

Total Maximum Daily Loads for the Rogue River Basin

Technical Support Document

Temperature

Date (EQC adoption meeting month and year)



State of Oregon
DEQ Department of Environmental Quality

Document information

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Acronyms

Listed acronyms apply to this document and its appendices.

7DADM	7-Day Average Daily Maximum
7Q10	7-Day, 10-Year Low Flow
ADWDF	Average Dry Weather Design Flow
AU	Assessment Unit
AWQMS	Ambient Water Quality Monitoring System
BG	Background Source
BLM	U.S. Bureau of Land Management
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
DEM	Digital Elevation Model
DEQ	Oregon Department of Environmental Quality
DMA	Designated Management Agency
DMR	Discharge Monitoring Report
DOGAMI	Oregon Department of Geology and Mineral Industries
DOQ	Digital Orthophoto Quad
DQL	Data Quality Level
DSM	Digital Surface Model
EPA	Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
ETL	Excess Thermal Load
GIS	Geographic Information System
GLO	General Land Office
GNIS	USGS Geographic Names Information System
HTML	Hyper Text Markup Language
HUA	Human Use Allowance
HUC	Hydrologic Unit Code
IMD	Internal Management Directive
LA	Load Allocation
LAC	Local Advisory Committee
LC	Loading Capacity
LiDAR	Light Detection and Ranging
LT50	Lethal Time 50
MF	Middle Fork
MGD	Millions of Gallons per Day
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
MWMT	Maximum Weekly Maximum Temperature
NA	Not Applicable
NF	North Fork
NHD	National Hydrography Dataset
NID	National Inventory of Dams

NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NWI	National Wetland Inventory
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODC	Oregon Department of Corrections
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish & Wildlife
ORS	Oregon Revised Statutes
OWRD	Oregon Water Resources Department
PCW	Protecting Cold Water
PGE	Portland General Electric
POD	Points of Diversion
POMI	Point of Maximum Impact
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RC	Reserve Capacity
SCS	Soil Conservation Service
SF	South Fork
SIA	Strategic Implementation Area
SIC	Standard Industrial Classification
STP	Sewage Treatment Plant
SWCD	Soil and Water Conservation District
TIR	Thermal Infrared Radiometry
TMDL	Total Maximum Daily Load
TSD	Technical Support Document
USACE	U.S. Army Corps of Engineers
USFS	U.S. Department of Agriculture Forest Service
USGS	United States Geological Survey
WDOE	Washington Department of Ecology
WLA	Wasteload Allocation
WQMP	Water Quality Management Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1. Introduction

1.1 Document purpose and organization

This document provides comprehensive supporting information on technical analyses completed for the Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) for addressing temperature impairments in the waters of the Rogue Basin. This document provides explanations of TMDL concepts and analysis, and support for conclusions and requirements included in the TMDL and WQMP, which have been adopted by Oregon's Environmental Quality Commission (EQC), by reference, in Oregon Administrative Rules (OAR) 340-42-0090.

This document is organized into sections with titles reflective of the TMDL elements required by Oregon Administrative Rule OAR 340-042-0040(4). This organization is intended to assist readers in finding and accessing the information relevant to that TMDL rule element. To keep the main sections in this document consistent with all the main sections in the TMDL but not duplicate content unnecessarily, some sections simply refer back to the TMDL.

1.2 Overview of TMDL elements

OAR 340-042-0030(15) defines a Total Maximum Daily Load as a written quantitative plan and analysis for attaining and maintaining water quality standards and must include a number of elements described in OAR 340-042-0040.

In plain language, a TMDL is a pollutant budget plan to ensure that the receiving waterbody can attain water quality standards that protect beneficial uses of the water. This budget calculates and assigns pollutant loads for discharges of point (end of pipe) and nonpoint (landscape) sources, in consideration of natural background levels, along with determination of a margin of safety and portion of the pollutant load held in reserve for new sources or expanded growth.

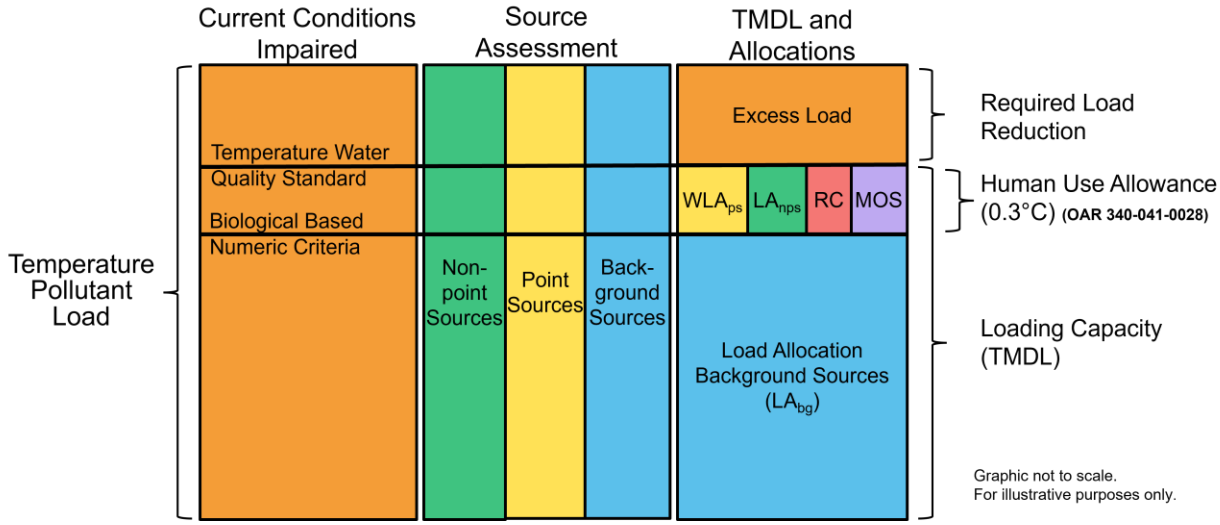


Figure 1-1: Conceptual representation of a TMDL and breakdown of total pollutant loading to a temperature-impaired waterbody into each TMDL element.

Figure 1-1 provides three separate conceptual representations of the TMDL and the pollutant budget. From left to right, the boxes represent steps in the TMDL development process, and the colors of the boxes show which terms are related. The first box on the left shows a temperature impaired water that exceeds the numeric temperature criteria. The current condition water temperature (the top of the box) is higher than the biologically based numeric criteria (which is visualized by the horizontal black line). The federal Clean Water Act requires that a TMDL be developed for waters that do not attain water quality standards.

The second box in the middle of the figure illustrates the TMDL source assessment step. This is where analysis is completed to identify the major sources of pollutant loading to the stream and categorize them into source categories or sectors. Nonpoint source related warming is in green, point source warming is in grey, and background source warming is in blue.

The third box on the right of Figure 1-1 is the last step in the TMDL process. At this step the numeric TMDL pollutant budget is calculated. A key element of a TMDL analysis is the amount of pollutant that a waterbody can receive and still meet the applicable water quality standard. The biologically based numeric criteria plus the human use allowance is the temperature water quality standard for temperature. This is represented by the upper horizontal black line in Figure 1-1. The amount of pollutant loading up to the water quality standard is referred to as the “loading capacity” (LC) of a waterbody. Because the loading capacity must not be exceeded by pollutant loads from all existing sources, plus a margin of safety and any reserve capacity, it can be considered the maximum load. Hence, the loading capacity is often referred to as the Total Maximum Daily Load, or TMDL. A loading capacity, or TMDL, is calculated on each assessment unit (AU) for each applicable temperature criteria in the TMDL project area. An AU is a partition (segment) of the state’s waterbodies (streams, river, lakes, estuaries, etc.) into manageable units. The Integrated Report makes assessment conclusions for each AU.

This general TMDL concept is represented by the following equation:

> TMDL = ∑Wasteload Allocations + ∑Load Allocations + Reserve Capacity + Margin of Safety

Together, these elements establish the pollutant loads necessary to meet the applicable water quality standards for impaired pollutants and protect beneficial uses.

The Excess Load is the amount of thermal load reduction required to meet the loading capacity and achieve temperature standards.

Wasteload allocations (WLAs) are portions of the TMDL loading capacity allocated to individual point sources. Load allocations (shown as LA_{nps} and LA_{bg}) are portions attributed to nonpoint sources, including background sources.

A margin of safety (MOS) accounts for the uncertainty in predicting how well pollutant reductions will result in meeting water quality standards and can be expressed either explicitly, as a portion of the allocations, or implicitly, by incorporating conservative assumptions into the analyses. Reserve capacity (RC) sets aside some portion of the loading capacity for pollutant discharges that may result from future growth and new or expanded sources.

The human use allowance or HUA is part of the Oregon temperature standard rule (Oregon Administrative Rule 340-041-0028). This is the condition under which insignificant additions of heat are authorized in waters that exceed the applicable temperature criteria. The rule states that

TMDL waste load allocations and load allocations will restrict all point sources and nonpoint sources to a cumulative water temperature increase of no greater than 0.3 degrees Celsius above the biologically based numeric criteria. As Figure 1-1 shows, the HUA defines the maximum pollutant loading for point source waste load allocations, nonpoint source load allocations, reserve capacity, and margin of safety.

1.3 TMDL administrative process and public participation

DEQ convened a rule advisory committee to provide input on drafts of the TMDL, WQMP, and TMDL Technical Support Document (TSD), fiscal and economic impacts, and environmental justice and racial equity statements. The committee met on February 26, 2026, and May 21, 2026. The agency also held an informational webinar about this TMDL on February 12, 2026. A public comment period was held from [date TBA] through [date TBA]. DEQ held a public hearing on [date TBA]. DEQ considered all input received during these public participation opportunities and used input to guide the analyses and preparation of documents. DEQ developed a written response to comments document that is available online. EQC adopted the Rogue River Basin Temperature TMDL and WQMP rule on [date TBA]. The TMDL was issued to EPA for action on [date TBA].

2. TMDL name and location

The Rogue River Basin (within Southern Oregon Coastal Basin, Hydrologic Unit Code [HUC] 171003) contains 3,300,000 acres (5,156 square miles) in southwestern Oregon and northern California (Figure 1.2). This TMDL applies to all land uses including lands managed by the State of Oregon, the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), irrigation districts, private forestlands, agricultural lands, rural residences, urban areas, and others. For the purposes of this TMDL, the Rogue River Basin refers to five 4th field hydrologic unit subbasins: the Lower Rogue River Subbasin (HUC 17100310), Middle Rogue River Subbasin (HUC 17100308), Upper Rogue River Subbasin (HUC 17100307), Illinois Subbasin (HUC 17100311) and Applegate Subbasin (HUC 17100309). The subbasins are located on the northeastern flank of the Siskiyou Mountains and the western flanks of the Cascade Mountains in southwestern Oregon. This is one of the most biologically, botanically, and geologically diverse areas in the country. It is steep and rugged, ranging in elevation from 0’ to 9,485’ at the summit of Mount McLoughlin.

Refer to the [final date] Rogue Basin TMDL (OAR ….) for the location of the impaired waters addressed by this TMDL.

2.1 Climate

The Rogue River Basin lies on the Pacific Northwest coast of the North American continent in a transitional area between four very different climate zones: Pacific Maritime on the Coast, Oregon High Desert to the East, California Mediterranean to the South, and Northern Temperate to the North. The fluctuating boundaries between these four zones result in highly unpredictable weather and large annual fluctuations in precipitation and temperature within longer climatic cycles. Normal annual precipitation ranges from approximately 500 mm (19.7 inches) in the interior

valleys to over 3200mm (126 inches) in the coastal mountains (**Figure 2-1**). Significant snowfall occurs at higher elevations in the interior. Normal annual maximum daily air temperature ranges from approximately 21°C (70°F) in the interior valleys to approximately 10°C (50°F) in the higher elevations (**Figure 2-1**).

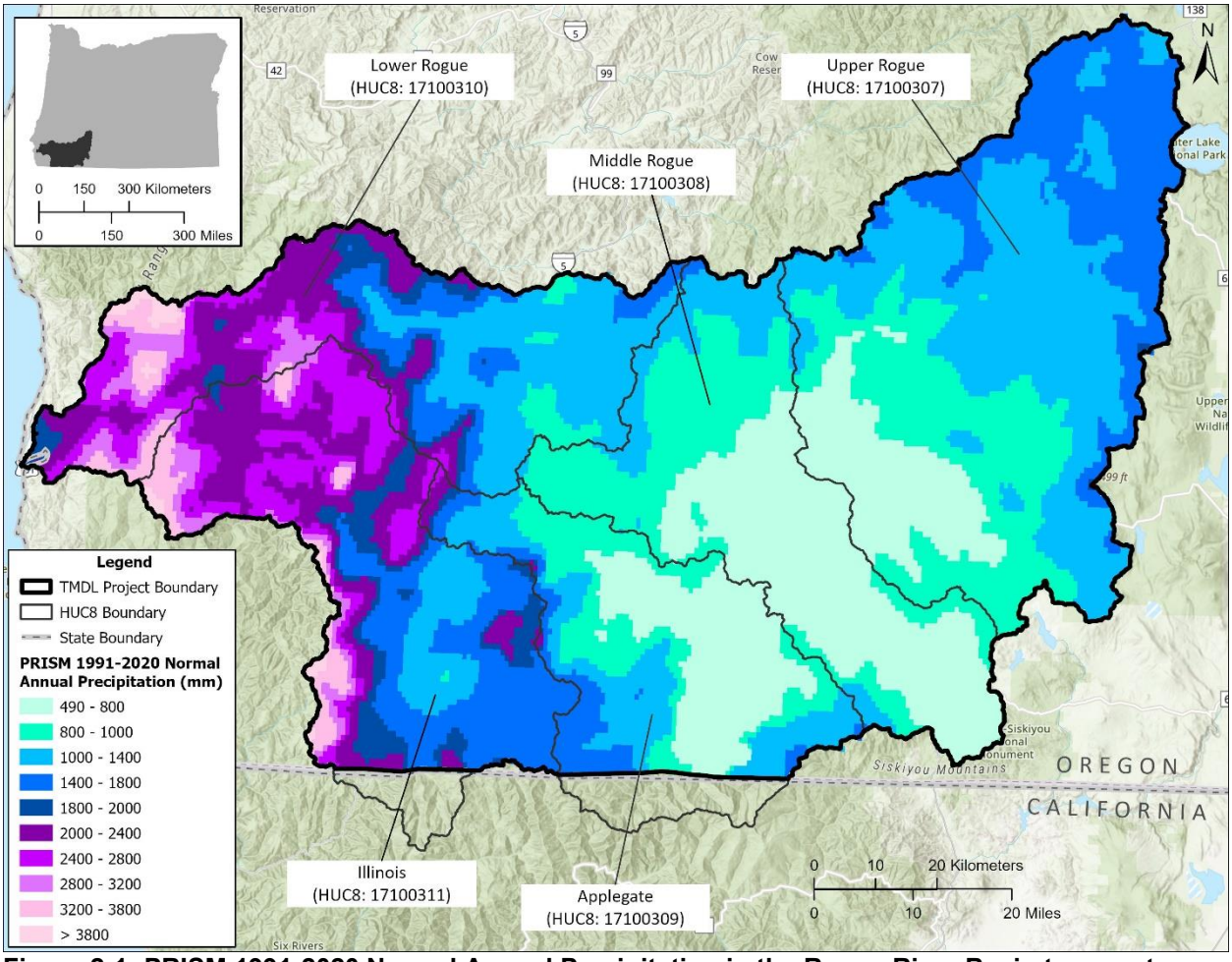


Figure 2-1: PRISM 1991-2020 Normal Annual Precipitation in the Rogue River Basin temperature TMDL project area (Data Source: PRISM Climate Group, 2022).

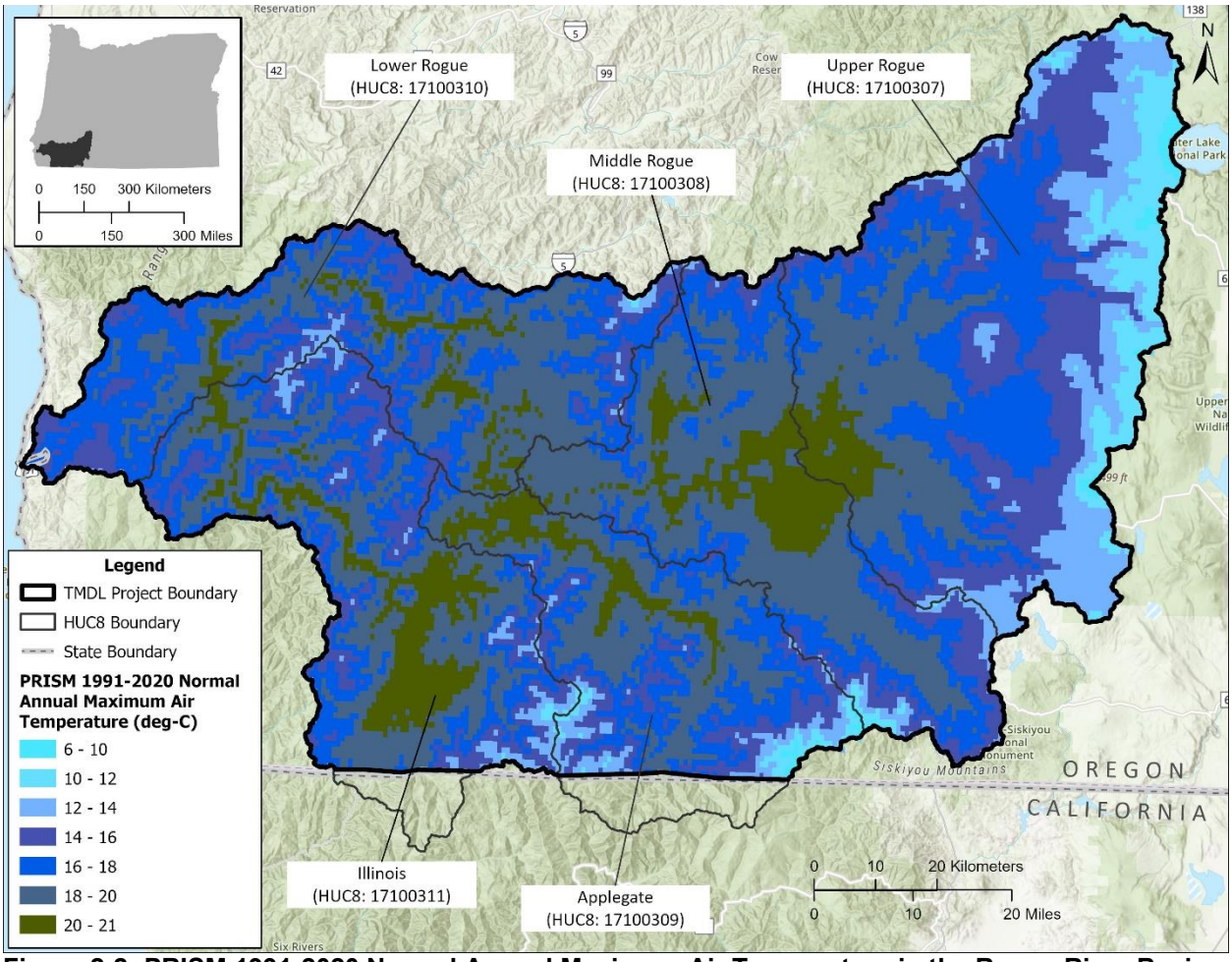


Figure 2-2: PRISM 1991-2020 Normal Annual Maximum Air Temperature in the Rogue River Basin temperature TMDL project area (Data Source: PRISM Climate Group, 2022).

2.2 Hydrology

Rogue River Basin hydrology is strongly influenced by its climate and soils. At higher elevations, on the slopes of the Cascades, much of the precipitation is snowfall and a significant portion infiltrates into the highly permeable volcanic soil and rock. This leads to higher flows in May due to snowmelt and to summer flows supported by significant spring flow, as seen in the upper Rogue River. In contrast, Illinois River flow is more typical of the Coast Range where most precipitation is rainfall and soils are shallow, resulting in rapid runoff and high flows in winter and low flows in the dry summer period.

Dams and reservoirs also influence basin hydrology; Figure 2-3 shows their locations in the TMDL project area. This information was downloaded from the National Inventory of Dams website (a repository maintained by USACE) and the Oregon Water Resources Department (OWRD) website (a repository listing only dams regulated by the State of Oregon). The dams in Figure 2-3 have storage capacities ranging from 19 to 500,000 acre-feet and are owned and operated by federal and local governments, private entities, and public utilities.

Figure 2-4 shows the locations of points of diversion and points of use in the TMDL project area. The major points of use in this area include industrial/manufacturing, mining, and municipal uses.

