



State of Oregon Department of Environmental Quality

Cool Water Species – Lower Long Tom River

Technical Support Document

Willamette Subbasins

March 2024

4.7 Cool water species

Proposed narrative for the TSD document Section 4.7

The narrative cool water species criterion in rule at OAR 340-041-0028(9)(a) states that “No increase in temperature is allowed that would reasonably be expected to impair cool water species.” Under the Clean Water Act, states must designate the uses of a waterbody and provide water quality for the protection and propagation of fish, shellfish, and wildlife, where attainable (40 CFR 131.10(j)). Long Tom River (Willamette River Tributaries) assessment unit (AU_ID OR_SR_1709000301_02_103791) is designated for the Cool Water Species subcategory of Fish and Aquatic Life Use. The designation applies from the mouth at the confluence with the Willamette River (river mile 0) to the Fern Ridge Reservoir (approximate river mile 24.1). This reach of the Long Tom River is hereafter referred to as “the lower reach”.

DEQ uses a stepwise approach to implement this narrative standard. The Department bases its evaluations on the best available information and professional judgment. Pertinent information includes: the species present and their thermal requirements, physical characteristics of the water body, current ambient temperatures and the magnitude, duration and frequency of the proposed temperature increase.

DEQ followed the procedures of the Water Quality Standard Implementation IMD (DEQ 2008) to implement the narrative provision of the Cool Water Species narrative criterion. First, DEQ considered if it would be reasonable to apply the Redband & Lahontan Cutthroat Trout criterion of 20 degrees Celsius plus the 0.3 degrees Celsius human use allowance to the lower reach. The rationale, as outlined in DEQ’s temperature water quality standard implementation IMD is that a target temperature based on 20 degrees Celsius will not impair cool water species, which have more tolerance of warm temperatures than trout. This approach was rejected because 20 degrees Celsius does not appear to be attainable and, as discussed later in this section, there are time periods when juvenile Spring Chinook Salmon may rear or forage in the lower reach, which require temperatures less than 20 degrees Celsius. Instead, DEQ determined what cool water species are present in the Long Tom River and identified a target temperature based on the thermal tolerance information available for those species. A temperature target was also identified for the periods when juvenile Chinook salmon are present.

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Figure 1 Sub-basin boundaries (black line) and extent of the Cool Water Species use designation in the lower Long Tom River (brown line). Approximate location of USGS monitoring station 14170000 Monroe, OR (circle) and 14169000 Alvadore, OR (triangle) are shown.



1.1.1 Lower Long Tom River temperatures

Continuous temperature data are available in the lower Long Tom River (Figure 4 and Figure 5). The data show current temperatures peak between June and August and exceed 18° Celsius from April 15 to October 30. Temperatures exceed 20° Celsius from May 15 through the end of October. The plots include the selected lower Long Tom River temperature target for comparison.

DEQ has not modeled the background temperatures of the lower reach, so an estimate of background temperatures was derived using a nearby stream that was modeled. The background temperatures provide useful estimates of the range of potential temperature reductions possible in the lower Long Tom R. and to estimate if a target temperature based on

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20 degrees Celsius is attainable, as outlined in DEQ's temperature water quality standard implementation IMD (DEQ, 2008).

