is summarized in the analysis in Attachment B. Overall Boise River temperatures reach 13°C MWMT 5-11 days earlier in the spring (warming) downstream of the two discharges (Eagle Island) as compared to upstream (Veteran's Bridge). This advancement in timing of spring warming corresponds with a downstream increase in temperature during this transition time that averages 1.19°C (\pm SD of 0.23). In the fall, falling temperatures reach 13°C MWMT with a tighter delay in cooling between locations of 2-5 days. This delay in fall cooling corresponds with a downstream increase in temperature during this transition time that averages 0.97°C (\pm SD of 0.29).

Midwinter increase in temperature is greater, for reasons described above, but the overall pattern of coldest temperatures in midwinter is maintained. This is most easily seen in comparing plots of Boise River MWMT at Veteran's Bridge and Eagle Island (see Attachment C). This pattern will be maintained if the application of criteria recommended above is followed.

The current thermal conditions of the Boise River, without any thermal limitations on NPDES discharges has supported a dramatically improving fishery as described above (see Health of lower Boise River Fishery). Future Boise River temperatures will likely be somewhat cooler than observed the past decade, as reissued permits are likely to include thermal effluent limitation based on meeting numeric water quality criteria to protect specific uses such as salmonid spawning and cold water aquatic life.

From these observations DEQ concludes that proper application of numeric temperature criteria will maintain normal seasonal cycles of receiving stream temperature and that thermal effluent limits based on numeric water quality criteria are sufficient to protect aquatic life uses absent the 1°C and 2°C thermal treatment requirements.

C. Statewide Revision of Thermal Treatment Requirements (IDAPA 58.01.02 Water Quality Standards, Section 401.01)

During the May 25th, 2011 rulemaking meeting EPA raised questions about the protectiveness of their regionally recommended spawning criteria in absence of limitations on stream warming and suggested Idaho's thermal treatment requirements were needed to protect water colder than criteria.

Protection of Water Cooler than Criteria

EPA in section V.2 of its regional temperature criteria guidance makes a case for provisions to protect water temperatures that are currently cooler than numeric criteria. To address this, EPA recommends a narrative temperature criterion that "prohibits more than a de-minimus increase to summer maximum temperatures" [emphasis added]. They also suggest that for non-summer periods "it may be appropriate to set a maximum allowable increase (e.g., 25% of the difference between the current temperature and the criterion)". Although it is unclear that Idaho's thermal

treatment requirements were adopted with this idea in mind, they could be thought of as providing such protection.

In order to protect water cooler than criteria Idaho does retain two narrative provisions of its thermal treatment requirement in section 401:

- 01. Temperature.** The wastewater must not affect the receiving water outside the mixing zone so that:
 - a. The temperature of the receiving water or of downstream waters will interfere with designated beneficial uses.
 - b. Daily and seasonal temperature cycles characteristic of the water body are not maintained.

DEQ believes these two provisions provide the flexibility to address protection of cooler water called for by EPA's guidance where it can be shown to be necessary. While dropping the two numeric limits on water temperature increases will alleviate the large and unwarranted impact on point sources across the state to cool their effluent through the winter.

DEQ believes it is also important to briefly consider the causes of thermal diversity in water temperatures, and the prospects that elimination of Idaho's numeric thermal treatment requirements would lead to loss of thermal diversity in Idaho.

Temporal Diversity of Water Temperature

Outside of effluent dominated receiving streams, DEQ has no reason to believe the Boise River situation is atypical. That is, rivers and streams receiving heated effluent will continue to experience seasonal cycles of temperature and will be colder in the winter than salmonid spawning criteria require. Persistence of these seasonal cycles can be assured by basing thermal effluent limits on critical conditions at the margins of spawning periods or the peak of summer heat for cold water aquatic life.

In the summer many streams do exceed cold water aquatic life criteria, but there is little reason to believe this is due primarily to point sources and much reason to believe it is a natural pattern common to all streams. Regardless of the cause of summer maximums in water temperature, streams that exceed the cold water aquatic life criteria in the summer will be required to meet either those numeric criteria or natural conditions if they are warmer than the criteria. It is meeting these criteria, not the thermal treatment requirements that are being dropped, that will be the limiting factor on thermal effluent limits for most if not all point sources in Idaho.

Please see also discussion of Boise River seasonal thermal patterns above under B.

Spatial Diversity of Water Temperature

As EPA notes in its regional temperature criteria guidance (US EPA, 2003) there is great spatial diversity to stream temperatures across the Pacific Northwest, including Idaho, in addition to the temporal cycles (diversity) noted above. They also point out that "upstream temperature increases to waters currently colder than the criteria may further contribute to the non-attainment

downstream”. This is an important concept that reflects the typical downstream increases (or upstream decreases) in water temperature in a stream network and the importance of watershed based permitting decisions.