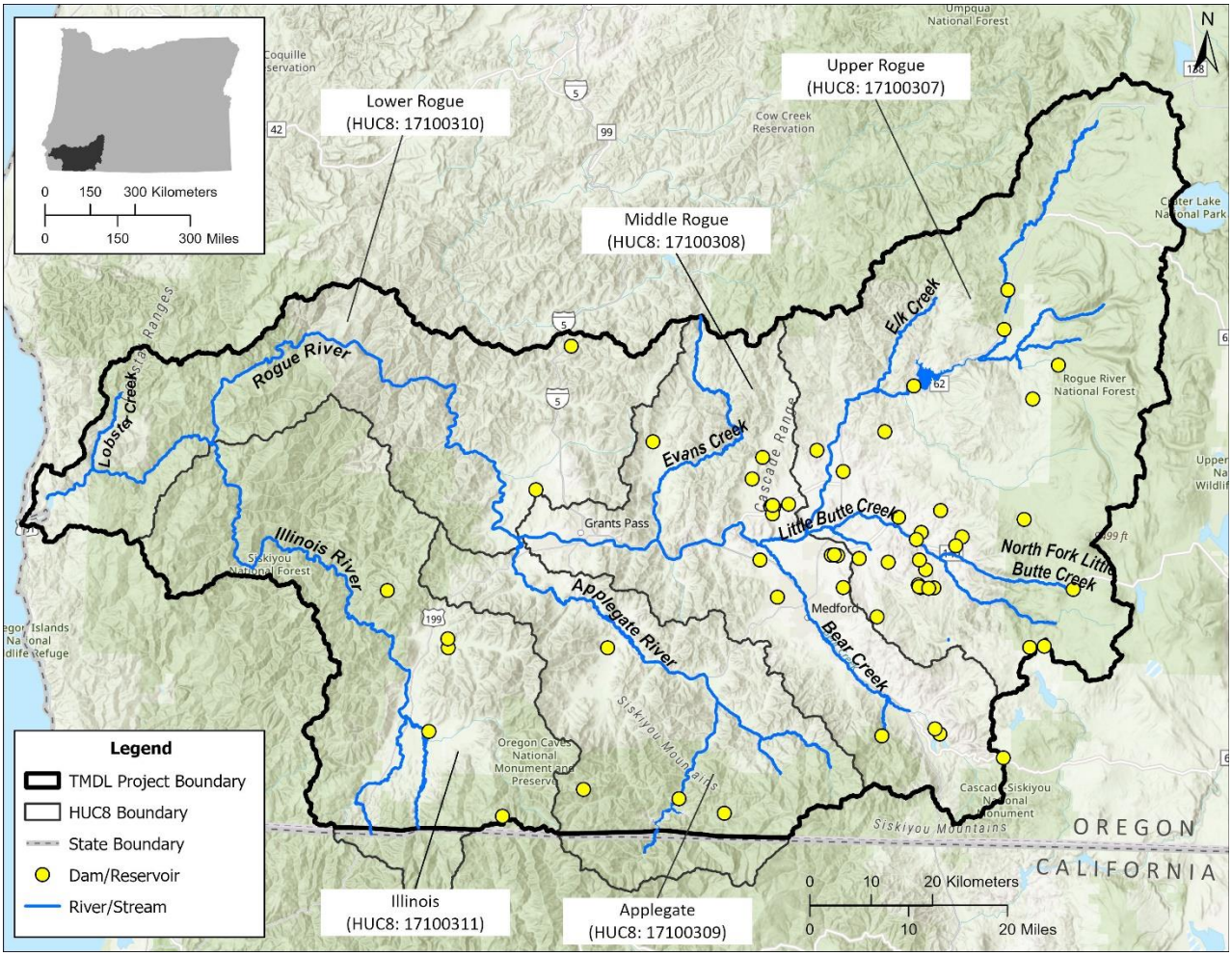


Figure 2-3: Dams and reservoirs located within the Rogue River Basin TMDL project area.

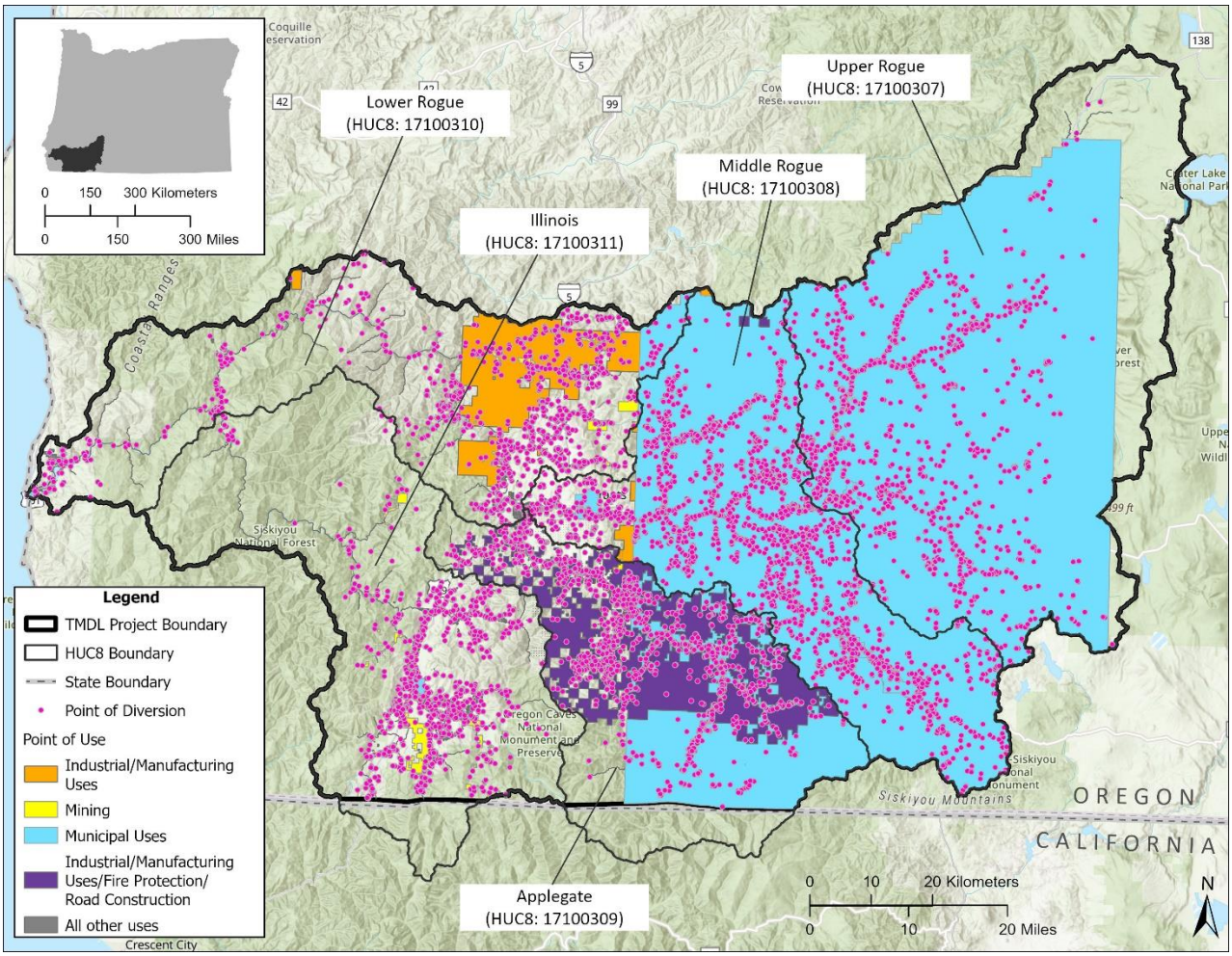


Figure 2-4: Points of diversion and use within the Rogue River Basin TMDL project area.

2.3 Land use

The majority of the Rogue River Basin is forested, with most of the developed areas located in the Middle Rogue Subbasin along the Interstate 5 corridor (**Figure 2-5**). Table 2-1 lists the portion (%) of total basin area that each land use occupies.

Table 2-1: Rogue River Basin TMDL project area land use summary based on the 2024 National Land Cover Database (NLCD).

2024 NLCD Land Cover	Area (ac.)	Percent (%) of Total Area
Evergreen Forest	1988650.5	62.07
Shrub/Scrub	624381.9	19.49
Grassland/Herbaceous	235870.1	7.36
Developed, Open Space	111961.0	3.49
Pasture/Hay	102839.9	3.21
Developed, Low Intensity	59162.1	1.85
Developed, Medium Intensity	20833.6	0.65
Woody Wetlands	14887.1	0.46
Open Water	10735.7	0.34
Cultivated Crops	9946.5	0.31

2024 NLCD Land Cover	Area (ac.)	Percent (%) of Total Area
Emergent Herbaceous Wetlands	8471.3	0.26
Mixed Forest	6759.2	0.21
Developed High Intensity	4523.9	0.14
Barren Land (Rock/Sand/Clay)	3945.6	0.12
Deciduous Forest	679.3	0.02
Perennial Ice/Snow	3.8	0.00

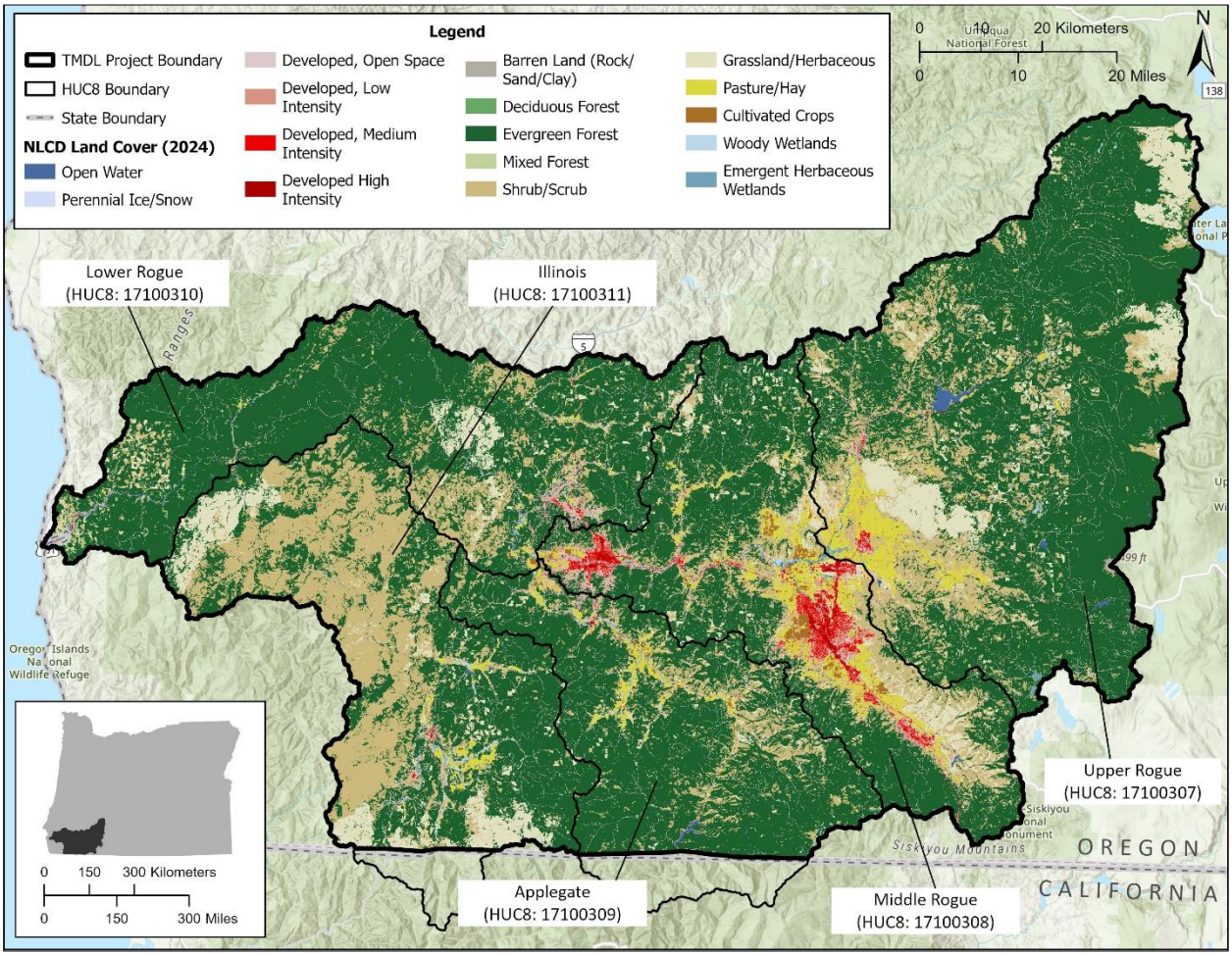


Figure 2-5: Rogue River Basin: Land use in the temperature TMDL project area based on the 2024 National Land Cover Database. (Note: Shrub/Scrub and Herbaceous land uses can be areas where forest clearcuts have occurred and would be classified as forest after regrowth.)

2.4 Land ownership and jurisdiction

The Rogue River Basin is located within Jackson, Josephine, Curry, Klamath and Douglas Counties in Oregon, with portions located in Siskiyou and Del Norte County California. Jackson County has a population of 181,269, most of which is in the Bear Creek Valley population centers of Ashland (19,522), Talent (5,589), Phoenix (4,060), Medford (63,154), Central Point (12,493), and Jacksonville (2,235). Outside of the Bear Creek Valley are the Jackson County cities of Shady Cove (2,307), Eagle Point (4,792), Butte Falls (439), and Rogue River (1,847). Josephine County (population: 75,726) contains the cities of Grants Pass (23,003) and Cave Junction

(1,363). Gold Beach (1,897) is the only Curry County (21,137) city in the Rogue River Basin (US Census Bureau 2000). Only small, relatively uninhabited, portions of the basin are within Klamath and Douglas Counties.

Approximately 60% (1,980,000 ac.) of the Rogue River Basin is publicly owned and managed by the US Forest Service, Bureau of Land Management, and US Bureau of Reclamation (Rogue Basin Coordinating Council 2006). These lands are managed for multiple uses, including water quality, timber production, livestock management, wildlife, and recreation.

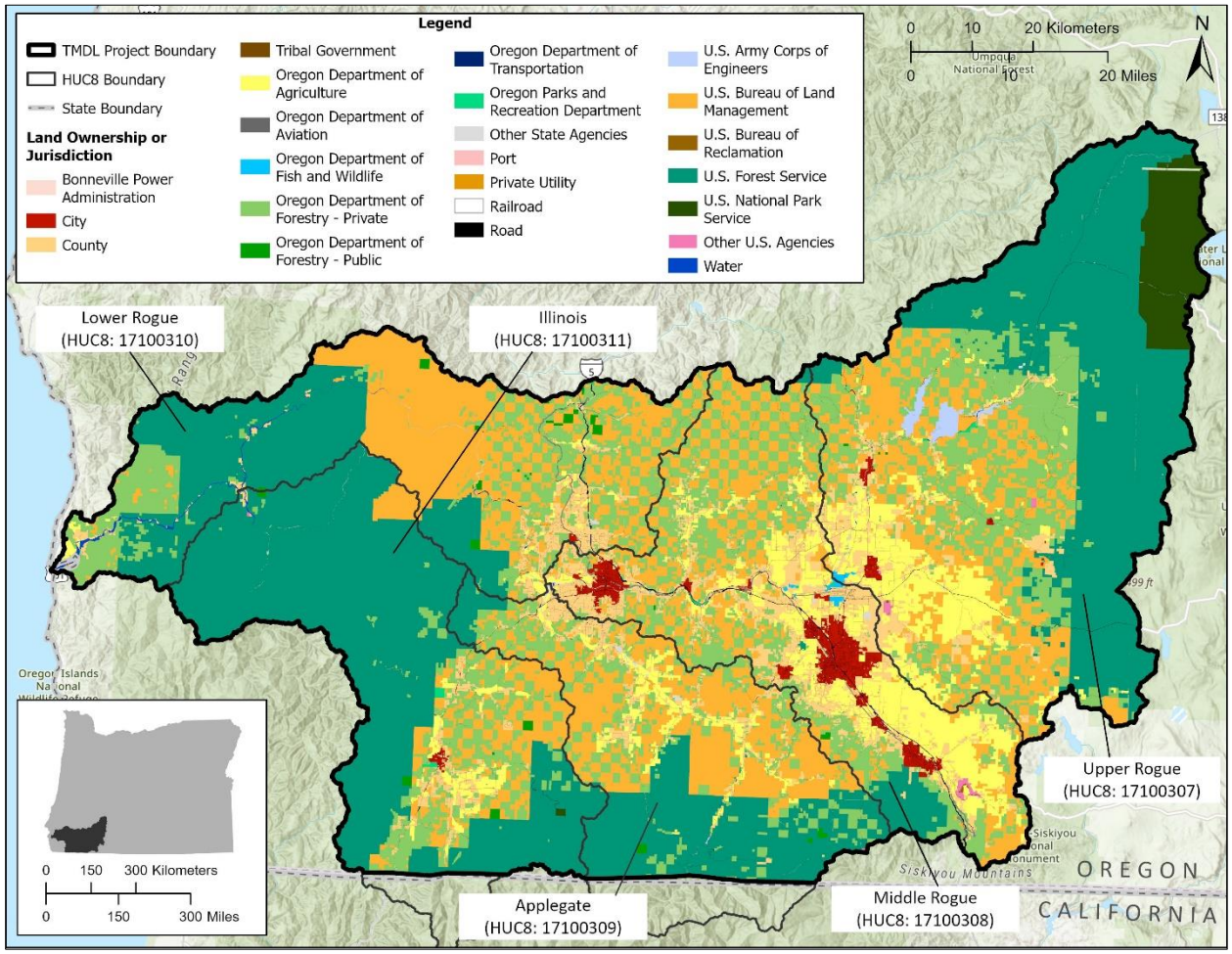


Figure 2-6: Land ownership and jurisdiction in the Rogue River Basin temperature TMDL project area.

3. Pollutant identification

Temperature is the water quality parameter of concern, but heat or thermal loading is the pollutant of concern that causes impairment. Heat caused by human activities is of particular concern. Refer to the [final date] Rogue River Basin TMDL (OAR ….) for a complete discussion.

4. Temperature water quality standards and beneficial uses

Refer to the [final date] Rogue River Basin TMDL (OAR ….) for the applicable beneficial uses, temperature water quality standards, and temperature criteria in the basin.

5. Seasonal variation and critical period for temperature

Per OAR 340-042-0040(4)(j) and 40 CFR 130.7(c)(1), TMDLs must identify any seasonal variation and the critical condition or period of each pollutant, if applicable.

DEQ reviewed available temperature data to determine seasonal temperature variation and the critical conditions and periods for various subbasins in the project area. For a given waterbody, the critical period is based on the frequency and period when instream 7DADM temperatures exceed applicable temperature criteria or contribute to exceedances in a downstream waterbody.

The water temperature monitoring locations and periods used to determine seasonal variation and critical periods for the Rogue River Basin TMDL are listed in Table 5-1 and mapped in Figure 5-1.

Table 5-2 shows the critical periods for waterbodies in the Rogue River Basin. In the Lower Rogue Subbasin, the critical periods for “all waters” and the Lobster Creek Watershed are based on exceedances of the spawning criterion (13°C), whereas the critical period for the Rogue River Watershed is based on exceedances of the rearing and migration criterion (18°C). This is why the critical period for the Rogue River mainstem within the Rogue River Watershed starts on May 1, while the critical period for the Rogue River mainstem upstream of the Rogue River Watershed starts on April 1.

Table 5-1: Water temperature monitoring locations and periods used to determine seasonal temperature variation and critical periods for the Rogue Basin.

Monitoring location ID	Monitoring location	Monitoring period	Number of 7DADM values
14348080	ANTELOPE CR BL ROGUE RIVER VALLEY IRR DIST DIV NR WHITE CITY, OR	04/23/15 - 12/31/23	2435
14348150	ANTELOPE CR NR EAGLE POINT, OR	05/07/15 - 12/07/23	2806
24409-ORDEQ	Antelope Creek downstream of Riley Road (tributary of Little Butte Creek)	06/21/03 - 10/04/05	305
14366000	APPLEGATE RIVER NEAR APPLEGATE, OR	01/16/00 - 12/31/22	8133
14369500	APPLEGATE RIVER NEAR WILDERVILLE, OR	01/07/00 - 12/31/22	7849
12377-ORDEQ	Bear Creek 500 feet downstream of Rrvid (Jackson Street) Dam	11/16/15 - 04/19/18	4
14358800	BEAR CR AB MOUTH NR CENTRAL POINT, OR	09/16/15 - 04/29/23	880
14335235	BIEBERSTEDT CR AB WILLOW LK NR BUTTE FALLS	04/29/15 - 12/31/23	2309
14337000	BIG BUTTE CR BL BUTTE FALLS, OR	01/15/15 - 12/31/23	3204

Monitoring location ID	Monitoring location	Monitoring period	Number of 7DADM values
14337500	BIG BUTTE CREEK NEAR MCLEOD, OR	01/07/00 - 09/30/00	268
25812-ORDEQ	East Fork Illinois River	07/19/00 - 09/26/00	70
14360500	EVANS CR AT WIMER, OR	06/02/15 - 12/31/23	2335
RRSNF-014	Foster Creek_LTWT	06/09/04 - 09/16/05	210
14365500	LITTLE APPLEGATE R NR RUCH, OR	05/27/15 - 12/31/23	3051
14348000	LITTLE BUTTE CR BL EAGLE POINT, OR	04/30/15 - 09/03/19	1163
10602-ORDEQ	Little Butte Creek at Agate Road (White City)	05/14/03 - 10/04/05	355
26637-ORDEQ	Little Butte, at mill diversion pond nr. Reese Cr. Rd. (Rogue)	08/26/15 - 12/13/18	1070
25846-ORDEQ	Lobster Creek (tributary to Rogue River) below Deadline Creek	07/12/00 - 08/31/04	321
30194-ORDEQ	Lobster Creek at mouth	06/26/16 - 10/20/16	117
RRSNF-005	Red Blanket Creek abv Lick Creek_LTWT	06/22/12 - 10/31/12	1
14339000	ROGUE RIVER AT DODGE BRIDGE, NEAR EAGLE POINT, OR	01/07/00 - 12/31/22	8245
14361500	ROGUE RIVER AT GRANTS PASS, OR	09/06/07 - 12/31/22	5474
14359000	ROGUE RIVER AT RAYGOLD NEAR CENTRAL POINT, OR	01/07/00 - 12/30/22	7583
10600-ORDEQ	Rogue River at Valley of the Rogue State Park	05/01/03 - 10/05/11	182
14330000	ROGUE RIVER BELOW PROSPECT, OR	01/07/00 - 12/31/22	8270
14372300	ROGUE RIVER NEAR AGNESS, OR	01/07/00 - 12/31/22	8366
14335500	S FK BIG BUTTE CR NR BUTTE FALLS, OR	10/24/13 - 12/31/23	3371
23758-ORDEQ	Slate Creek at mouth, tributary to Applegate River	06/10/02 - 10/04/04	210
14375200	SUCKER CR AT BRIDGEVIEW, OR	02/03/16 - 04/18/22	2166
23365-ORDEQ	West Fork Illinois River at confluence with mainstem Illinois River	07/19/00 - 10/09/01	180
23362-ORDEQ	West Fork Illinois River upstream of Rough and Ready Creek	06/25/01 - 10/09/01	107
28383-ORDEQ	Williams Creek at Williams Hwy Bridge (Applegate, Rogue)	06/10/02 - 08/31/04	308
14335230	WILLOW CR AB WILLOW LK NR BUTTE FALLS	10/07/14 - 12/31/23	3195
14335250	WILLOW CR DAM OUTLET NR BUTTE FALLS, OR	05/07/15 - 02/21/19	1382