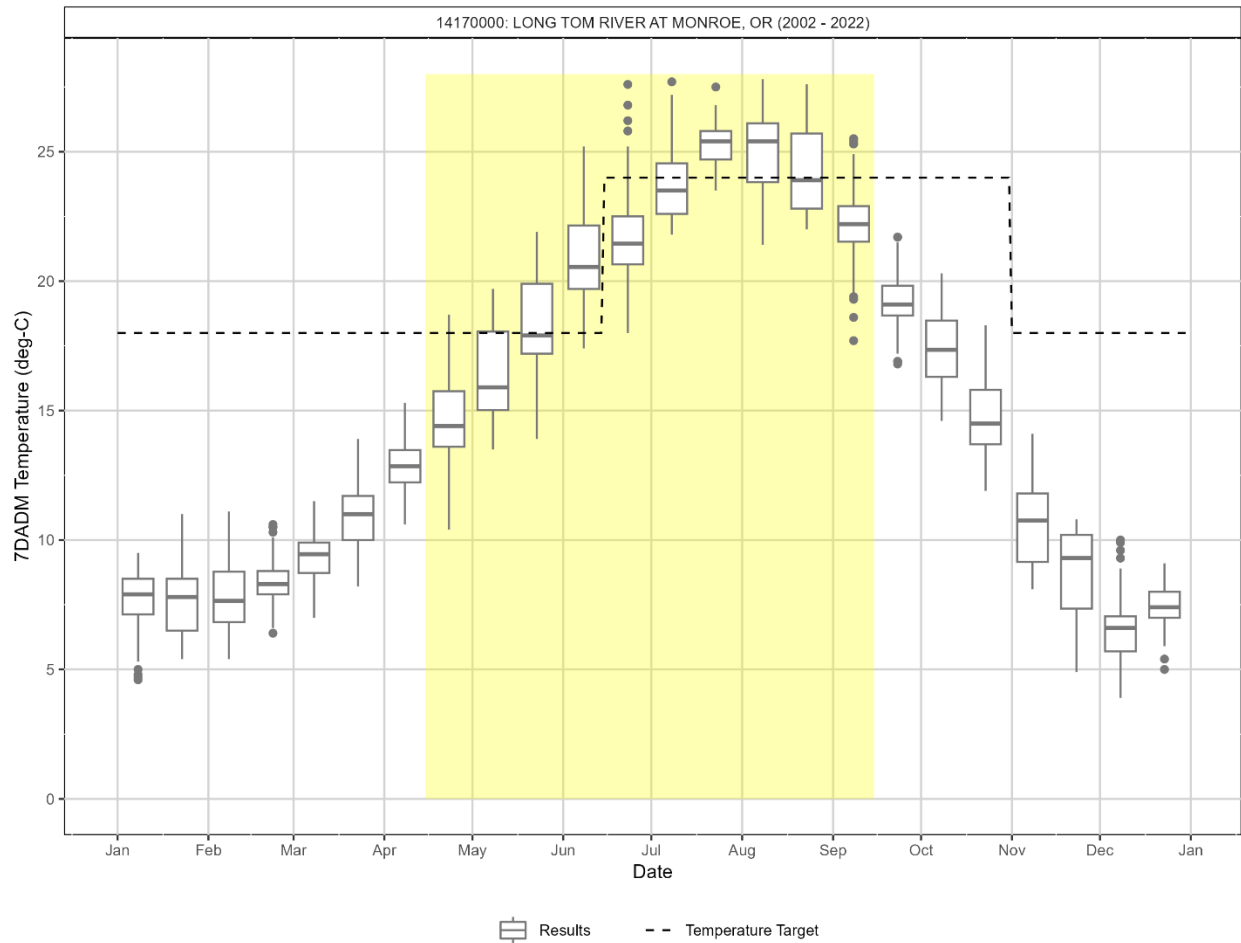
The Luckiamute River watershed is a tributary of the Willamette River, approximately 60 miles long, that drains the eastern Coast Range mountains with an outlet on the Willamette Valley floor. The mouth of the Luckiamute River is approximately 38 river miles north of the mouth of the Long Tom River along the Willamette River. DEQ estimated the background temperatures of the nearby Luckiamute River as part of the Willamette Subbasins TMDL. See the Willamette Subbasins TMDL Technical Support Document Appendix A for more details. A temperature reduction refers to the decrease to 7-day average daily maximum temperatures from full restoration of streamside vegetation in a system free of dam and reservoir operations, such as the Luckiamute.

Thermal pollutant sources identified for the Luckiamute River include lack of sufficient shade-producing streamside vegetation, and background sources. Along the Luckiamute River model extent, lack of sufficient streamside vegetation was associated with a mean effective shade gap of 9%, corresponding to daily maximum water temperature increases of 3.56 deg-C at the point of maximum impact at model kilometer 42.8 (~ river mile 26) and 0.34 deg-C at the mouth. The Luckiamute background model suggests temperature reductions of approximately 3.5 to 0.3 degrees Celsius are possible depending on the position of a site along the watershed.

The temperature reductions suggested by the Luckiamute background model at both the mouth and point of maximum impact indicate that a 20 degrees Celsius temperature target may not be attainable in the lower reach of the Long Tom River between June and September. The configuration of Fern Ridge Dam may also limit the amount of temperature reduction that is feasible with restoration (Rounds 2010).