The reality is that there is no evidence that point sources of heat have disrupted the great spatial diversity of stream temperatures across broad reaches of streams in Idaho. Reservoirs, and natural lakes, have a far greater influence on water temperatures across the stream-scape than do point sources. This is illustrated in the City of Boise’s modeling of natural conditions of temperature in the Boise River below Lucky Peak dam (see Attachment F, in particular figures 7-25, 7-26 & 7-27). Here it is seen that the magnitude of changes in water temperature - both decreased summer peak and delayed fall cooling - swamp the warming due to two large WWTP discharges.

Summary

In summary, if the numeric thermal treatment requirements were employed in NPDES permitting by EPA they would not come into play during the summer in most if not all waters receiving wastewater discharge in Idaho as those receiving waters for the most part already exceed applicable numeric criteria. If applied during the winter, they would have a great effect on treatment costs to remove heat from NPDES dischargers. The value to use protection of removal of winter heat is not evident, but could still be addressed by Idaho’s remaining narrative thermal treatment requirements should it be shown to interfere with beneficial uses. Lack of implementation of the numeric thermal treatment limits to date has demonstrably not prevented or overwhelmed winter cooling of streams to less than criteria.

It has been suggested that numeric temperature criteria alone could result in stream temperatures that are held or fixed at criteria values. DEQ finds this view unsupported. It is unrealistic to expect that numeric temperature criteria in absence of thermal treatment requirements would or even could result in a pattern of stream temperatures that were no more but also no less than what numeric criteria specify, i.e. a rectangular rather than sinusoidal seasonal thermograph. It is also unrealistic to suppose that we could regulate point source discharges to achieve in-stream water temperatures that were constant from headwaters to mouth.

DEQ has every reason to believe that prudent development of thermal effluent limits based on meeting numeric use-based temperature criteria at critical times in the seasonal progression of water temperature will continue to provide the vast spatial and temporal diversity of water temperatures we see today while protecting aquatic life uses from the adverse effects of temperatures that are too warm to support them.

New Rule Language

Sections ‘**278. LOWER BOISE RIVER SUBBASIN, HUC 17050114 SUBSECTION 140.12**’ and ‘**401. POINT SOURCE WASTEWATER TREATMENT REQUIREMENTS**’ of the Idaho WQS are included in the Temporary Proposed Rule Notice with changes in strike-out (deletions) and underline (additions). Only the indicated changes are being submitted for EPA review.

References

- Jeff Dillon. Personal Communication with Susan Beattie, IDEQ, February 23, 2011.
- Grafe, C.S. and others. 2002. **The Idaho Department of Environmental Quality Water Body Assessment Guidance, Second Edition-Final**. Idaho Department of Environmental Quality; Boise, Idaho.
- Hillman, T.W., M.D. Miller and BA Nishitani. 1999. **Evaluation of seasonal-cold-water temperature criteria**. BioAnalysts, Boise Idaho.
- Pappani, J. 2010. **Extent and Condition of Idaho's Major Rivers, 2010**. Draft Report. Idaho Department of Environmental Quality; Boise, Idaho.
- Simpson, J.C. and R.L. Wallace. 1982. **Fishes of Idaho**. The University Press of Idaho; Moscow, Idaho.
- US EPA. 2003. **EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards**. EPA 910-B-03-002, April 2003. Region 10, Office of Water, Seattle WA.

Attachments

- A. 2010 Southwest Region (Nampa) Fisheries Management Report, River and Streams Investigations, Lower Boise River Electrofishing Survey.** Prepared by Art Butts, Regional Fisheries Biologist, Idaho Department of Fish and Game.
File: DFG 2011 Report on Boise River Fishery.pdf
- B. Temporal Shift in Time of Reaching 13°C MWMT in Lower Boise River.** Analysis by Don Essig, IDEQ, of City of Boise ambient monitoring data.
Files: Analysis of temporal shift in time of reaching 13°C MWMT.pdf & Temporal shift in attainment of 13°C MWMT.xls
- C. Seasonal Thermal Pattern in the Boise River.** Analysis by Don Essig, IDEQ, of City of Boise ambient monitoring data.
Files: Seasonal Thermal Pattern in the Boise River.pdf
- D. Nampa Cooling Impact Analysis.** File: Nampa 1°C Cooling Impact Analysis.pdf
- E. Chapter 7 Temperature from City of Boise 2004 NPDES Permit Reapplication.** Analysis of natural temperatures in Boise River below Lucky Peak Dam.
File: Chapter 7 Temperature 2004 Permit Reapplication.pdf