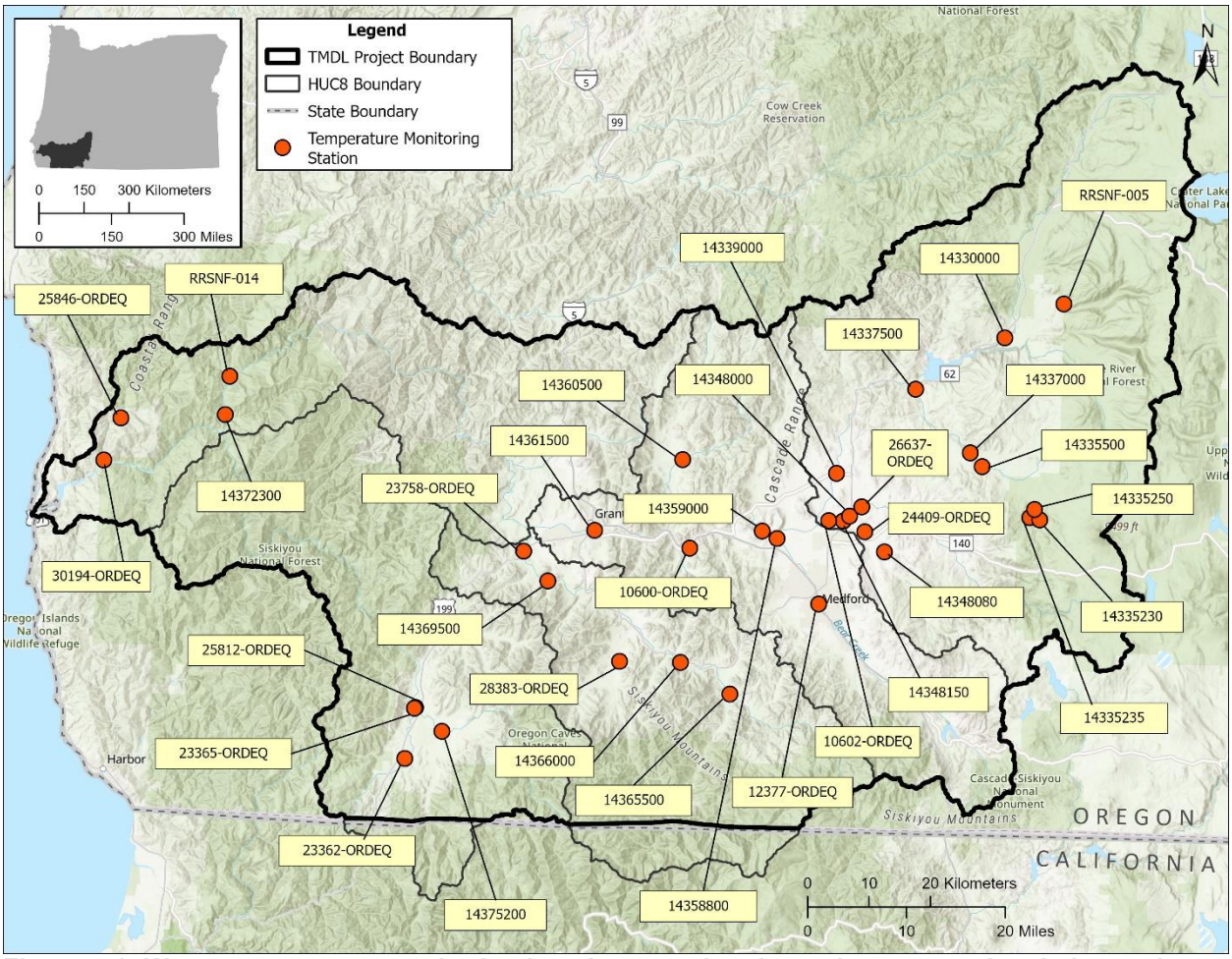


Figure 5-1: Water temperature monitoring locations used to determine seasonal variation and critical periods for the Rogue River Basin TMDL.

Table 5-2: Designated critical periods for waterbodies in the Rogue Basin.

Subbasin	Waterbody name	Critical period
Applegate Subbasin 17100309	All waters, except those noted	March 15 – Nov. 15
	Little Applegate Watershed (1710030903)	April 15 – Oct. 31
Illinois Subbasin 17100311	All waters	May 1 – Oct. 31
Lower Rogue Subbasin 17100310	All waters, except those noted	April 1 – Oct. 31
	Lobster Creek Watershed (1710031007)	May 1 – Oct. 31
	Rogue River Watershed (1710031008)	May 1 – Oct. 31
Middle Rogue Subbasin 17100308	All waters, except those noted	April 1 – Oct. 31
	Bear Creek Watershed (1710030801)	April 1 – Nov. 15
Upper Rogue Subbasin 17100307	All waters, except those noted	April 1 – Oct. 31
	Headwaters Rogue River Watershed (1710030701)	May 1 – Oct. 31
	South Fork Rogue River Watershed (1710030702)	May 1 – Oct. 31

Figure 5-2 through Figure 5-35 show boxplots of the seasonal variation of 7DADM temperatures and the period of exceedance at temperature monitoring locations in the Rogue River Basin.

Temperature data were split into bimonthly groups. Each month was split on the 15th; the first group included all results measured on the 1st through the 14th day, and the second group included all results measured on the 15th through the end of the month. The boxplots are Tukey-style boxplots in which the middle line represents the median and box ends represent the temperature range between the 1st and 3rd quartiles (25th – 75th percentiles). The whiskers extend to values no further than 1.5 times the interquartile 7DADM temperature range (i.e., 1.5 times the difference between 25th and 75th percentiles. Any points beyond the whiskers represent individual 7DADM temperature values beyond 1.5 times the interquartile range; such values are sometimes considered as potential statistical outliers. The dashed line corresponds to the applicable temperature criterion.

The magnitudes and periods of exceedance vary based on monitoring location and applicable criteria. The plots show that maximum stream temperatures typically occur in July or August. This period coincides with the lowest annual streamflows, maximum solar radiation flux, and warmest air temperatures. Conversely, the coolest stream temperatures typically occur in December and January, which coincides with the lowest solar radiation fluxes and coolest air temperatures. Instream 7DADM temperatures exceeded 26°C (79°F) at roughly 15% of AUs for which excess loads were calculated. While these locations were spread among the 5 TMDL subbasins, the Lower Rogue, Middle Rogue, and Illinois subbasins accounted for more of these AUs than the Upper Rogue or Applegate subbasins. When considering the magnitude of temperature exceedances, however, the Upper Rogue subbasin had the most AUs with exceedances greater than 9°C (16°F) above the applicable criterion. From the seasonal temperature plots in Figure 5-2 through Figure 5-35, it is clear that most but not all of the sites included in the seasonal variation and critical period assessment had median 7DADM stream temperatures that exceeded the applicable standard during most or all of the summer period (June through mid-Sept).

In setting critical periods, DEQ relied upon monitoring sites with the longest periods of exceedance along with modeling analysis results that provided temperature estimates at locations without monitoring data. When downstream locations had longer exceedance periods relative to upstream waters, the longer period was used as the critical period for upstream waterbodies. This ensures warming of upstream waters does not contribute to downstream exceedances.

DEQ also considered the frequency of exceedance. If a given bimonthly period had any 7DADM temperature values that exceeded the criterion and were within 1.5 times the interquartile range (i.e., at or below the upper whisker in the plot, which may indicate that the value is not an outlier), DEQ included that period in the critical period. The critical periods and relevant locations are presented in Section 5-1 of the TMDL.

5.1 Applegate Subbasin seasonal variation

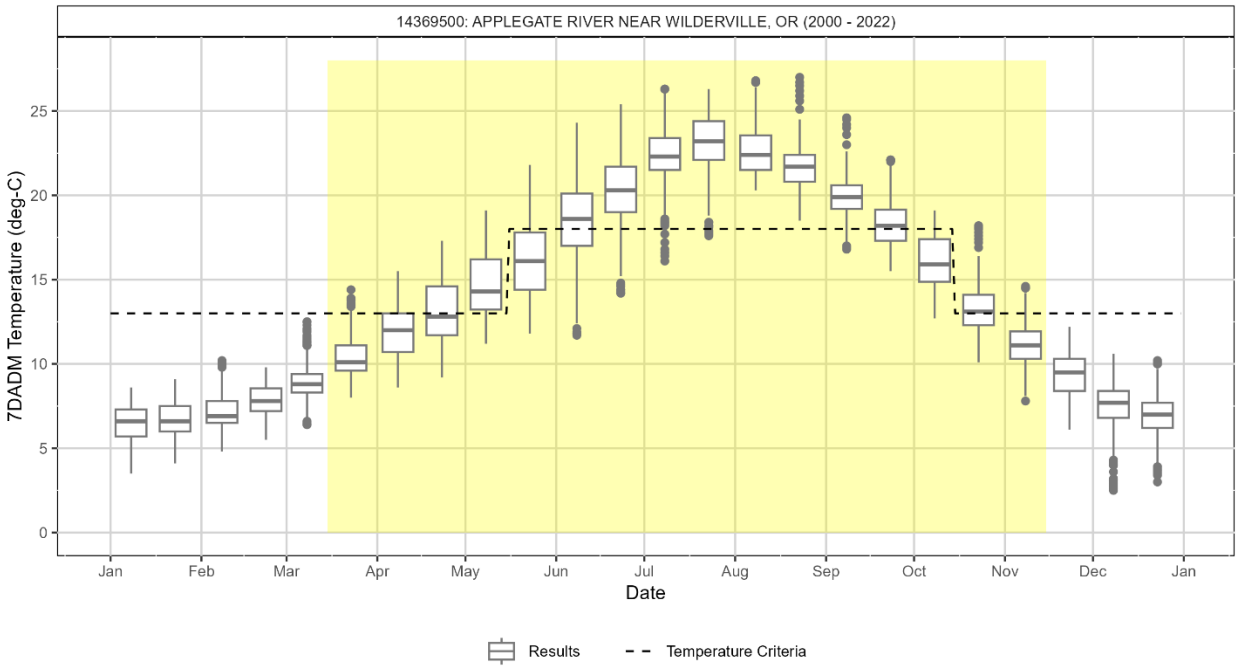


Figure 5-2: Seasonal variation in 7DADM temperature at the Applegate River near Wilderville, OR monitoring site in the Applegate Subbasin.

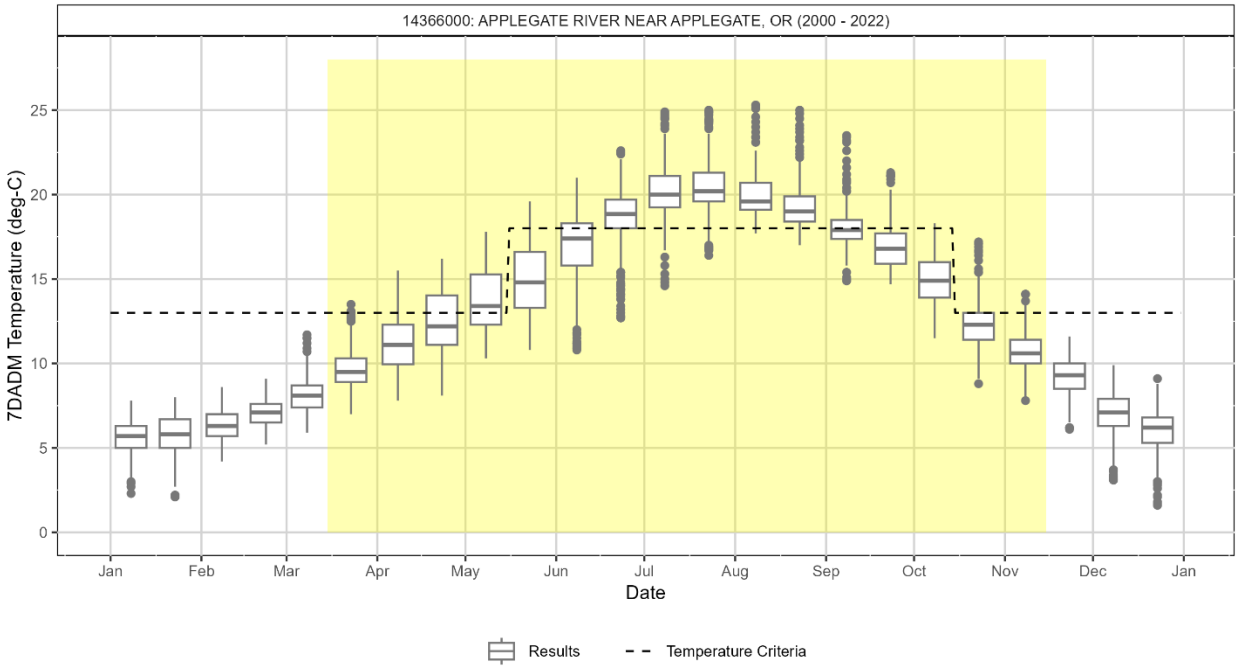


Figure 5-3: Seasonal variation in 7DADM temperature at the Applegate River near Applegate, OR monitoring site in the Applegate Subbasin.

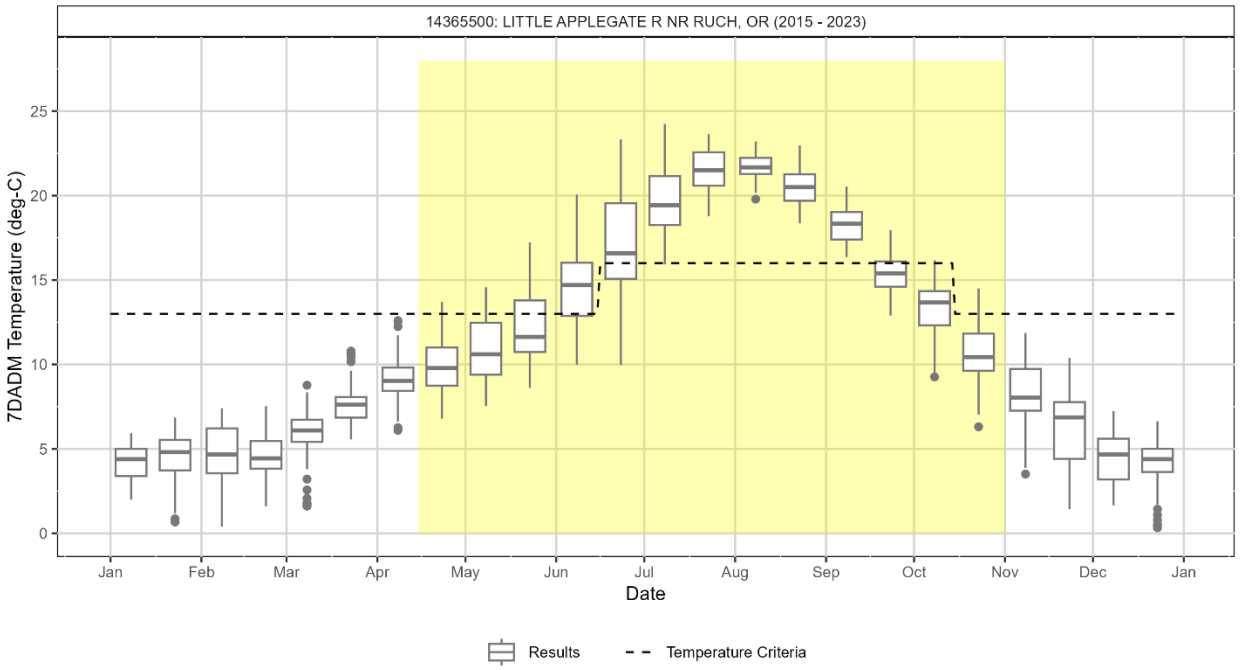


Figure 5-4:Seasonal variation in 7DADM temperature at the Little Applegate River near Ruch, OR monitoring site in the Applegate Subbasin.

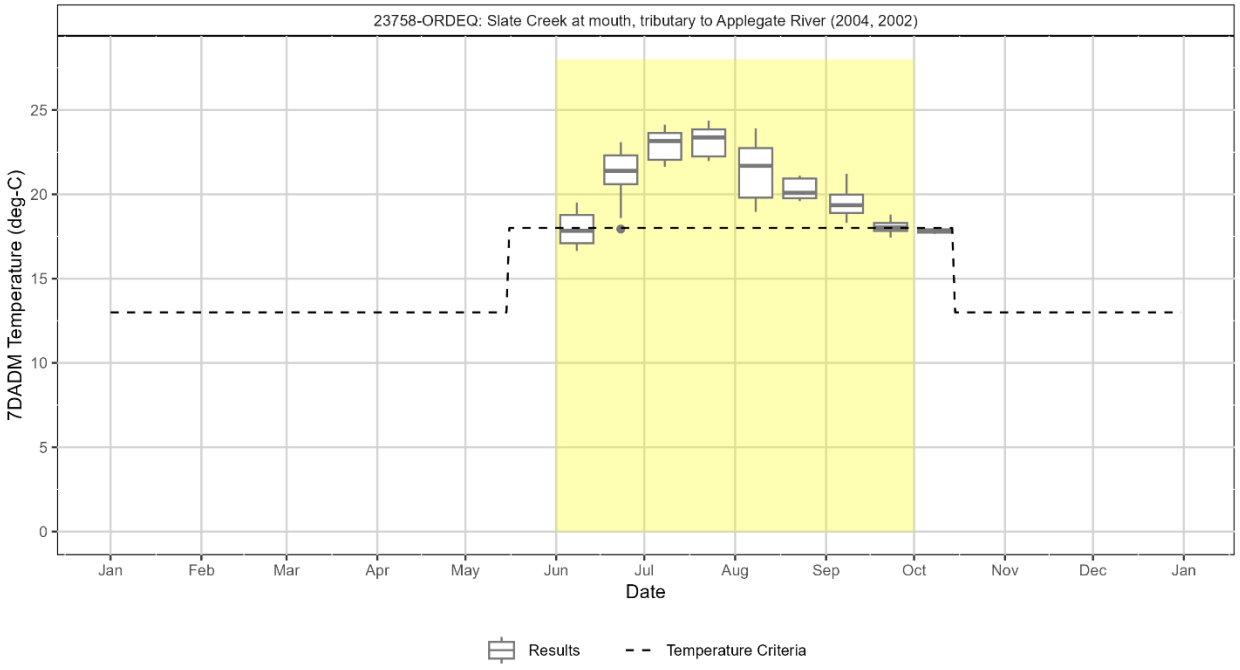


Figure 5-5: Seasonal variation in 7DADM temperature at the Slate Creek at mouth monitoring site in the Applegate Subbasin.

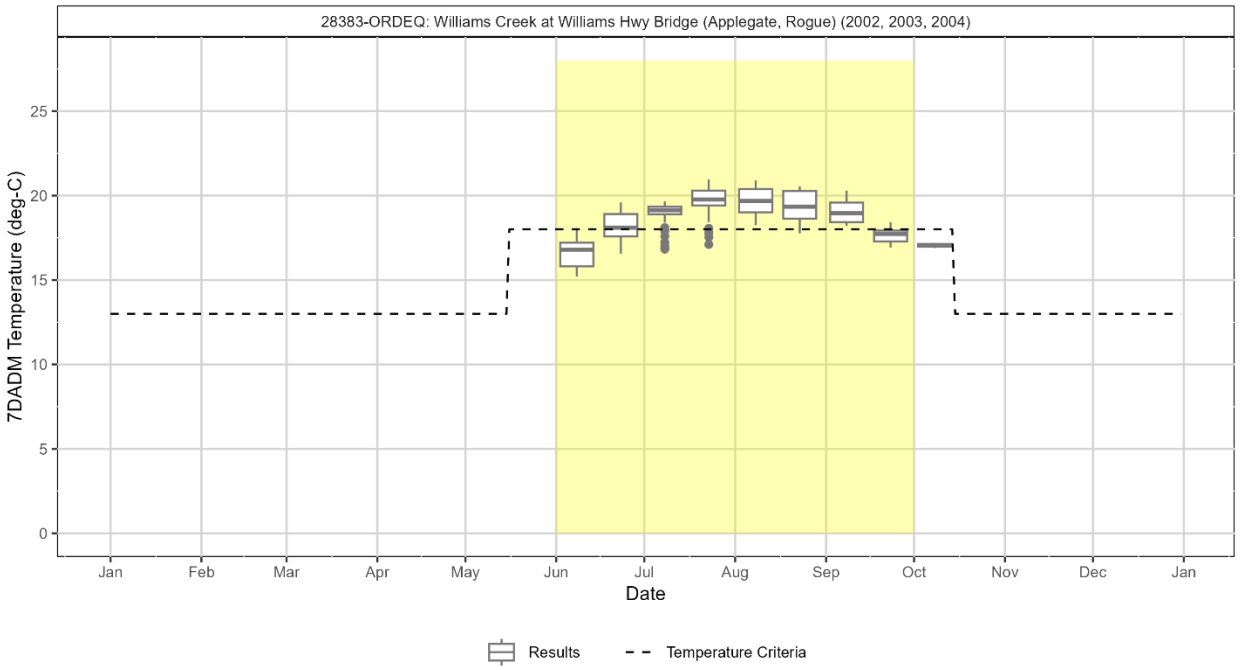


Figure 5-6: Seasonal variation in 7DADM temperature at the Williams Creek at Williams Highway Bridge monitoring site in the Applegate Subbasin.