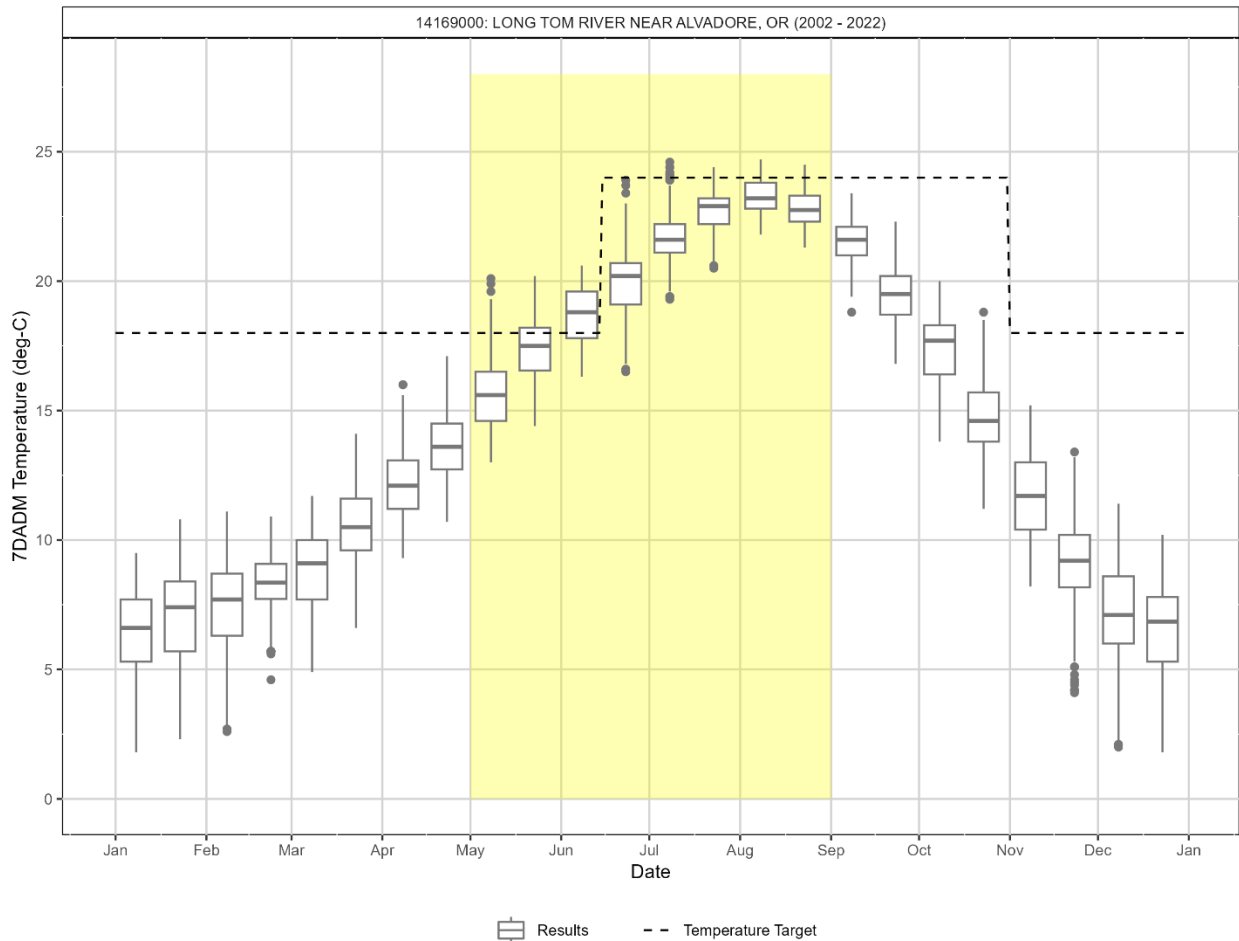
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Figure 2 Box plots of bi-monthly 7-day average of daily maximum temperatures for the Long Tom River at USGS station 14170000 near Monroe, OR. Dashed line: proposed temperature targets of 24.0 deg-C from June 1 to Oct. 14 and 18.0 deg-C from November 1 to June 14. Yellow shading: indicates time periods when the targets are exceeded within the lower reach under current conditions.



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Figure 3 Box plots of bi-monthly 7-day average of daily maximum temperatures for the Long Tom River at USGS station 14169000 near Alvadore, OR. Dashed line: proposed temperature targets of 24.0 deg-C from June 1 to Oct. 14 and 18.0 deg-C from November 1 to June 14. Yellow shading: indicates time periods when the targets are exceeded under current conditions.