5.2 Illinois Subbasin seasonal variation

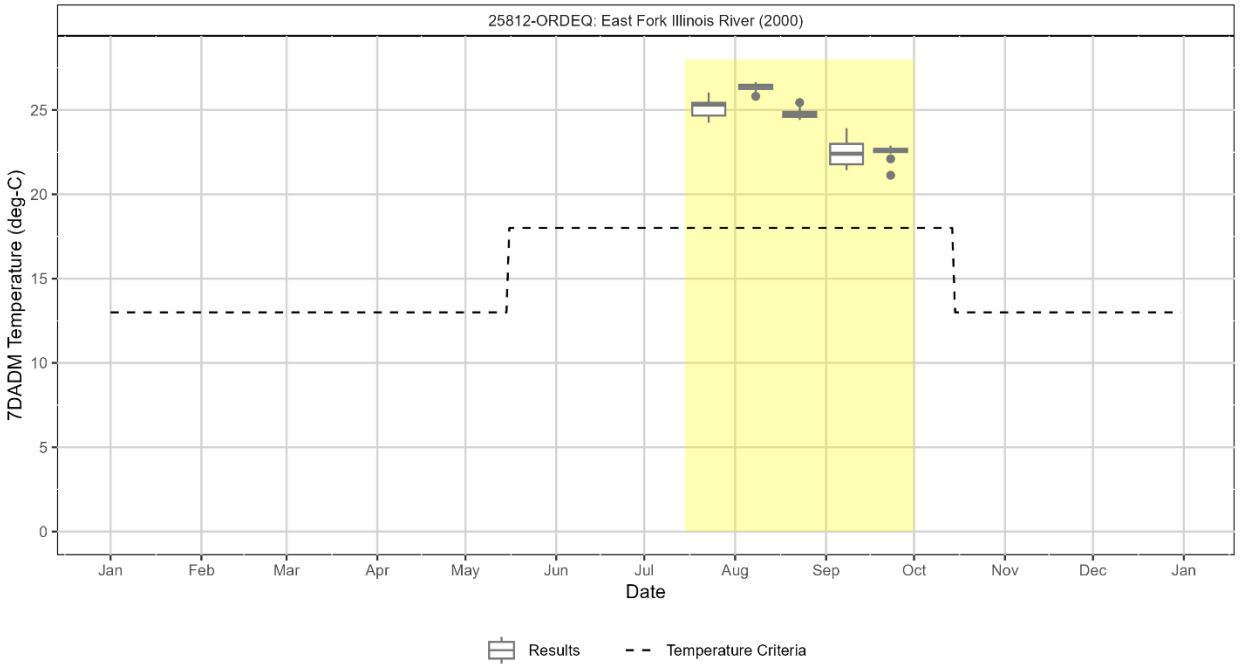


Figure 5-7: Seasonal variation in 7DADM temperature at the East Fork Illinois River monitoring site in the Illinois Subbasin.

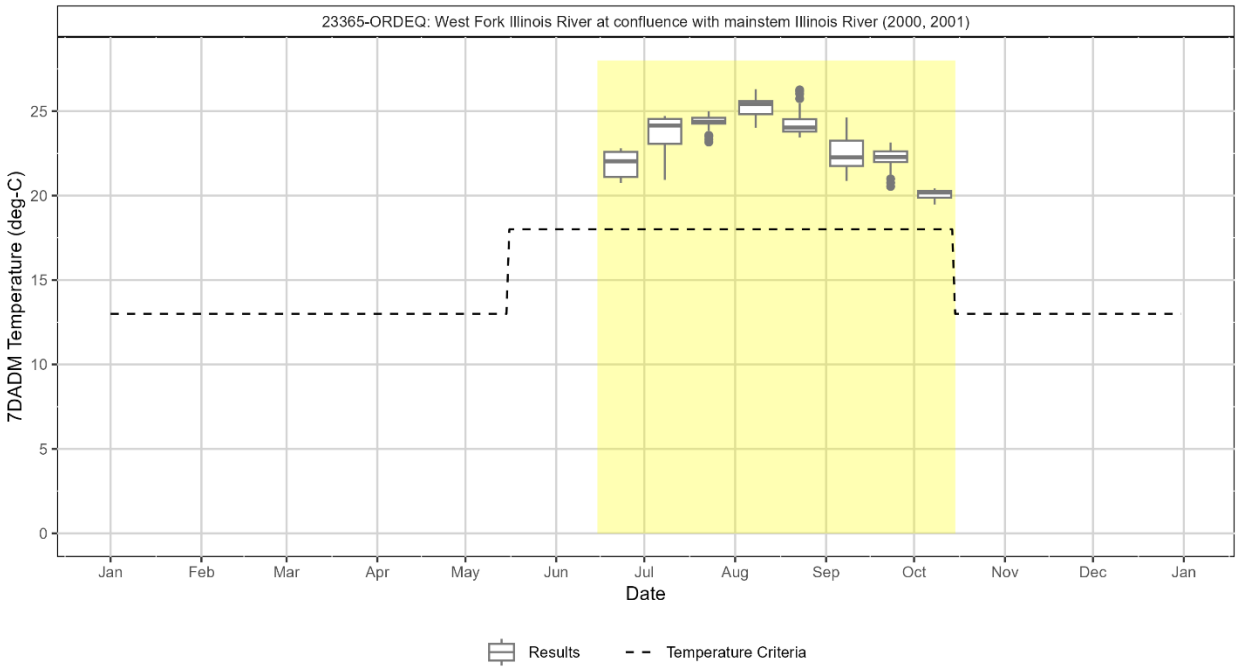


Figure 5-8: Seasonal variation in 7DADM temperature at the West Fork Illinois River at confluence with the mainstem Illinois River monitoring site in the Illinois Subbasin.

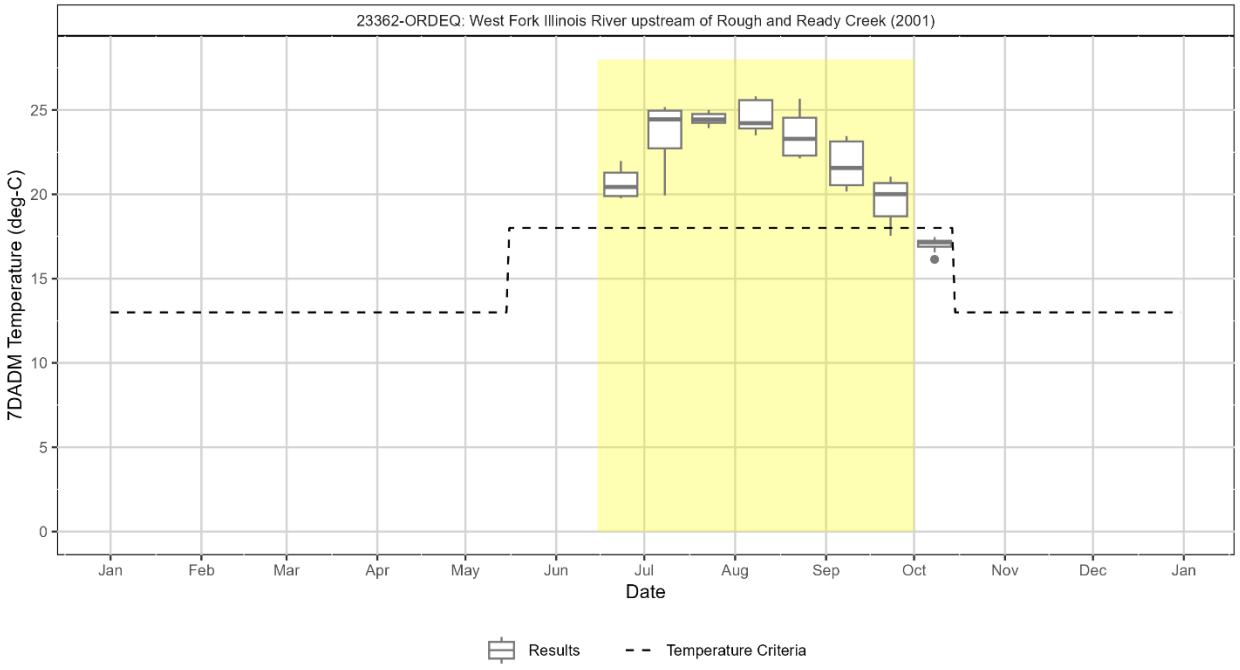


Figure 5-9: Seasonal variation in 7DADM temperature at the West Fork Illinois River upstream of Rough and Ready Creek monitoring site in the Illinois Subbasin.

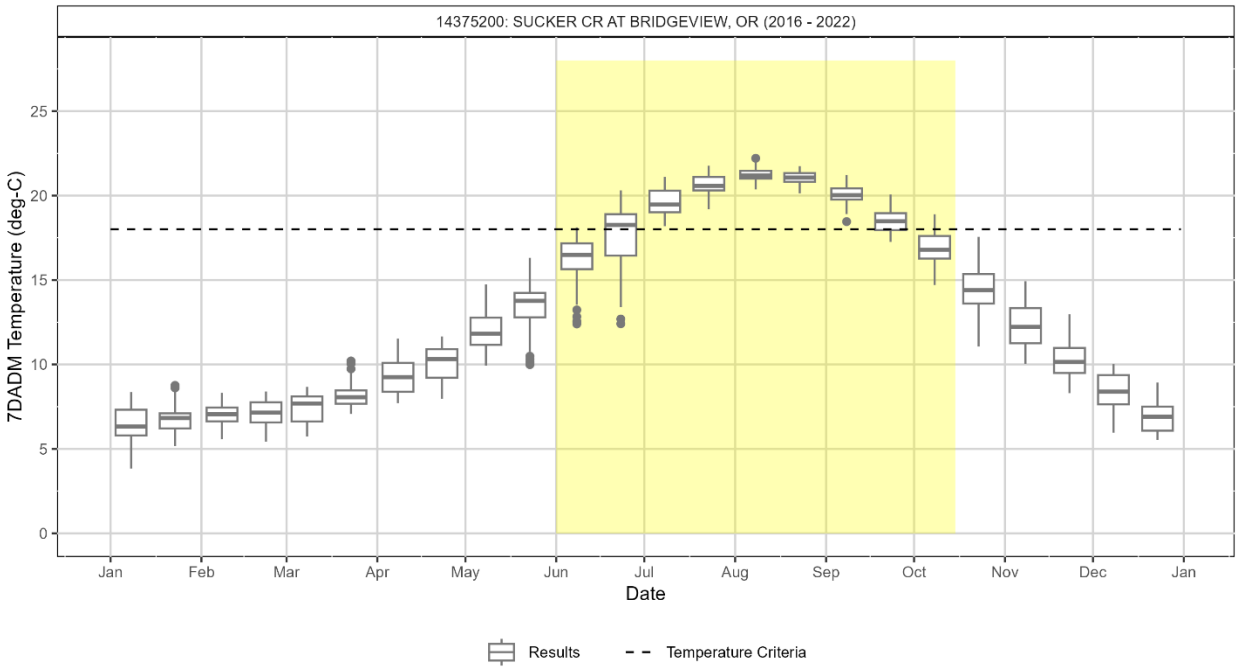


Figure 5-10: Seasonal variation in 7DADM temperature at the Sucker Creek at Bridgeview, OR monitoring site in the Illinois Subbasin.

5.3 Lower Rogue Subbasin seasonal variation

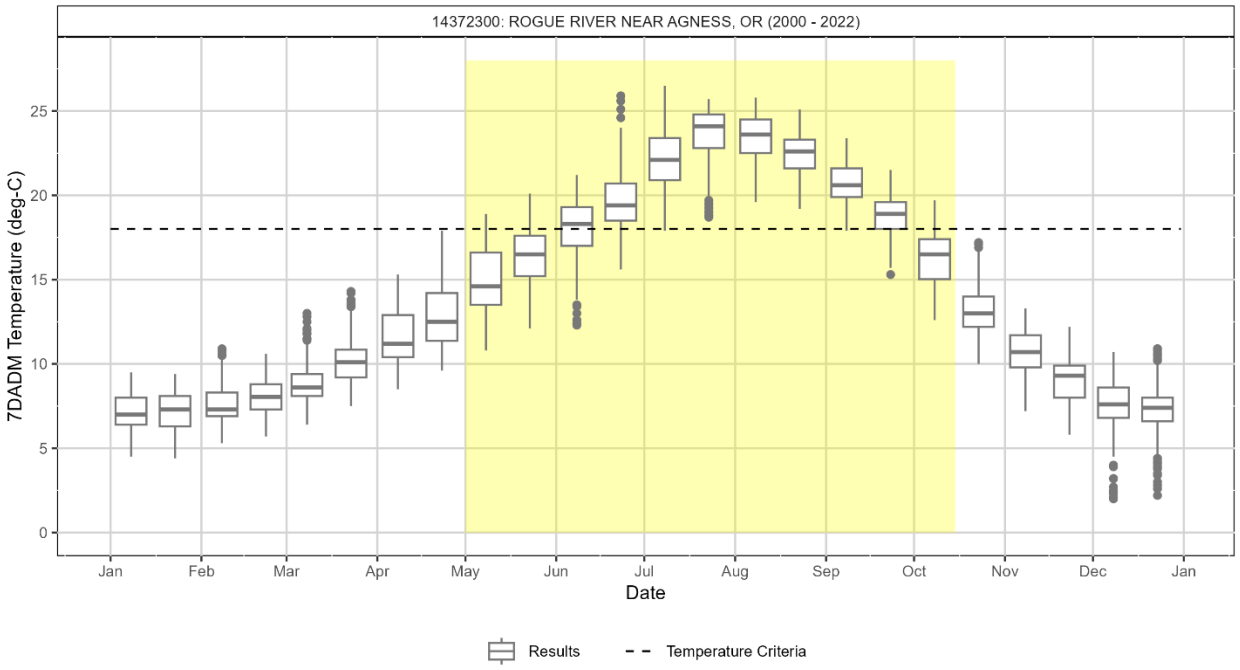


Figure 5-11: Seasonal variation in 7DADM temperature at the Rogue River near Agness, OR monitoring site in the Lower Rogue Subbasin.

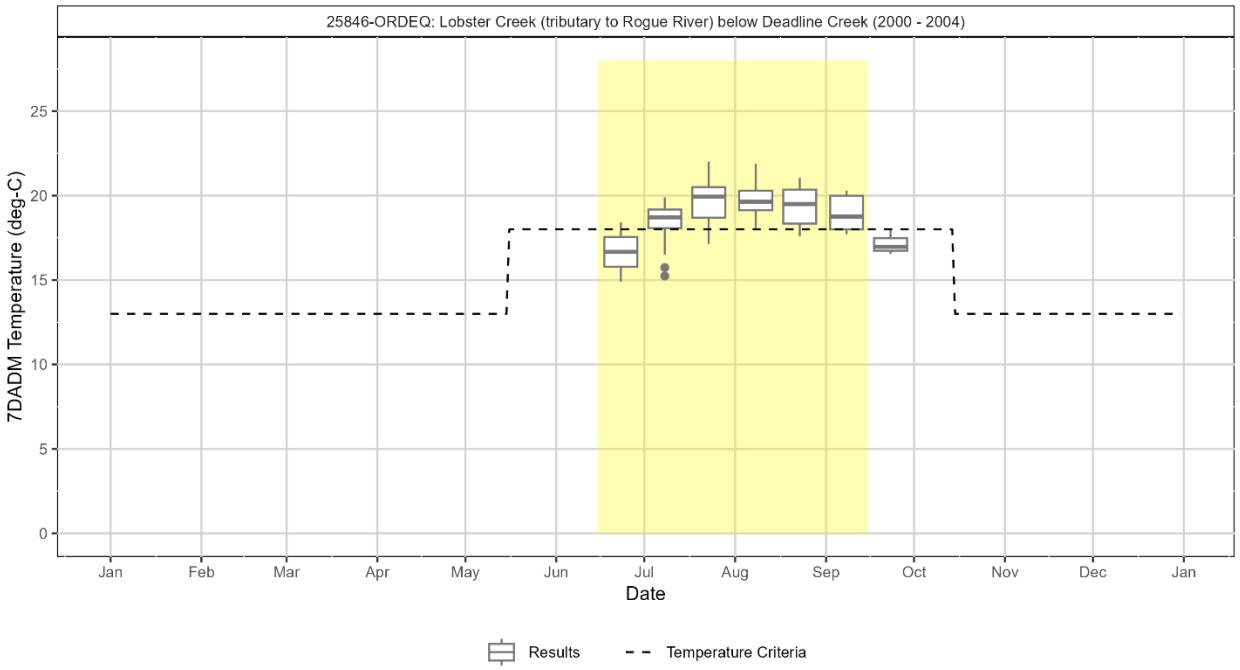


Figure 5-12: Seasonal variation in 7DADM temperature at the Lobster Creek below Deadline Creek monitoring site in the Lower Rogue Subbasin.

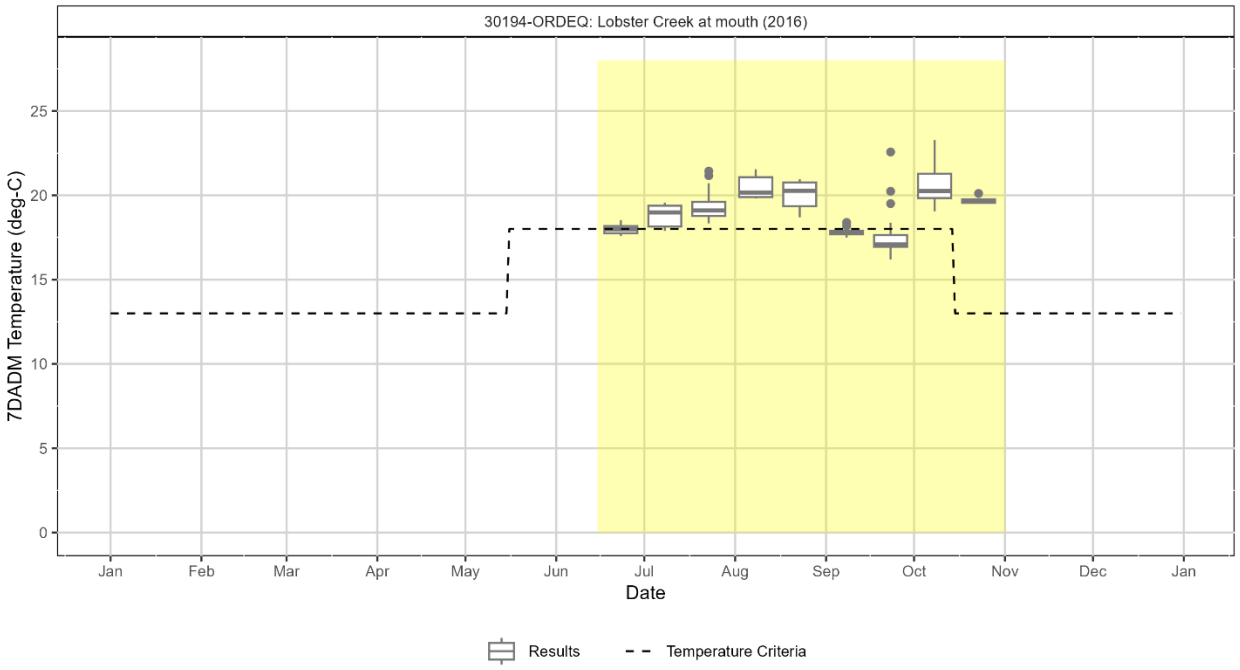


Figure 5-13: Seasonal variation in 7DADM temperature at the Lobster Creek at mouth monitoring site in the Lower Rogue Subbasin.

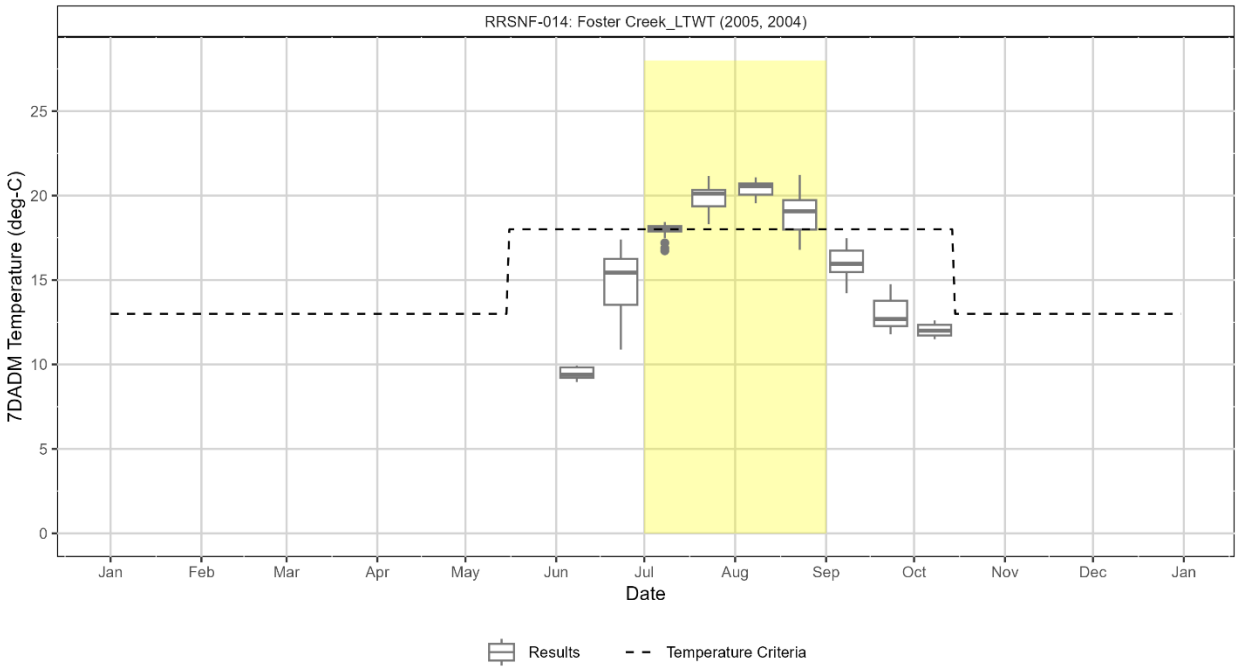


Figure 5-14: Seasonal variation in 7DADM temperature at the Foster Creek monitoring site in the Lower Rogue Subbasin.