1.1.2 Long Tom River Cool Water Species

DEQ reviewed the ODFW fish habitat distribution database and life stage timing tables for the Long Tom River watershed (ODFW 2023) and consulted with the ODFW district biologist about the fish species in the lower Long Tom River. Based on this information, DEQ determined the resident cool water species that may be present in the lower Long Tom River are:

- Chiselmouth (*Acrocheilus alutaceus*) (An EPA RIS "Representative Important Species" for Oregon)
- Northern Pikeminnow (*Ptychocheilus oregonensis*)
- Redside Shiner (*Richardsonius balteatus*)
- Peamouth (*Mylocheilus caurinus*)
- Largescale Sucker (*Catostomus macrocheilus*)
- Mountain Sucker (*Catostomus platyrhynchus*)
- Sand Roller (*Percopsis transmontana*)
- Pacific Lamprey (*Entosphenus tridentatus*)

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ODFW's information also shows that juvenile Spring Chinook salmon (*Oncorhynchus tshawytscha*) may be present at least part of the year and Coastal Cutthroat trout (*Oncorhynchus clarkii*) are resident in tributaries to the lower reach and may utilize it for at least part of the year.

Based on review of available studies, Sand Roller and Redside shiner are the most temperature sensitive cool water species based on adult thermal tolerance and observed presence. Redside Shiner has an upper lethal temperature threshold between 22.8 and 27.7 degrees Celsius (Black, 1953) and Sand Roller have preference temperatures of up 24.0 degrees Celsius and a recommended acute threshold of 27.0 degrees Celsius (Gray & Dauble 1979; Parsley et al. 1989, Tiffan et al. 2017).

Spawning of Chiselmouth, Northern Pikeminnow, Peamouth, and Mountain Sucker could occur in the lower reach between April and July, based on observations of spawning timing from the Columbia River, British Columbia, Montana, and Nevada. However, exact spawning timing for these species in the lower reach is unknown. These species initiate spawning when water temperatures exceed 12-18 degrees Celsius (Gadomski et al. 2001; Gray and Dabule 2001, Montana FWP, 2023, Roberge et al. 2001, Roberge et al. 2002, and Snyder 1983). Spawning habitat within the lower reach between Monroe and Fern Ridge Reservoir may also be limited (Hutchison 1966). DEQ could not identify documentation of lethal maximum temperatures for egg incubation for these species. Spawning in these species appears to be initiated as temperatures warm to a certain level, and the species may shift spawning to times when temperatures are favorable (Gadomski et al. 2001). Moodie found there is no survival of Chiselmouth eggs incubated unless temperatures were above 12 degrees Celsius (Moodie, 1966). Minimum, rather than maximum, thermal requirements may be the limiting factor for distribution of Chiselmouth (Rosenfeld, 2003).

Table 1 Temperature tolerance endpoints for cool water species as reported in literature reviewed by DEQ.

Species	Acclimation Temperature (deg-C)	Endpoint	Endpoint Temperature (deg-C)	Source
Chiselmouth (<i>Acrocheilus alutaceus</i>)	NA	Observed absence in field	<20	Rosenfeld et. al. 2003
	NA	Adult preference	>20	Gray and Dabule, 2001
	NA	Spawning initiation	15	Gray and Dauble, 2001
	NA	Spawning peak	13 – 20	Gray and Dauble, 2001, Moodie 1966
	NA	100% mortality, eggs	≤12	Moodie 1966
Redside shiner (<i>Richardsonius balteatus</i>)	14	100% survival after 24 hours, adult	22.8	Black, 1953
		50% survival after 24 hours, adult	27.6	
		No survival after 24 hours, adult	30.3	
	NA	Spawning Initiation	14.5 – 18	Gray and Dauble, 2001
	NA	100% survival, egg incubation	21 – 23	Scharpf, 2008
	19-22	50% survival after 24 hours, adult	29.3	Black 1953

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Species	Acclimation Temperature (deg-C)	Endpoint	Endpoint Temperature (deg-C)	Source
Northern Pikeminnow (<i>Ptychocheilus oregonensis</i>)	NA	Spawning Initiation (Columbia R. populations, May - June)	14 – 18	Gadomski et al. 2001, Gray and Dauble, 2001, Roberge et al. 2002
	NA	Adult preference	21.7 (“warmest available”)	Bartoo, 1972
Peamouth (<i>Mylocheilus caurinus</i>)	NA	Spawning Initiation	10 – 11	Gray and Dauble 2001
	NA	Spawning Initiation (Western Montana, May or June)	10 – 18	Roberge et al. 2001, Montana FWP 2023
	14	50% mortality after 24 hours	26.6	Black, 1953
	11.5	50% mortality after 24 hours, adult	27	
Largescale Sucker (<i>Catostomus macrocheilus</i>)	19	100% survival after 24 hours, adult	25.7	Black, 1953
	19	50% survival after 24 hours, adult	29.4	
	19	0% survival after 24 hours, adult	32.2	
Mountain Sucker (<i>Catostomus platyrhynchus</i>)	NA	Observed occurrence in field	10 – 28	Smith, 1966
	NA	Spawning Initiation (Truckee River, NV, May 1 – August 1)	11 – 19	Snyder, 1983
	20	Loss of Equilibrium	32.3 – 32.9	Schultz, 2011
	22.5	Loss of Equilibrium	32.6 – 33.2	
	25	Loss of Equilibrium	33.6 – 34	
	NA	Recommended Acute Tolerance (MDMT)	28	NVDEP 2016
Sand Roller (<i>Percopsis transmontana</i>)	NA	Observed presence in field (Columbia Basin)	2.5 – 24	Gray & Dauble 1979; Parsley et al. 1989
	NA	Adult preference, field observations	18-24	Tiffan et al. 2017

Black (1953) reported the upper lethal temperature for Redside Shiner as 27.6 degrees Celsius. The upper lethal temperature was based on 50% survival after 24 hours of exposure to various treatment temperatures. The treatment temperature at which all Redside shiner survived after 24 hours was reported as 22.8 degrees Celsius. These results indicate that Redside Shiner have a reasonable margin of safety between complete survival and the point at which half the population died (4.8 degrees Celsius).

A constant lab exposure temperature for 100% survival of Redside Shiner at 22.8 degrees Celsius is equivalent to a 7-day average of daily maximum temperatures of 24.0. degrees Celsius. In order to attain 24.0 degrees Celsius as a 7-day average of daily maximum temperature, daily mean water temperatures in the lower Long Tom River would be 21-22 degrees Celsius, 2-3 degrees cooler than the criterion (EPA 2003). Therefore, fish would experience daily temperatures above the limit for 100% survival of Redside Shiner (22.8 degrees Celsius) for only a small part of the day during the warmest 7-day period of the year. Given the wide margin between temperatures at 50% and 100% survival, exposure to maximum water temperatures greater than 22.8 degrees for just a few hours a day during this period will likely not cause harm to Redside Shiner.

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Therefore, DEQ selected 24.0 degrees Celsius expressed as the instream seven-day average maximum temperature target plus an insignificant addition of heat for human use equal to 0.3 degrees Celsius as the target temperature. This target will approximate daily average temperatures that match the constant lab exposure temperature limit for 100% survival and reduce the risk of daily exposure to temperatures that could result in impairment to Redside shiner. It will also ensure conditions within the preferred range for the next most sensitive species, Sand Roller and Mountain Sucker.

1.1.3 Long Tom River salmonid uses

ODFW's FHD and timing tables indicate there is some limited Spring Chinook salmon rearing use of the lower reach with peak use from December 1 through May 15 downstream of the City of Monroe to the confluence with the Willamette River. At the time the use was designated, ODFW indicated the Long Tom River likely did not support a natural run of anadromous salmonids and juvenile Cutthroat trout were largely absent downstream of Fern Ridge Reservoir (Hutchison 1966, ODFW 1992). Hutchison et al. identified that Cutthroat trout are resident in tributaries to the lower reach, and appeared to have adapted to survive the high summertime temperatures typical of the lower river system. They also noted there is little spawning habitat between Monroe and Fern Ridge Reservoir (Hutchison 1966). Cutthroat trout are resident, and regularly tagged in, tributaries to the lower Long Tom River (Bear Creek, Ferguson Creek, Owens Creek, Rattlesnake Creek, and Davidson Creek). Recapture data indicates that a minority of Cutthroat individuals migrate between these tributary creeks via the lower reach of the Long Tom River. However, no fish are sampled from the lower Long Tom River mainstem, and it is uncertain what months of the year these individuals use the lower reach to migrate (LTWC and ODFW, unpublished data).