5.4 Middle Rogue Subbasin seasonal variation

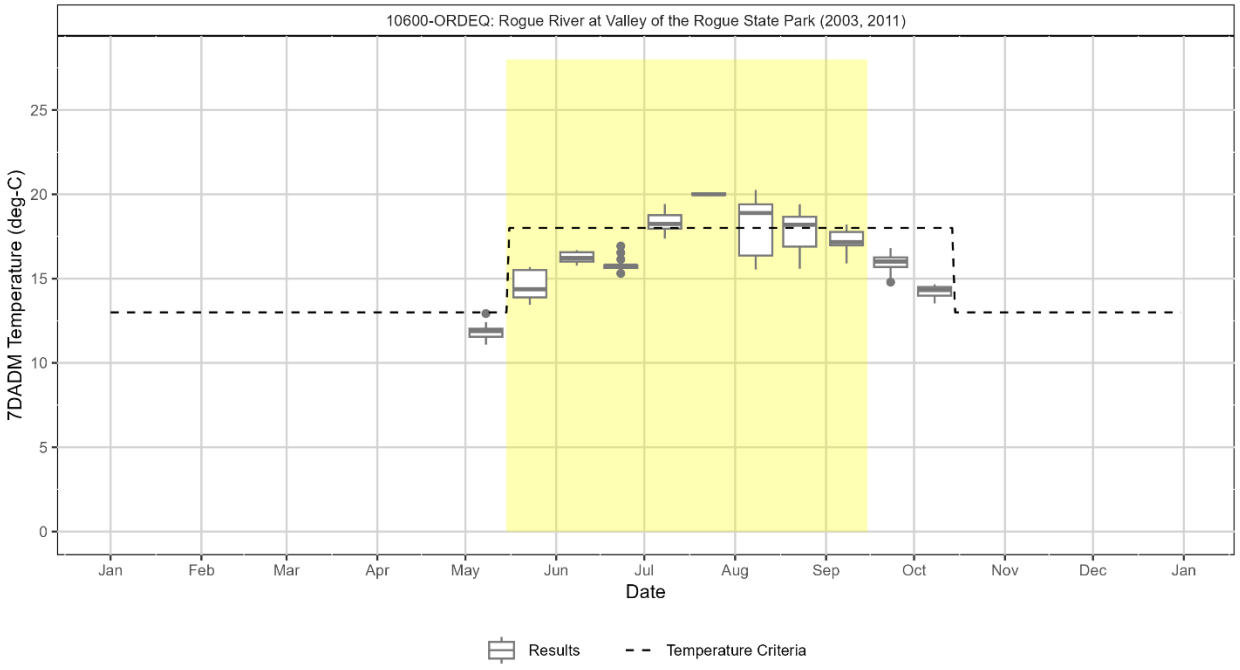


Figure 5-15: Seasonal variation in 7DADM temperature at the Rogue River at Valley of the Rogue State Park monitoring site in the Middle Rogue Subbasin.

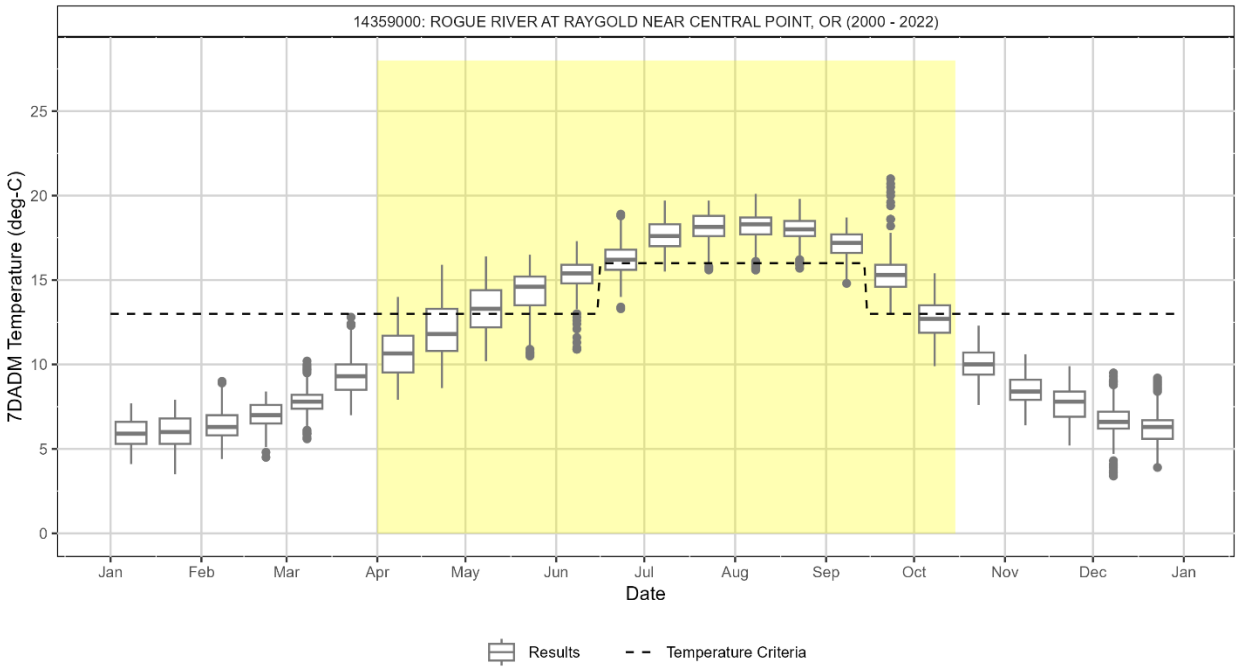


Figure 5-16: Seasonal variation in 7DADM temperature at the Rogue River at Raygold near Central Point, OR monitoring site in the Middle Rogue Subbasin.

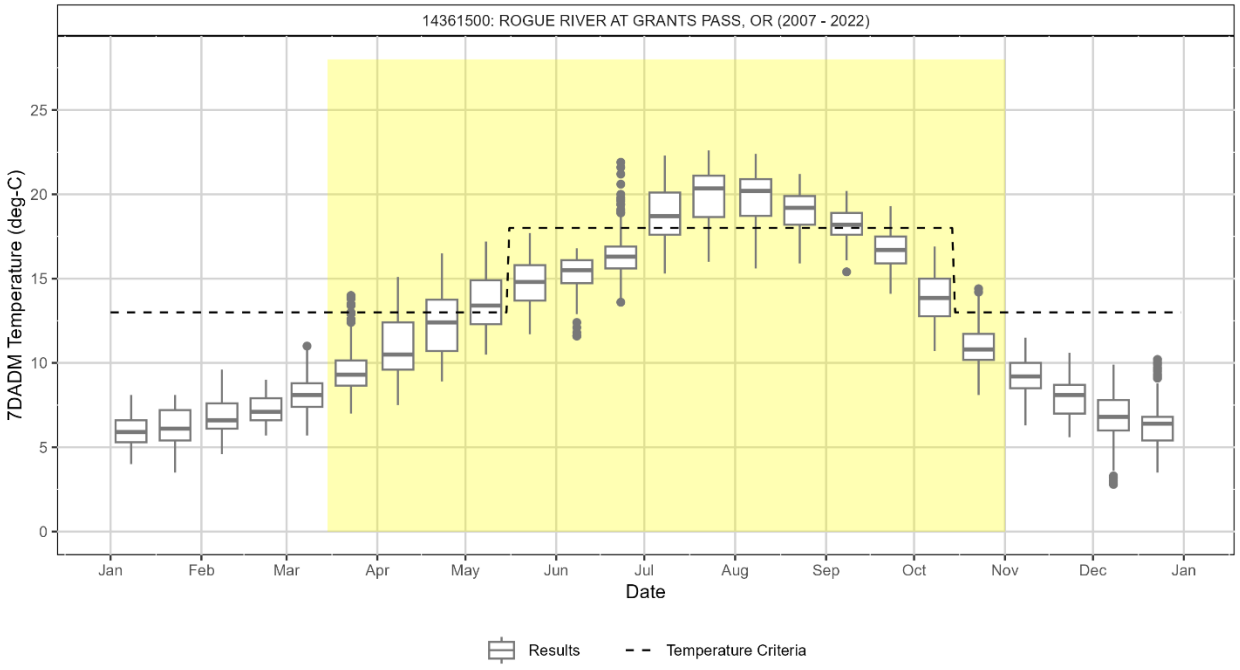


Figure 5-17: Seasonal variation in 7DADM temperature at the Rogue River at Grants Pass, OR monitoring site in the Middle Rogue Subbasin.

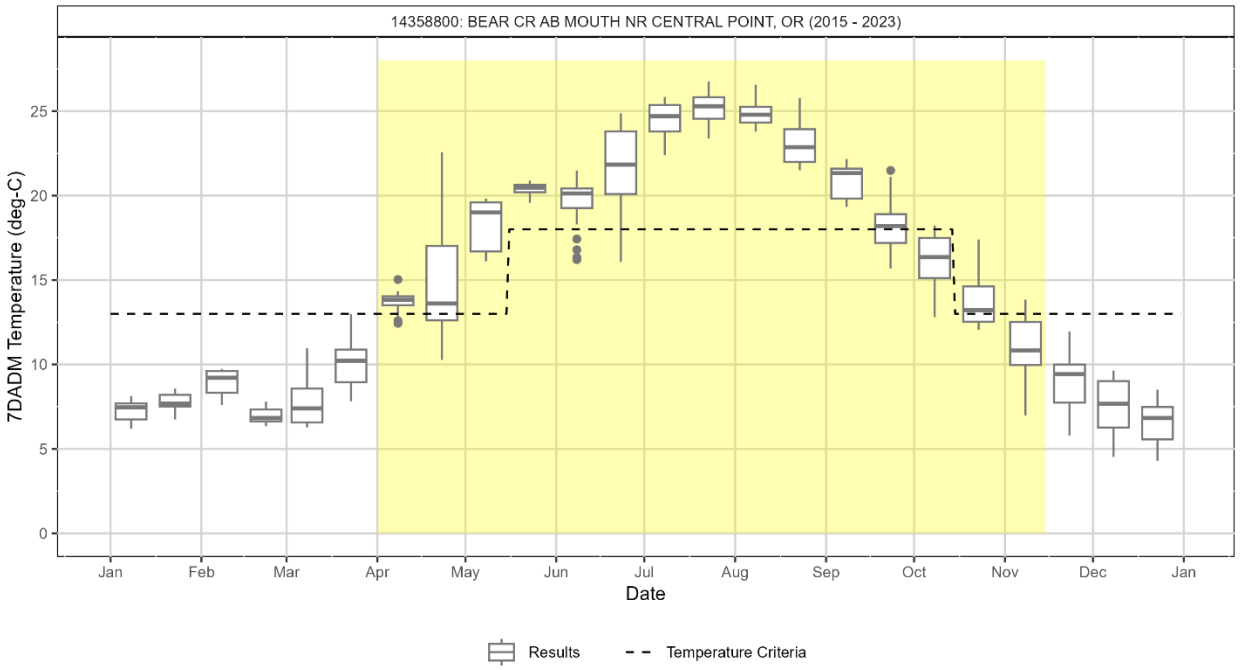


Figure 5-18: Seasonal variation in 7DADM temperature at the Bear Creek above mouth near Central Point, OR monitoring site in the Middle Rogue Subbasin.

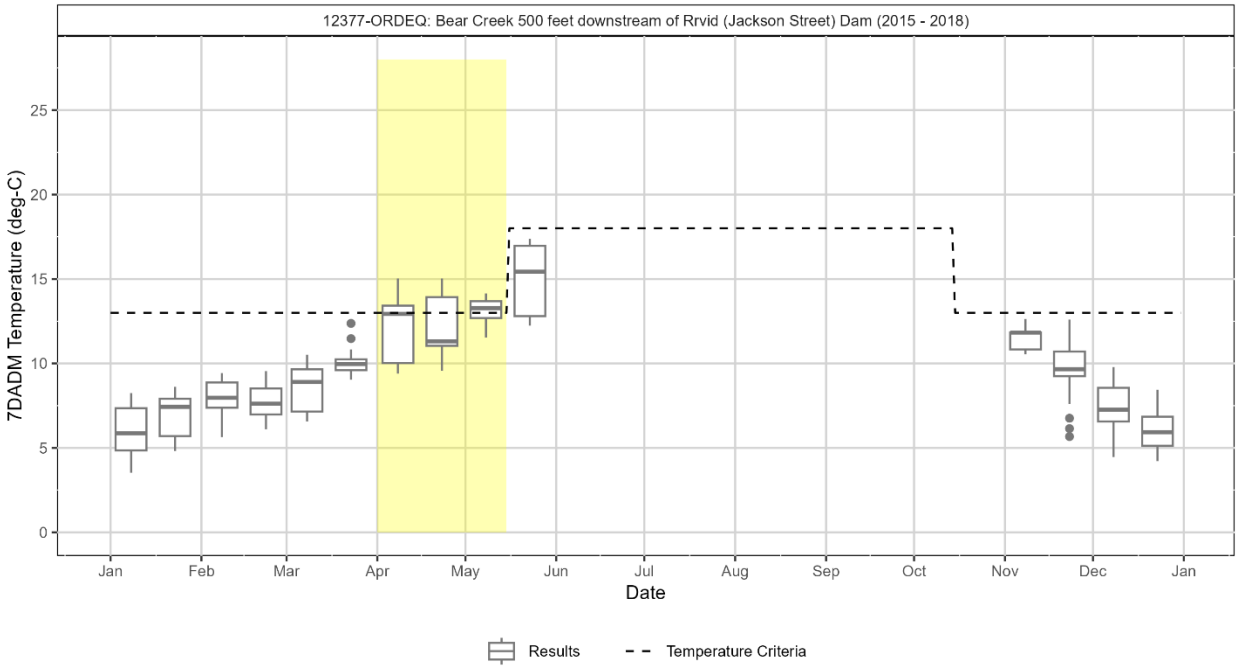


Figure 5-19: Seasonal variation in 7DADM temperature at the Bear Creek 500 feet downstream of Rrvid (Jackson Street) Dam monitoring site in the Middle Rogue Subbasin.

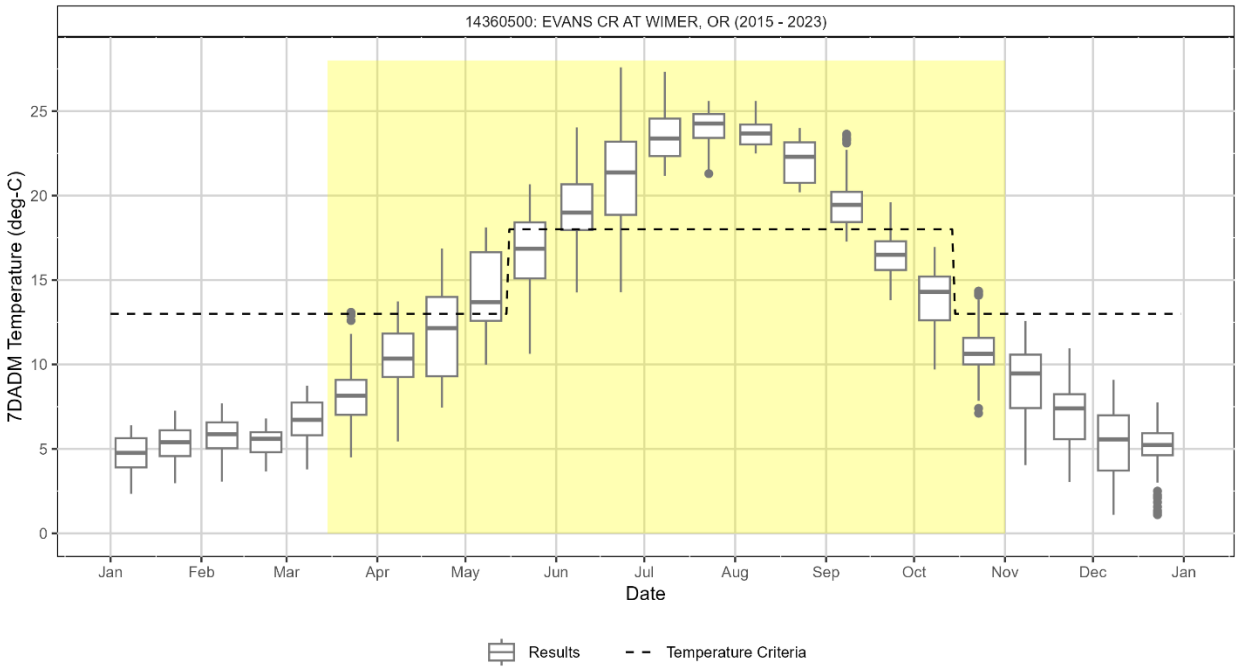


Figure 5-20: Seasonal variation in 7DADM temperature at the Evans Creek at Wimer, OR monitoring site in the Middle Rogue Subbasin.

5.5 Upper Rogue Subbasin seasonal variation

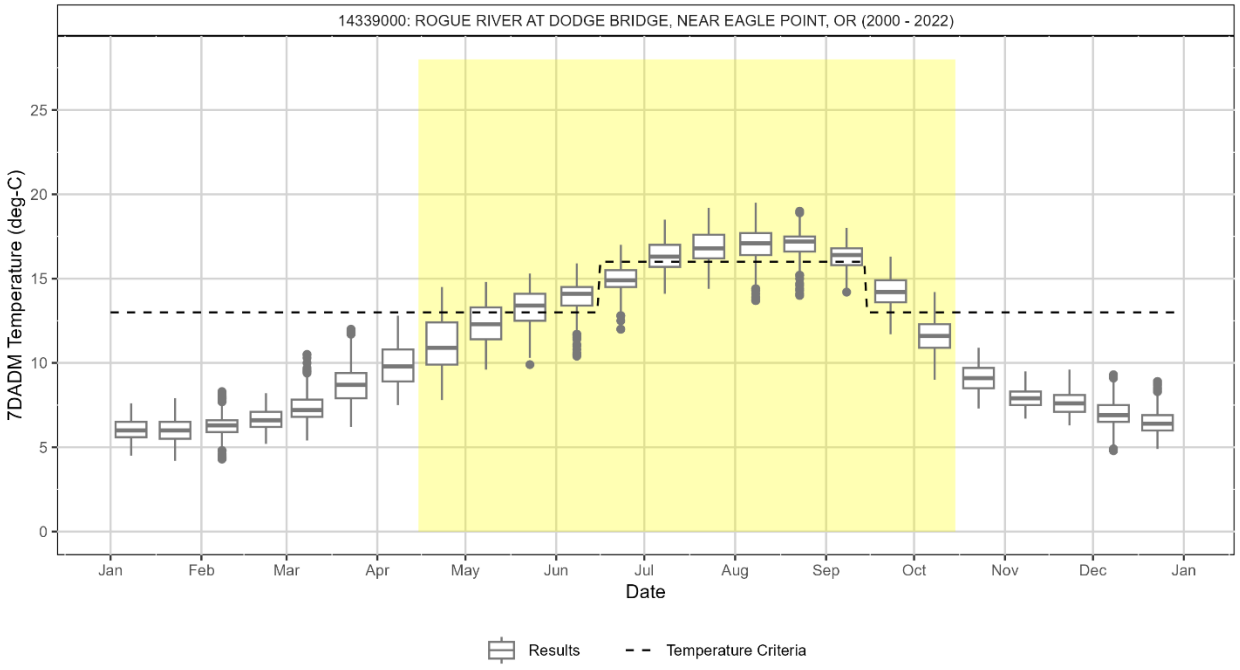


Figure 5-21: Seasonal variation in 7DADM temperature at the Rogue River at Dodge Bridge near Eagle Point, OR monitoring site in the Upper Rogue Subbasin.

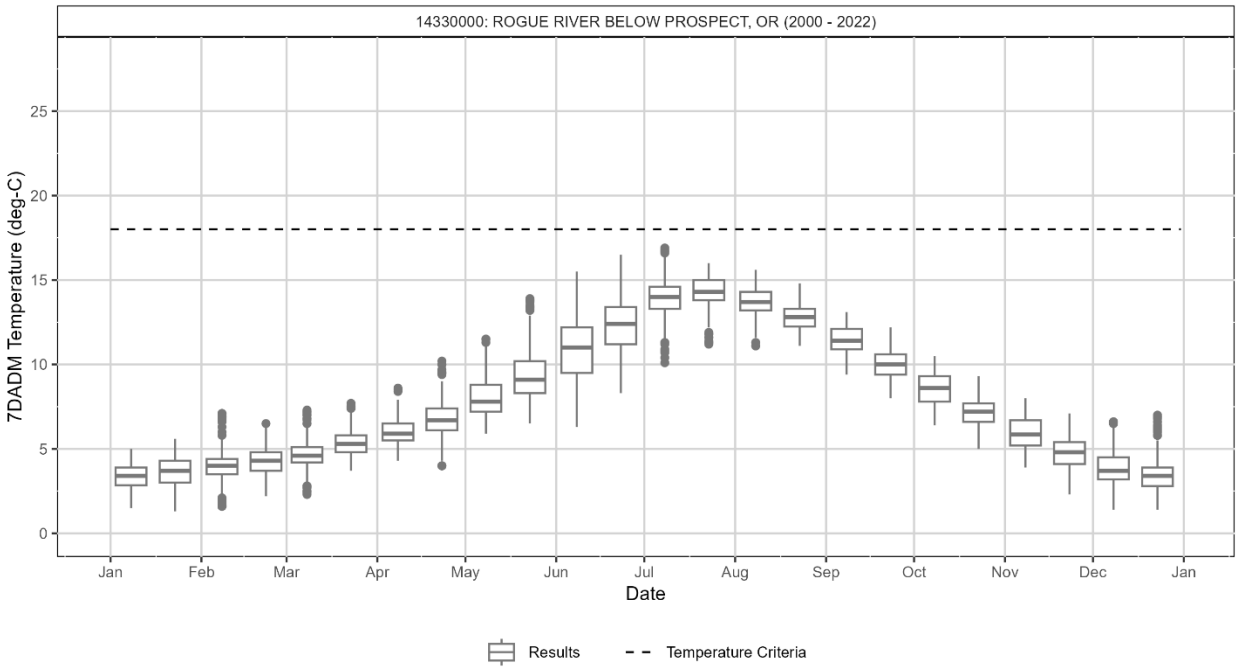


Figure 5-22: Seasonal variation in 7DADM temperature at the Rogue River below Prospect, OR monitoring site in the Headwaters Rogue River Watershed in the Upper Rogue Subbasin.

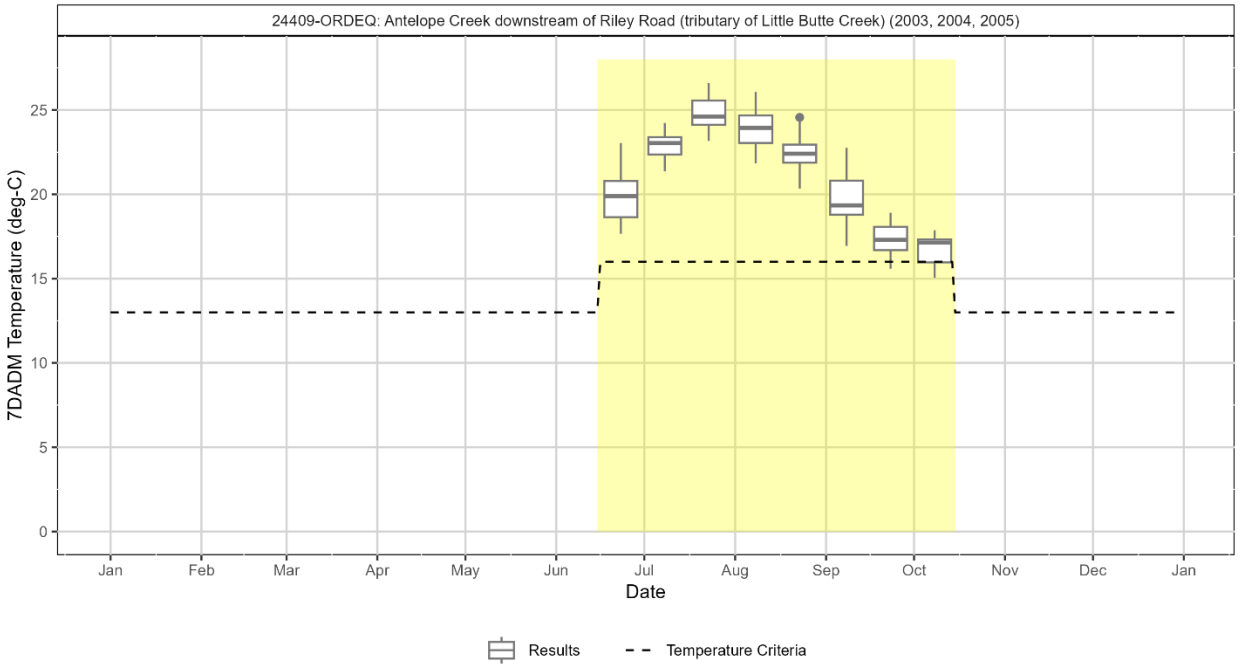


Figure 5-23: Seasonal variation in 7DADM temperature at the Antelope Creek downstream of Riley Road monitoring site in the Upper Rogue Subbasin.

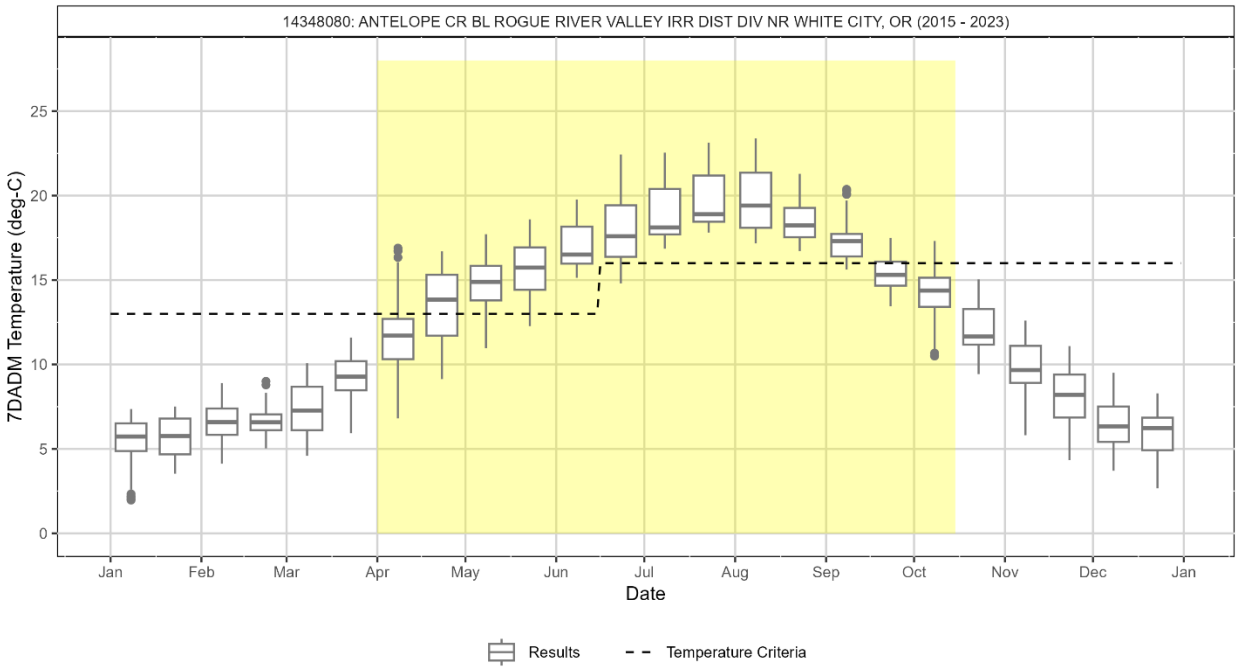


Figure 5-24: Seasonal variation in 7DADM temperature at the Antelope Creek near White City, OR monitoring site in the Upper Rogue Subbasin.

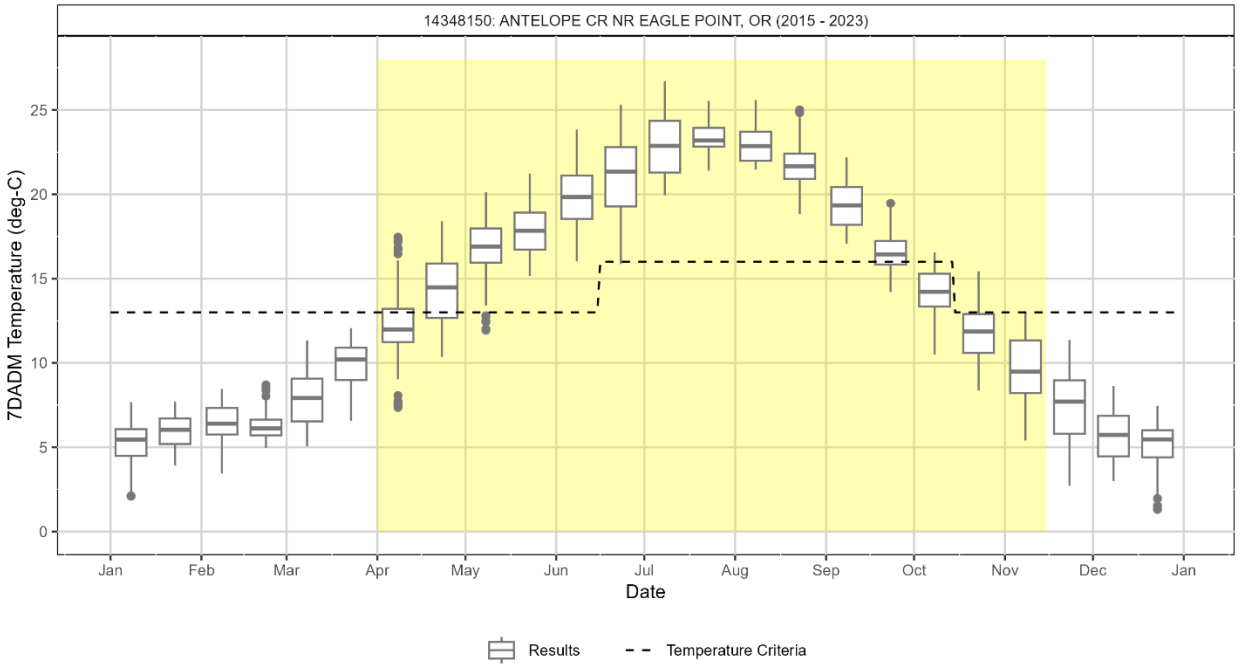


Figure 5-25: Seasonal variation in 7DADM temperature at the Antelope Creek near Eagle Point, OR monitoring site in the Upper Rogue Subbasin.

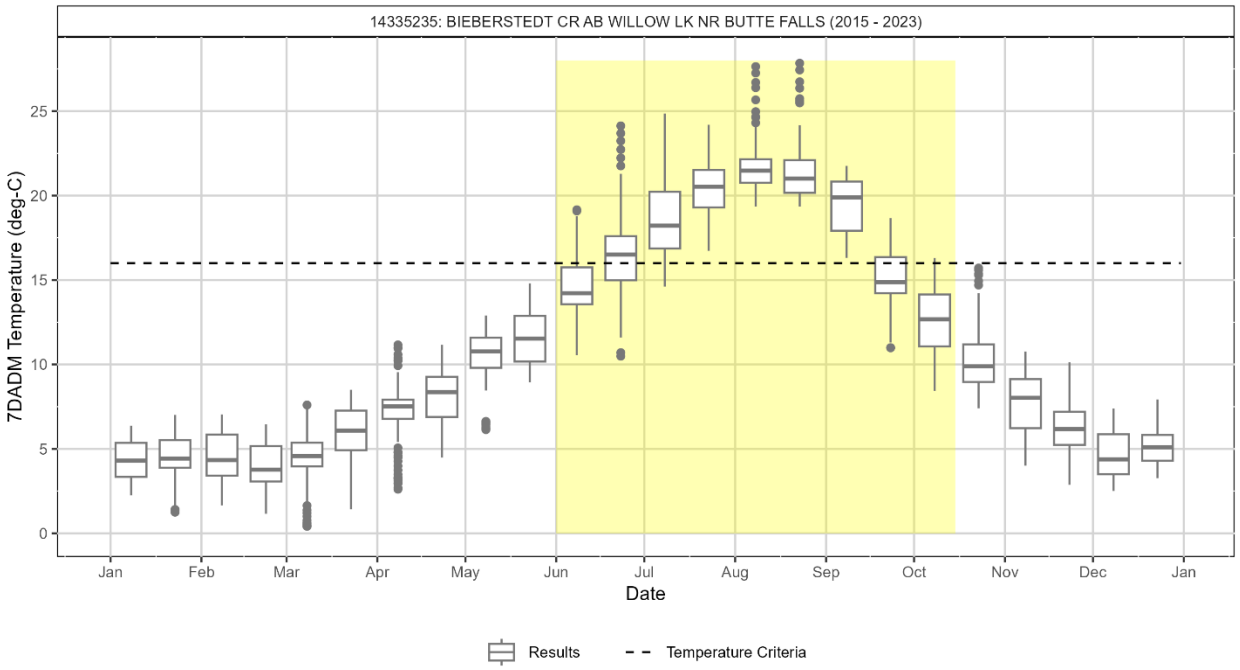


Figure 5-26: Seasonal variation in 7DADM temperature at the Bieberstedt Creek near Butte Falls, OR monitoring site in the Upper Rogue Subbasin.

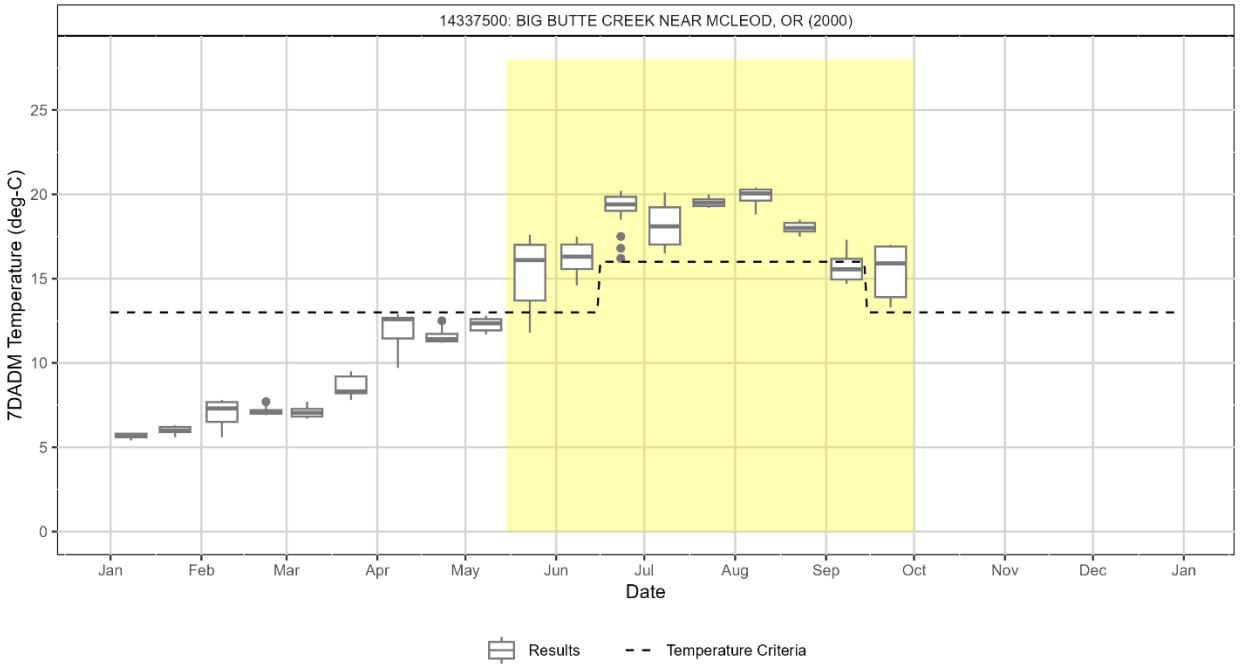


Figure 5-27: Seasonal variation in 7DADM temperature at the Big Butte Creek near McLeod, OR monitoring site in the Upper Rogue Subbasin.

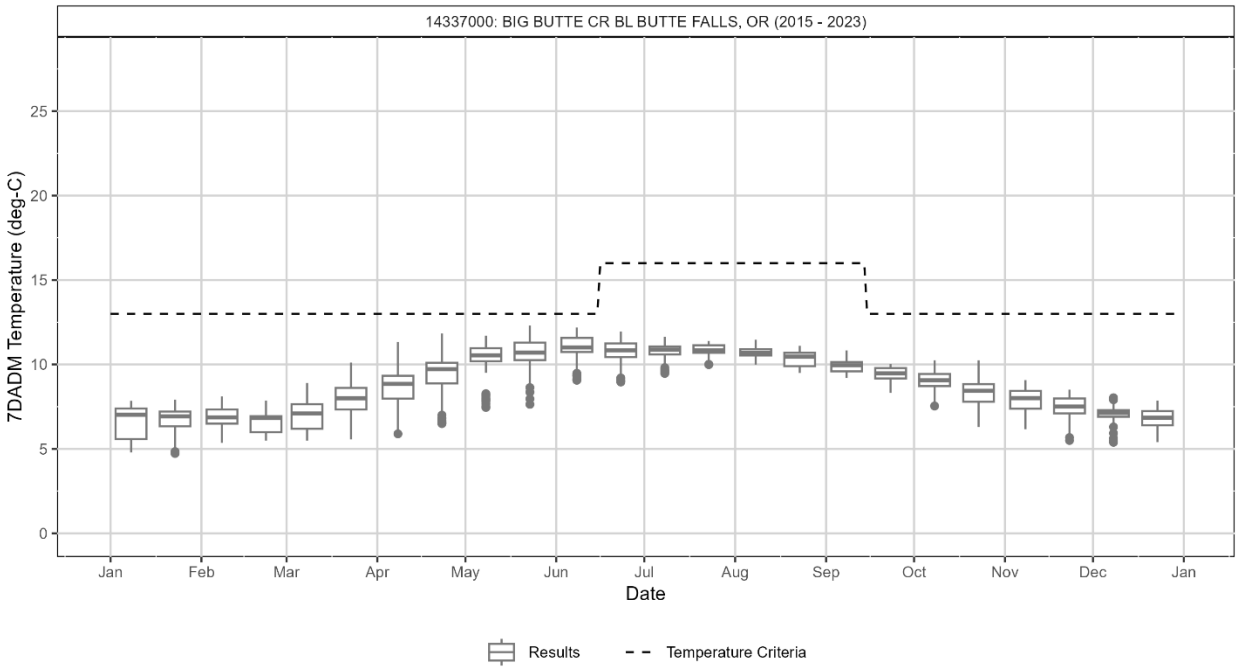


Figure 5-28: Seasonal variation in 7DADM temperature at the Big Butte Creek below Butte Falls, OR monitoring site in the Upper Rogue Subbasin.

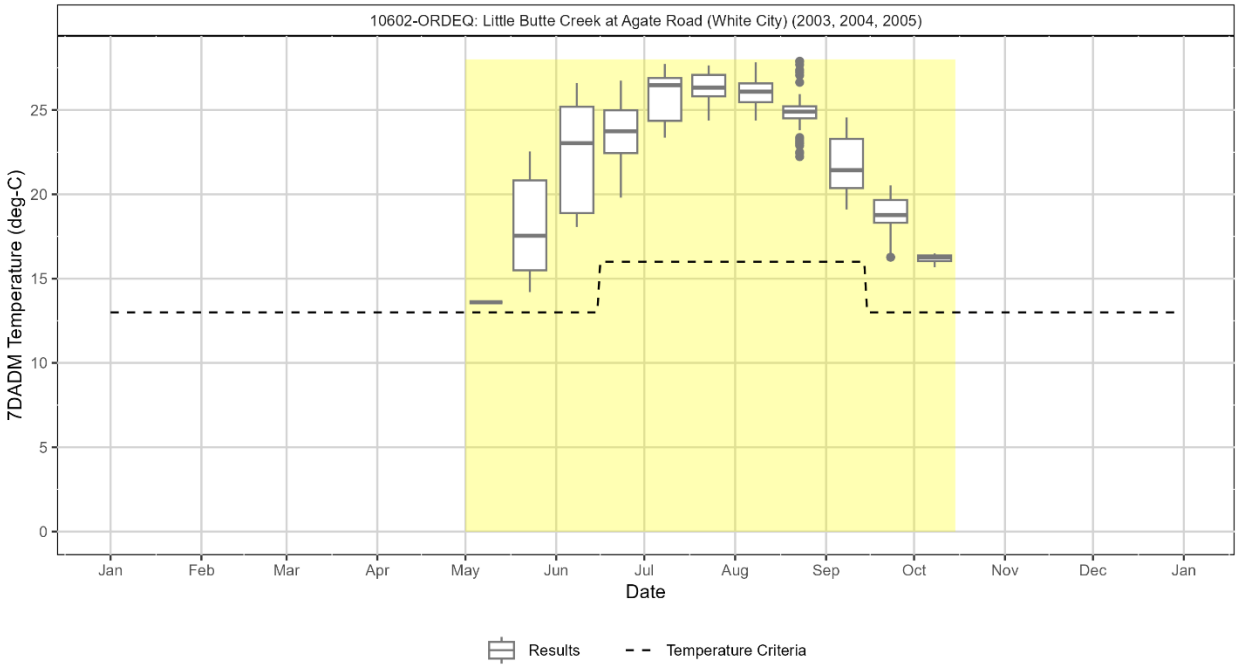


Figure 5-29: Seasonal variation in 7DADM temperature at the Little Butte Creek at Agate Road monitoring site in the Upper Rogue Subbasin.

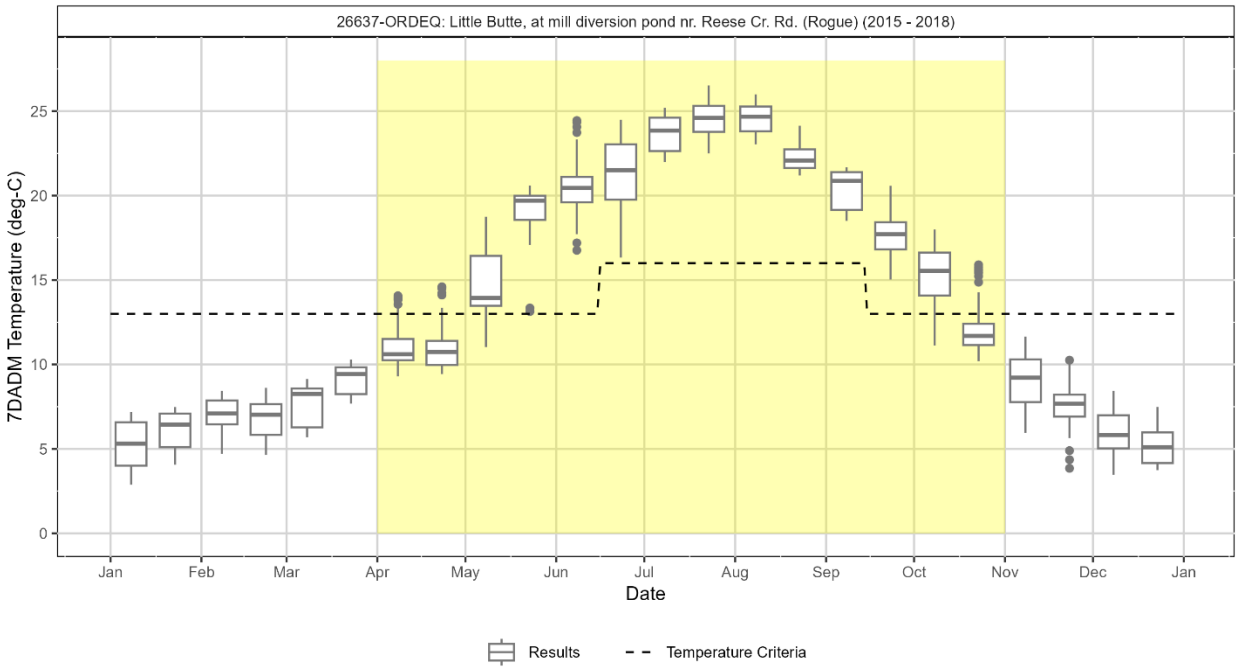


Figure 5-30: Seasonal variation in 7DADM temperature at the Little Butte Creek near Reese Creek Road monitoring site in the Upper Rogue Subbasin.