In order to protect juvenile Chinook salmon and Cutthroat Trout that may be migrating or overwintering, DEQ will rely upon the 18.0 degrees Celsius target temperature established for protection of Salmon & Trout Rearing and Migration use suggested by EPA guidance (EPA, 2003) and adopted in Oregon's water quality standards (OAR 340-041-0028 (4)(c)). The 18.0 degree temperature target is also fully protective of any life stage of Pacific Lamprey (Meeuwig et al. 2003, Whitesel 2023). This target is also within observed temperature ranges supporting spawning and egg incubation use by the cool water species Mountain Sucker, Peamouth, and Northern Pikeminnow which may occur within that timeframe.

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Figure 4 Anadromous salmonid species use in the Long Tom River subbasin (Source: ODFW¹)

Long Tom R - Anadromous Species													
Waterway ID: MidWill06													
Life Stage/Activity/Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Upstream Adult Migration													
Spring Chinook salmon													
Adult Spawning													
Spring Chinook salmon													
Adult Holding													
Spring Chinook salmon													
Egg Incubation through Fry Emergence													
Spring Chinook salmon													
Juvenile Rearing													
Spring Chinook salmon													
Downstream Juvenile Migration													
Spring Chinook salmon													







 Represents periods of peak use based on professional opinion, survey data, or other information
 Represents lesser level of use based on professional opinion, survey data, or other information
 Represents periods of presence OR uniformly distributed level of use

Figure 5 Resident salmonid species use of the Long Tom River subbasin (Source: ODFW¹)

Long Tom R - Non-Anadromous Species													
Waterway ID: MidWill06													
Life Stage/Activity/Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Adult Fluvial or Adfluvial Migration													
Cutthroat Trout - Resident													
Adult Spawning													
Cutthroat Trout - Resident													
Adult/Sub-Adult Rearing													
Cutthroat Trout - Resident													
Egg Incubation through Fry Emergence													
Cutthroat Trout - Resident													
Juvenile Rearing													
Cutthroat Trout - Resident													
Juvenile/Sub-Adult Migration													
Cutthroat Trout - Resident													

 Represents periods of peak use based on professional opinion, survey data, or other information
 Represents lesser level of use based on professional opinion, survey data, or other information
 Represents periods of presence OR uniformly distributed level of use

1.1.4 Long Tom River Temperature Target

Based on the literature review above the temperature targets for the Long Tom River are:

¹ Fish Life Stage Timing Tables

<https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=42654.xml>

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- 1) 24.0°C + 0.3°C human use allowance (HUA) from June 15 through October 31 (based on thermal preference for Sand Roller and Mountain Sucker and thermal tolerance for Redside Shiner);
- 2) 18.0°C + 0.3°C human use allowance (HUA) from November 1 to June 14 (Based on Spring Chinook rearing and juvenile migration; spawning preferences for Mountain Sucker, Peamouth, and Chiselmouth).

The human use allowance (HUA) applies because the maximum 7-DADM temperature of the Long Tom River exceeds both 24.0 and 18.0 degrees Celsius during their respective time periods. From June 1 through October 15, where the cool water species criterion applies in the Long Tom River, warming from anthropogenic sources shall be limited to a cumulative increase of no greater than 0.3 degrees Celsius above 24.0 degrees Celsius after complete mixing in the water body, and at the point of maximum impact. During November 1 through June 14 the numeric benchmark protecting cool water fish and migrating juvenile Chinook salmon is an instream 7-day average daily maximum temperature target of 18.0 degrees Celsius plus an insignificant addition of heat for human use equal to 0.3 degrees after complete mixing in the water body, and at the point of maximum impact.

The mixing zone and thermal plume limitations in OAR 340-041-0053 (2)(E)(d) will provide further protections against potential migration blockages when temperatures exceed 21.0 degrees Celsius. The TMDL assumes assessment and application of thermal plume limitations, as necessary, will be completed during the NPDES permit renewal process.

Table 2 Summary of temperature targets implementing the Cool Water Species narrative in Long Tom River.

Time period	7DADM Temperature Target (deg-C)	Most Temperature Sensitive Species
June 15 – October 31	24.0 + 0.3 HUA	Redside shiner (Richardsonius balteatus)
November 1 – June 14	18.0 + 0.3 HUA	Chinook Salmon (Oncorhynchus tshawytscha)

1.2 References

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