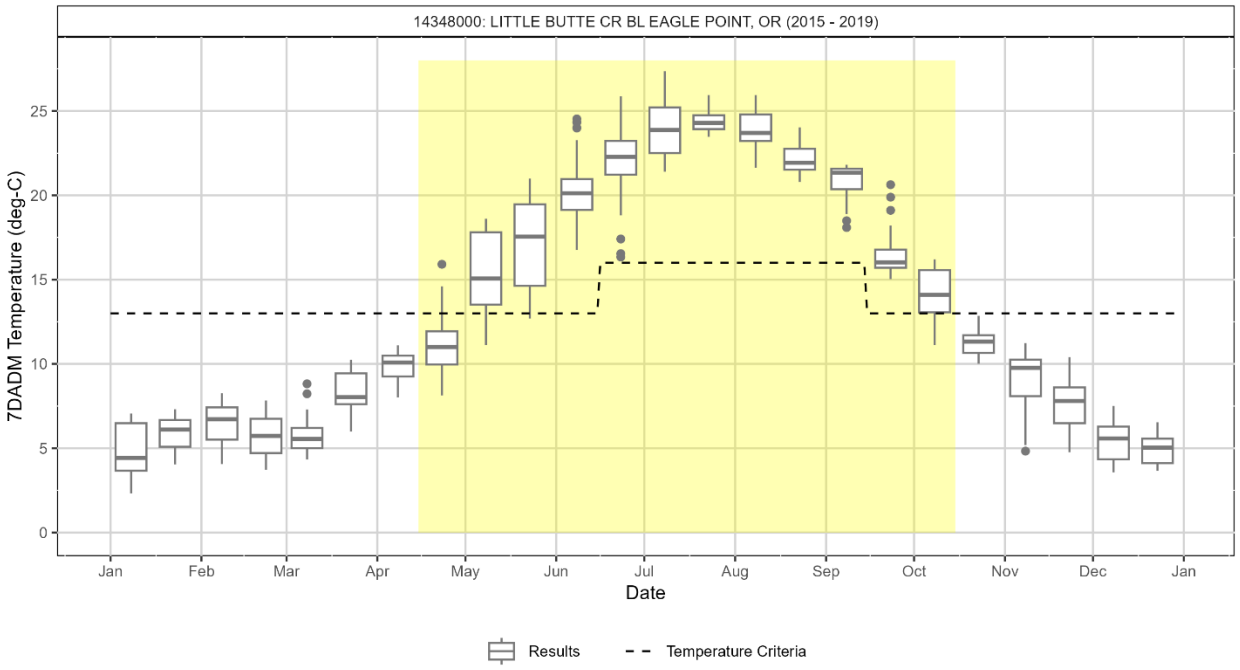


Figure 5-31: Seasonal variation in 7DADM temperature at the Little Butte Creek below Eagle Point, OR monitoring site in the Upper Rogue Subbasin.

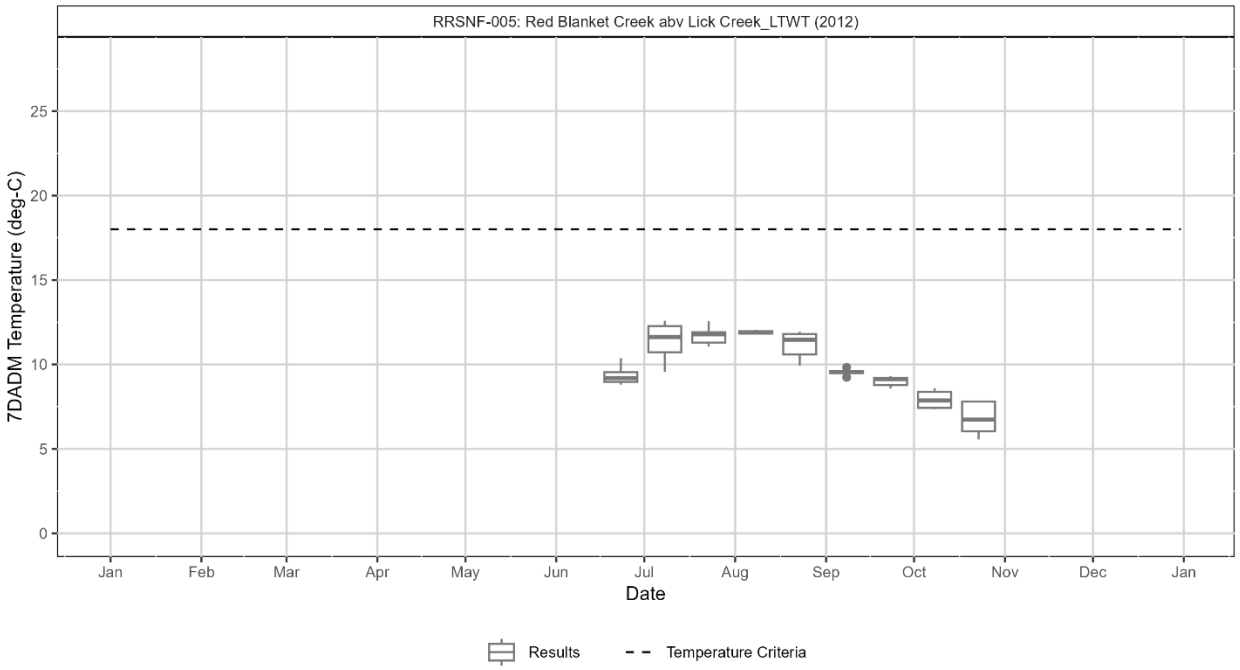


Figure 5-32: Seasonal variation in 7DADM temperature at the Red Blanket Creek above Lick Creek monitoring site in the Upper Rogue Subbasin.

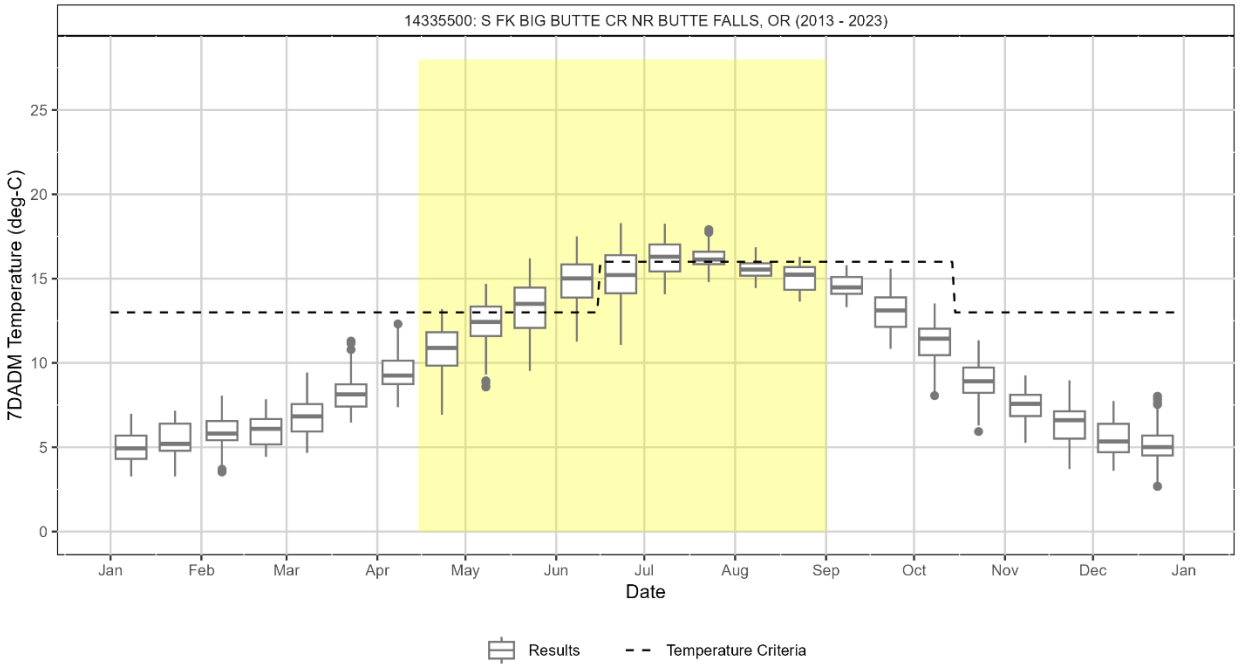


Figure 5-33: Seasonal variation in 7DADM temperature at the South Fork Big Butte Creek near Butte Falls, OR monitoring site in the Upper Rogue Subbasin.

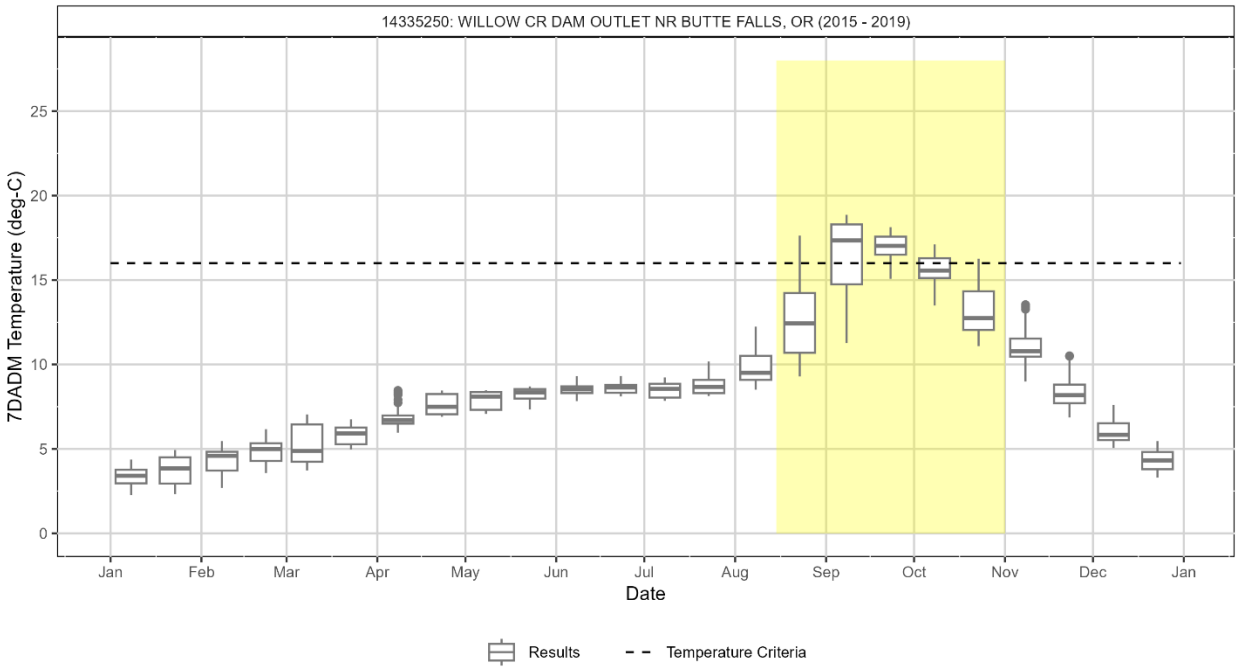


Figure 5-34: Seasonal variation in 7DADM temperature at the Willow Creek dam outlet monitoring site in the Upper Rogue Subbasin.

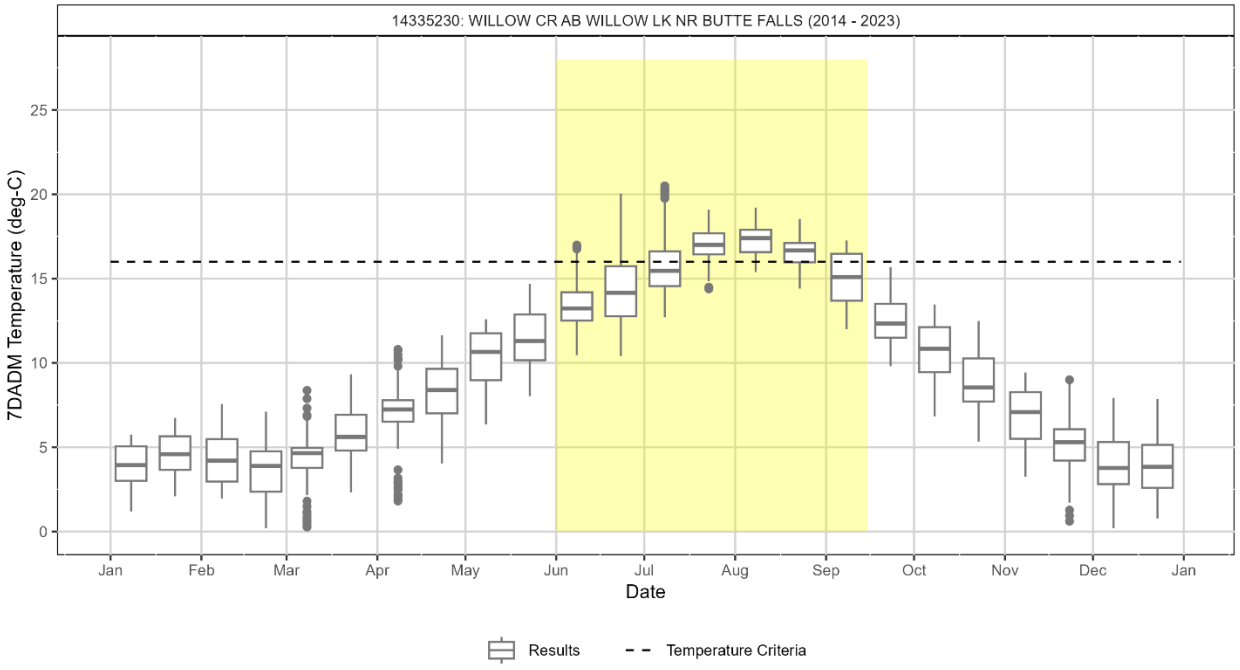


Figure 5-35: Seasonal variation in 7DADM temperature at the Willow Creek above Willow Lake monitoring site in the Upper Rogue Subbasin.

6. Temperature water quality data evaluation and analyses

Refer to the [final date] Rogue River Basin TMDL (OAR ….) for a description of the TMDL water quality analyses completed for the TMDL, including an overview of the water quality model. A description of the critical ambient stream flows used for these analyses is below.

6.1 The 7Q10 low-flow statistic

The "7Q10" is a summary low-flow statistic equal to the lowest seven-day average flow that occurs once every ten years (on average). The 7Q10 is considered the critical low flow and used to calculate numeric loading capacities and allocations. DEQ calculated annual 7Q10s for each temperature-impaired assessment unit (Table 6-1) and for the receiving waterbodies that have NPDES-permitted discharges with a WLA (Table 6-2).

The 7Q10 estimates were based on the following approaches:

1. If sufficient daily mean flow data from USGS or OWRD gaging stations were available for a given waterbody, 7Q10 estimates were calculated using these data. Available flow data were retrieved for up to a 30-year period (typically October 1, 1992 to September 30, 2022). DEQ relied on quality control protocols implemented by USGS and OWRD. Only data with a result status of "Approved" (USGS) or "Published" (OWRD) were included in 7Q10 calculations. 7Q10s were calculated by the method of EPA's DFLOW program (Rossman, 1990), which computes extreme design flows using the log-Pearson Type III probability distribution. A minimum of 10 years of flow data were used with some exceptions. Annual periods were defined by the water year (Oct 1 – Sept 30). For some ungaged reaches, it was possible to estimate the daily mean flow using nearby gages located upstream, downstream, or on tributaries. The daily mean flows at the ungaged reach were estimated by summing or subtracting the daily mean flows from the gaged locations as appropriate. For example, the daily mean flow on a mainstem river downstream of a major tributary is not gaged but can be estimated by summing the daily mean flow from a gage on the tributary and a gage on the mainstem river upstream of the major tributary. Flow records needed to be available from all gages on the same day, otherwise the flow rate on that day was recorded as missing. Daily mean flows for the ungaged reach were calculated first, prior to the 7Q10 calculation using DFLOW.

2. If insufficient daily mean flow data from USGS and OWRD stream flow gaging stations were available, the web-based tool StreamStats (USGS, 2019) was used to estimate 7Q10s. The 7Q10s are reported with the same level of significant figures as the values calculated using the gage method, except for values equal to or greater than 1000 cfs, which are reported to three significant figures. Details of StreamStats are described below.

3. 7Q10s calculated and reported elsewhere (e.g., consultant studies, water quality permits, TMDLs) may have been used. In such cases, DEQ relied on the source's data quality and reported the values as they were provided.

StreamStats version 4 is a web-based GIS application developed by the USGS. StreamStats has a map-based interface that allows the user to determine drainage area delineations, basin characteristics, and estimates of stream flow statistics for user-selected locations along available streams. The program also provides users with access to stream monitoring data by selecting USGS data-collection stations in the map application and providing access to flow statistics and other information for the stations. StreamStats provides estimates of various stream flow statistics for user-selected sites by solving site-specific regression equations. The regression equations were developed through a process, known as regionalization, which involves use of regression analysis to relate stream flow statistics computed for a group of selected stream gages (usually within a state) to basin characteristics measured for the stream gages. Basin characteristics are used to obtain estimates of the stream flow statistics for ungaged sites.

StreamStats regression equations for Oregon were developed by Cooper (2005) and Risley et al. (2008). These equations were based on basin characteristics and flow statistics (e.g., historical percentile flow-exceedance values and annual and monthly 7Q10). Flow statistics were computed at 466 gaging stations across Oregon and proximal out-of-state areas. This study area was divided into 10 regions based on ecological, topographic, geologic, hydrologic, and climatic criteria. StreamStats includes 910 annual and monthly regression equations to estimate 7Q10s for ungaged stream sites in the 10 aforementioned regions. These equations were developed for unregulated streams (without major dams, constructed reservoirs, catchment development, or significant diversions/withdrawals). If the equations are applied to ungaged streams subject to such influences, the resultant estimates may require adjustment to approximate actual flows.

The StreamStats user selects a stream location of interest and the program estimates the associated drainage area and summary flow statistics. For this TMDL, DEQ's procedure specified that selected stream locations should be the most downstream location on each stream for which DEQ required flow estimates; the exception was if DEQ required 7Q10 estimates for NPDES permitted point source receiving waters, in which case the selected stream location was immediately upstream of the point source outfall. StreamStats also estimates basin characteristics for the selected catchment, including drainage area, mean annual precipitation, mean slope, and climatic characteristics (Cooper, 2005; Risley et al., 2008). If estimates are outside suggested parameter ranges, the warning message "extrapolated with uncertainty" appears in the StreamStats report.

Table 6-1: Annual 7Q10 estimates for category 5 impaired assessment units in the Rogue R. Basin.

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_EB_1710031008_01_100280	2120	StreamStats	42.421, -124.429	
OR_LK_1710030801_02_100256	3.14	StreamStats	42.157, -122.718	
OR_LK_1710030801_02_100257	0.84	StreamStats	42.161, -122.606	
OR_LK_1710030901_02_100274	42.8	StreamStats	42.055, -123.116	
OR_SR_1710030701_02_105457	0.00	StreamStats	42.996, -122.397	
OR_SR_1710030701_02_105460	4.41	StreamStats	42.859, -122.51	
OR_SR_1710030701_02_105469	217	StreamStats	42.988, -122.397	
OR_SR_1710030704_02_105476	16.4	USGS Gage #14335200	42.521, -122.486	1992-10-01 ~ 2017-09-30
OR_SR_1710030704_02_105477	33.1	USGS Gage #14335500	42.54, -122.555	1992-10-01 ~ 2017-09-30
OR_SR_1710030704_02_105477	28.9	USGS Gage #14337500	42.651, -122.691	1994-10-01 ~ 2024-09-30

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_SR_1710030704_02_105477	32.5	USGS Gage #14337000	42.56, -122.579	2015-01-01 ~ 2018-09-30
OR_SR_1710030704_02_105478	1.42	StreamStats	42.559, -122.578	
OR_SR_1710030704_02_105480	2.41	StreamStats	42.466, -122.439	
OR_SR_1710030705_02_105482	0.31	USGS Gage #14337870	42.711, -122.75	1992-10-01 ~ 2000-09-29
OR_SR_1710030705_02_105484	4.03	StreamStats	42.776, -122.665	
OR_SR_1710030705_02_105485	0.32	USGS Gage #14338000	42.679, -122.742	1992-10-01 ~ 2022-09-30
OR_SR_1710030705_02_105489	1.44	StreamStats	42.777, -122.665	
OR_SR_1710030705_02_105490	0.52	StreamStats	42.801, -122.672	
OR_SR_1710030705_02_105491	1.48	StreamStats	42.797, -122.64	
OR_SR_1710030707_04_105507	869	USGS Gage #14339000	42.525, -122.843	1992-10-01 ~ 2022-09-30
OR_SR_1710030708_02_105508	18.7	StreamStats	42.382, -122.579	
OR_SR_1710030708_02_105509	0.49	StreamStats	42.459, -122.831	
OR_SR_1710030708_02_105510	0.00	StreamStats	42.421, -122.622	
OR_SR_1710030708_02_105511	5.87	StreamStats	42.42, -122.615	
OR_SR_1710030708_02_105513	0.00	StreamStats	42.38, -122.625	
OR_SR_1710030708_02_105515	17.8	StreamStats	42.338, -122.625	
OR_SR_1710030708_02_105519	0.21	StreamStats	42.311, -122.656	
OR_SR_1710030708_02_105520	2.25	StreamStats	42.338, -122.453	
OR_SR_1710030708_02_105521	18.4	StreamStats	42.451, -122.874	
OR_SR_1710030708_02_105522	29.0	StreamStats	42.421, -122.621	
OR_SR_1710030801_02_105532	6.57	StreamStats	42.248, -122.779	
OR_SR_1710030801_02_105533	0.00	StreamStats	42.315, -122.984	
OR_SR_1710030801_02_105534	0.00	StreamStats	42.412, -122.942	
OR_SR_1710030801_02_105537	0.00	StreamStats	42.231, -122.754	
OR_SR_1710030801_02_105538	0.00	StreamStats	42.314, -122.851	
OR_SR_1710030801_02_105539	0.90	StreamStats	42.217, -122.614	
OR_SR_1710030801_02_105540	0.29	StreamStats	42.115, -122.54	
OR_SR_1710030801_02_105541	0.12	StreamStats	42.102, -122.531	
OR_SR_1710030801_02_105542	0.00	StreamStats	42.13, -122.567	
OR_SR_1710030801_02_105545	0.093	StreamStats	42.23, -122.793	
OR_SR_1710030801_02_105548	1.94	StreamStats	42.215, -122.715	
OR_SR_1710030801_02_105550	2.61	StreamStats	42.194, -122.666	
OR_SR_1710030801_02_105551	1.23	StreamStats	42.193, -122.651	
OR_SR_1710030801_02_105823	0.00	StreamStats	42.193, -122.64	
OR_SR_1710030801_02_105824	0.41	StreamStats	42.138, -122.576	
OR_SR_1710030801_05_105552	6.12	USGS Gage #14354200	42.216, -122.722	1992-10-01 ~ 2022-04-18
OR_SR_1710030802_02_105555	0.00	StreamStats	42.407, -123.151	
OR_SR_1710030802_02_105560	0.00	StreamStats	42.433, -123.072	
OR_SR_1710030802_04_105816	956	USGS Gage #14359000	42.437, -122.987	1992-10-01 ~ 2022-09-30
OR_SR_1710030803_02_105573	0.29	StreamStats	42.543, -123.167	
OR_SR_1710030803_02_105574	0.67	StreamStats	42.661, -123.097	

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_SR_1710030803_02_105576	0.40	StreamStats	42.656, -122.947	
OR_SR_1710030803_02_105577	0.000	StreamStats	42.662, -123.051	
OR_SR_1710030803_02_105578	0.026	StreamStats	42.649, -123.043	
OR_SR_1710030803_02_105579	0.36	StreamStats	42.653, -123.052	
OR_SR_1710030803_02_105580	0.000	StreamStats	42.653, -123.036	
OR_SR_1710030803_02_105581	0.73	StreamStats	42.652, -123.053	
OR_SR_1710030803_02_105583	0.79	StreamStats	42.594, -123.014	
OR_SR_1710030803_02_105584	0.22	StreamStats	42.662, -123.049	
OR_SR_1710030803_02_105589	0.000	StreamStats	42.619, -123.044	
OR_SR_1710030803_02_105795	5.64	StreamStats	42.434, -123.175	
OR_SR_1710030804_02_105594	0.000	StreamStats	42.419, -123.22	
OR_SR_1710030804_04_106341	955	USGS Gage #14361500	42.43, -123.318	1992-10-01 ~ 2022-09-30
OR_SR_1710030902_02_105598	0.030	StreamStats	42.152, -123.055	
OR_SR_1710030902_02_105599	80.0	USGS Gage #14362000	42.064, -123.111	1993-10-01 ~ 2023-09-30
OR_SR_1710030902_02_105600	0.032	StreamStats	42.12, -123.083	
OR_SR_1710030902_02_105603	32.8	StreamStats	42.198, -123.046	
OR_SR_1710030903_02_105605	0.49	StreamStats	42.131, -122.959	
OR_SR_1710030903_02_105611	0.000	StreamStats	42.172, -122.997	
OR_SR_1710030904_02_105616	0.000	StreamStats	42.252, -123.156	
OR_SR_1710030904_02_105618	71.4	USGS Gage #14366000	42.242, -123.14	1992-10-01 ~ 2022-09-30
OR_SR_1710030904_02_105624	0.000	StreamStats	42.282, -123.14	
OR_SR_1710030905_02_105627	1.75	USGS Gage #14368300	42.231, -123.262	2014-10-01 ~ 2023-09-30
OR_SR_1710030905_02_106342	1.35	StreamStats	42.213, -123.274	
OR_SR_1710030906_02_104779	0.52	StreamStats	42.397, -123.458	
OR_SR_1710030906_02_106343	62.8	USGS Gage #14369500	42.354, -123.407	1992-10-01 ~ 2022-09-30
OR_SR_1710031001_02_104782	0.072	StreamStats	42.519, -123.444	
OR_SR_1710031001_02_104783	0.90	StreamStats	42.529, -123.497	
OR_SR_1710031001_02_106344	0.38	StreamStats	42.52, -123.426	
OR_SR_1710031001_02_106345	0.23	StreamStats	42.521, -123.424	
OR_SR_1710031002_02_104785	0.19	StreamStats	42.499, -123.489	
OR_SR_1710031002_04_104794	533	StreamStats	42.648, -123.585	
OR_SR_1710031003_02_104796	1.98	StreamStats	42.649, -123.584	
OR_SR_1710031003_02_104797	0.063	StreamStats	42.693, -123.397	
OR_SR_1710031003_02_104800	1.12	StreamStats	42.649, -123.479	
OR_SR_1710031003_02_104801	0.29	StreamStats	42.65, -123.481	
OR_SR_1710031003_02_104802	0.12	StreamStats	42.654, -123.57	
OR_SR_1710031003_02_104803	0.067	StreamStats	42.693, -123.397	
OR_SR_1710031003_02_106346	1.12	StreamStats	42.627, -123.347	
OR_SR_1710031003_02_106346	1.12	StreamStats	42.627, -123.347	
OR_SR_1710031004_02_104811	0.26	StreamStats	42.659, -123.637	
OR_SR_1710031004_04_104821	623	StreamStats	42.715, -123.883	
OR_SR_1710031005_04_106305	698	StreamStats	42.644, -124.047	

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_SR_1710031006_04_104637	1137	USGS Gage #14372300	42.578, -124.058	1992-10-01 ~ 2022-09-30
OR_SR_1710031008_04_104646	2080	StreamStats	42.461, -124.383	
OR_SR_1710031101_02_104822	4.03	StreamStats	42.128, -123.614	
OR_SR_1710031103_02_104825	4.68	USGS Gage #14372500	42.069, -123.626	1992-10-01 ~ 2023-09-30
OR_SR_1710031103_02_104827	19.4	StreamStats	42.16, -123.659	
OR_SR_1710031103_02_104828	12.8	StreamStats	42.129, -123.615	
OR_SR_1710031104_02_104831	9.30	StreamStats	42.063, -123.707	
OR_SR_1710031104_02_104831	9.30	StreamStats	42.063, -123.707	
OR_SR_1710031104_02_104831	9.30	StreamStats	42.063, -123.707	
OR_SR_1710031104_02_104832	21.8	StreamStats	42.159, -123.658	
OR_SR_1710031105_02_104834	2.85	StreamStats	42.276, -123.592	
OR_SR_1710031105_02_104835	5.58	StreamStats	42.269, -123.687	
OR_SR_1710031105_02_104836	0.47	StreamStats	42.256, -123.572	
OR_SR_1710031105_02_104837	0.87	StreamStats	42.273, -123.625	
OR_SR_1710031106_02_104838	10.8	StreamStats	42.243, -123.684	
OR_SR_1710031106_02_104840	50.2	StreamStats	42.375, -123.808	
OR_SR_1710031106_02_104840	14.6	USGS Gage #14377100	42.232, -123.664	1993-10-01 ~ 2023-09-30
OR_SR_1710031107_02_104843	9.30	StreamStats	42.063, -123.707	
OR_SR_1710031108_02_104647	21.4	StreamStats	42.412, -124.014	
OR_SR_1710031108_02_104844	8.08	StreamStats	42.396, -123.901	
OR_SR_1710031108_02_106306	73.3	StreamStats	42.454, -124.002	
OR_SR_1710031109_02_104845	13.1	StreamStats	42.456, -123.884	
OR_SR_1710031109_02_104846	5.39	StreamStats	42.457, -123.884	
OR_SR_1710031109_02_106307	20.9	StreamStats	42.454, -124.001	
OR_SR_1710031110_02_106308	37.8	StreamStats	42.49, -124.011	
OR_SR_1710031111_02_104645	121	StreamStats	42.55, -124.066	
OR_SR_1710031111_02_104648	33.3	StreamStats	42.514, -124.039	
OR_WS_171003070102_02_105712	20.0	StreamStats	43.048, -122.351	
OR_WS_171003070107_02_105717	2.67	StreamStats	42.912, -122.462	
OR_WS_171003070110_02_105719	4.41	StreamStats	42.859, -122.51	
OR_WS_171003070404_02_105731	17.6	StreamStats	42.558, -122.578	
OR_WS_171003070404_02_105731	0.000	StreamStats	42.547, -122.573	
OR_WS_171003070405_02_105732	1.42	StreamStats	42.559, -122.575	
OR_WS_171003070405_02_105732	1.42	StreamStats	42.559, -122.577	
OR_WS_171003070406_02_105733	21.8	StreamStats	42.607, -122.668	
OR_WS_171003070408_02_105735	21.6	StreamStats	42.658, -122.695	
OR_WS_171003070501_02_105736	3.58	StreamStats	42.797, -122.64	
OR_WS_171003070501_02_105736	1.48	StreamStats	42.797, -122.641	
OR_WS_171003070503_02_105738	1.44	StreamStats	42.777, -122.665	
OR_WS_171003070505_02_105740	9.26	StreamStats	42.663, -122.755	
OR_WS_171003070802_02_105748	5.87	StreamStats	42.42, -122.615	
OR_WS_171003070803_02_105749	8.26	StreamStats	42.328, -122.381	
OR_WS_171003070805_02_105751	23.4	StreamStats	42.351, -122.473	

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_WS_171003070805_02_105751	5.02	StreamStats	42.282, -122.458	
OR_WS_171003070806_02_105752	17.0	StreamStats	42.418, -122.612	
OR_WS_171003070806_02_105752	17.9	StreamStats	42.385, -122.582	
OR_WS_171003070807_02_105753	24.1	StreamStats	42.438, -122.651	
OR_WS_171003070810_02_105756	0.48	StreamStats	42.428, -122.751	
OR_WS_171003080101_02_105759	0.41	StreamStats	42.138, -122.576	
OR_WS_171003080103_02_105761	1.23	StreamStats	42.194, -122.65	
OR_WS_171003080104_02_105762	0.15	StreamStats	42.194, -122.666	
OR_WS_171003080107_02_105765	5.99	StreamStats	42.247, -122.779	
OR_WS_171003080108_02_105766	0.085	StreamStats	42.247, -122.779	
OR_WS_171003080109_02_105767	6.71	StreamStats	42.285, -122.821	
OR_WS_171003080109_02_105767	0.00	StreamStats	42.282, -122.803	
OR_WS_171003080110_02_105768	5.99	StreamStats	42.395, -122.924	
OR_WS_171003080110_02_105768	0.00	StreamStats	42.316, -122.846	
OR_WS_171003080112_02_105770	6.12	StreamStats	42.432, -122.969	
OR_WS_171003080301_02_105777	0.79	StreamStats	42.594, -123.014	
OR_WS_171003080302_02_105778	0.73	StreamStats	42.652, -123.053	
OR_WS_171003080303_02_105804	2.18	StreamStats	42.594, -123.016	
OR_WS_171003080303_02_105804	0.000	StreamStats	42.639, -123.043	
OR_WS_171003080303_02_105804	0.000	StreamStats	42.653, -123.036	
OR_WS_171003080303_02_105804	0.000	StreamStats	42.476, -123.001	
OR_WS_171003080401_02_106354	373	StreamStats	42.426, -123.287	
OR_WS_171003090201_02_105784	373	StreamStats	42.426, -123.287	
OR_WS_171003090403_02_105791	41.4	StreamStats	42.255, -123.167	
OR_WS_171003090503_02_106358	1.86	StreamStats	42.294, -123.24	
OR_WS_171003090604_02_104861	0.51	StreamStats	42.396, -123.459	
OR_WS_171003100103_02_106361	0.23	StreamStats	42.521, -123.424	
OR_WS_171003100104_02_104864	0.90	StreamStats	42.529, -123.497	
OR_WS_171003100201_02_104865	481	StreamStats	42.528, -123.497	
OR_WS_171003100301_02_105794	1.07	StreamStats	42.649, -123.239	
OR_WS_171003100301_02_105794	0.039	StreamStats	42.643, -123.224	
OR_WS_171003100301_02_105794	0.078	StreamStats	42.705, -123.17	
OR_WS_171003100304_02_106363	0.29	StreamStats	42.65, -123.481	
OR_WS_171003100304_02_106363	0.063	StreamStats	42.693, -123.397	
OR_WS_171003100305_02_104871	1.98	StreamStats	42.648, -123.583	
OR_WS_171003100401_02_104872	584	StreamStats	42.659, -123.638	
OR_WS_171003100601_02_106319	21.3	StreamStats	42.572, -124.051	
OR_WS_171003100602_02_104676	5.46	StreamStats	42.635, -124.049	
OR_WS_171003110303_02_104903	19.4	StreamStats	42.16, -123.659	
OR_WS_171003110401_02_104911	5.09	StreamStats	42.034, -123.751	
OR_WS_171003110401_02_104911	21.8	StreamStats	42.159, -123.658	
OR_WS_171003110404_02_104885	27.2	StreamStats	42.088, -123.674	
OR_WS_171003110504_02_104890	5.58	StreamStats	42.269, -123.687	
OR_WS_171003110601_02_104915	0.38	StreamStats	42.201, -123.663	
OR_WS_171003110602_02_104891	10.8	StreamStats	42.243, -123.685	

AU ID	Annual 7Q10 (cfs)	Flow estimation method	Flow estimation latitude/ longitude	Gage period
OR_WS_171003110602_02_104891	10.8	StreamStats	42.243, -123.684	
OR_WS_171003110603_02_104892	0.14	StreamStats	42.294, -123.741	
OR_WS_171003110604_02_104893	50.2	StreamStats	42.374, -123.807	
OR_WS_171003110604_02_104893	5.43	StreamStats	42.304, -123.78	
OR_WS_171003110701_02_104894	1.63	StreamStats	42.403, -123.724	
OR_WS_171003110702_02_104895	4.89	StreamStats	42.376, -123.808	
OR_WS_171003110801_02_104896	55.4	StreamStats	42.402, -123.881	
OR_WS_171003110802_02_104897	8.08	StreamStats	42.396, -123.901	

Table 6-2: Annual 7Q10 low-flow estimates for instream locations that receive NPDES-permitted discharges with numeric wasteload allocations in this TMDL

Facility name (Facility number)	Stream	7Q10 (cfs)	Flow estimate data source	Flow estimate latitude/ longitude	Gage period
Ashland STP, Outfall 001 (3780)	Ashland Creek	1.94	StreamStats	42.214, -122.713	N/A
Ashland STP, Outfall 002 (3780)	Bear Creek	4.73	USGS #14354200	42.216, -122.722	1992-10-01 ~ 2022-04-18
Ashland WTP (3781)	Ashland Creek	2.74	StreamStats	42.169, -122.715	N/A
Biomass One, Limited Partnership (100110)	Military Slough	0	StreamStats	42.441, -122.89	N/A
Boise – Medford Plywood, Outfall 001 (9539)	Pipe to Elk Cr.	1.09	Permit	42.352, -122.902	N/A
Boise – Medford Plywood, Outfall 002, (9539)	Ditch to Mingus Cr. to Bear Cr.	0.167	Permit	42.361, -122.907	N/A
Butte Falls STP (12800)	S. Fork Big Butte Cr.	33.1	USGS #14335500	42.540, -122.555	1992-10-01 ~ 2017-09-30
Cascade Wood Products – White City (101757)	Military Slough	0	StreamStats	42.442, -122.856	N/A
Cave Juncton Wastewater Treatment Facility (15243)	Illinois River	148	Permit	42.232, -123.664	N/A
Country View Mobile Home Estates (96385)	Cusick Creek	0	StreamStats	42.636, -122.814	N/A
Fleming Middle School STP (29920)	Unnamed Stream	0.00	StreamStats	42.508, -123.374	N/A
Gold Beach WTP (109728)	Rogue River	2070	StreamStats	42.465, -124.372	N/A
Gold Hill STP (33901)	Rogue River	968.6	USGS #14359000	42.437, -122.987	1992-10-01 ~ 2022-09-30
Grants Pass STP (34630)	Rogue River	962	USGS #14361500	42.43, -123.318	1992-10-01 ~ 2022-09-30
Grants Pass WTP (35631)	Skunk Creek	0	StreamStats	42.432, -123.321	N/A
Harry And David (37200)	Ditch to Bear Creek	0.00	StreamStats	42.306, -122.845	N/A
Hidden Valley High School STP (38625)	Applegate River	60.5	USGS #14369500	42.354, -123.407	1992-10-01 ~ 2022-09-30
Medford RWRF (55125)	Rogue River	948	USGS #14359000 - 14358800	42.437, -122.987	1992-10-01 ~ 2022-09-30
ODFW - Cole M. Rivers Hatchery (64445)	Rogue River	502	14335072	42.666, -122.686	2011-12-16 ~ 2023-09-30
ODVA – Southern Oregon Rehabilitation Center and Clinics (117435)	Military Slough	0.00	StreamStats	42.442, -122.856	N/A
Pacific Power & Light Company – Eagle Point (66600)	Tributary to Nichols Branch	0.0	StreamStats	42.514, -122.758	N/A
Pacific Power & Light Company – Prospect Plant #1 (66620)	Rogue River	539	USGS #14328000	42.775, -122.500	1994-10-01 ~ 2023-12-31

Facility name (Facility number)	Stream	7Q10 (cfs)	Flow estimate data source	Flow estimate latitude/ longitude	Gage period
Pacific Power & Light Company – Prospect Plant #2 (66622)	Rogue River	539	USGS #14328000	42.775, -122.500	1994-10-01 ~ 2023-12-31
Pacific Power & Light Company – Prospect Plant #3 (66624)	Middle Fork Canal	14	Facility-provided data	42.732, -122.417	2014-10-01 ~ 2024-09-30
Pacific Power & Light Company – Prospect Plant #4 (66626)	Rogue River	539	USGS #14328000	42.775, -122.500	1994-10-01 ~ 2023-12-31
Riviera Mobile Park (75500)	Rogue River	962	USGS #14361500	42.430, -123.318	1992-10-01 ~ 2022-09-30
Robert A. Duff WTP (55370)	Rogue River	948	USGS #14359000 - 14358800	42.437, -122.987	1992-10-01 ~ 2022-09-30
Rogue River STP (76030)	Rogue River	969	USGS #14359000	42.437, -122.987	1992-10-01 ~ 2022-09-30
Shady Cove STP (80535)	Rogue River	887	USGS #14339000	42.525, -122.843	1992-10-01 ~ 2022-09-30
U.S Army Corp of Engineers - William L. Jess Dam Project (126718)	Rogue River	502	USGS #14335072	42.666, -122.686	2011-12-16 ~ 2023-09-30

7. Sources or source categories

A key element of TMDL development is a complete, comprehensive source assessment for the relevant water quality pollutant(s). This includes identification of all relevant point and nonpoint sources to the impaired waterbody, characterization/quantification of their pollutant load contributions, determination of seasonal variation, and delineation of periods when applicable temperature criteria are exceeded at various locations, to the extent that existing data allow. The TMDL report and its appendices describe the significant thermal pollutant sources identified within the Rogue Basin temperature TMDL area and the data sources that DEQ utilized for TMDL modeling.

The various source categories are discussed in Sections 7.1 and 7.2 below.

7.1 Point sources

Point sources in the basin are generally required to obtain coverage under either an individual or a general National Pollutant Discharge Elimination System (NPDES) permit. Most individual and some general NPDES permittees were identified as sources of thermal loading to waters in the Rogue Basin and were assigned thermal wasteload allocations. DEQ's individual facility-specific thermal load assessments are documented in Section 9.1.6.1.

For stormwater discharges authorized under general and individual permits, DEQ determined that such discharges are unlikely to contribute to exceedances of the temperature standard. The same is true for landfill leachate discharges. Therefore, no additional TMDL requirements are needed for stormwater and landfill leachate sources to control temperature, other than those included in the existing NPDES permits.[1] The determination for stormwater discharges is based on a DEQ review of published literature and other studies related to stormwater runoff and stream temperature in Oregon. The substantive findings of the literature review are summarized below.

A review of available studies from the midwestern and eastern United States indicated that, under certain conditions, runoff from impervious pavement or runoff retained in uncovered open ponds can produce short-duration warm discharges (Herb et. al., 2008; Jones and Hunt, 2009; UNH Stormwater Center, 2011; Winston et al., 2011; Hester and Bauman, 2013). Yet, runoff temperature changes are highly dependent on many factors including air temperature, dewpoint, seasonal precipitation patterns, pavement type, percent imperviousness, and the amount of impervious surface shielded from solar radiation (Nelson and Palmer, 2007; Herb et al., 2008; Thompson et al., 2008; Winston et al., 2011; Jones et al., 2012; Sabouri et al., 2013; Zeiger and Hubbert, 2015). When they occur, such warmed runoff discharges can create "surges" associated with typically short-duration stream temperature increases (Hester and Bauman, 2013; Wardynski et al., 2014; Zeiger and Hubbert, 2015). However, studies that evaluated stormwater discharges over longer (e.g., 7-day) averaging periods such as those used in assessing TMDL attainment (i.e., 7DADM) did not indicate exceedances above biologically-based benchmarks (Wardynski et al., 2014; WDOE, 2011a and 2011b).

Additionally, DEQ evaluated rainfall, cloud cover, air temperature, and stream temperature data from warm seasons for three years in the Miles Creeks area of the Middle Columbia-Hood

[1] ODOT has a state-wide Municipal Separate Storm Sewer System (MS4) NPDES permit that also does require additional TMDL requirements.

Subbasin (DEQ, 2008b). DEQ concluded that stormwater discharges likely do not contribute to temperature standard exceedances in the study area. This is because (1) the standard is based on 7DADM temperatures such that a majority of days within each 7-day period would need have precipitation-runoff influences to affect the 7DADM, (2) exceedances are assessed for the critical summer period, and (3) 95% of summer time 7-day periods had fewer than 3 days of rain, while 80% had less than one day of rain. Thus, there are generally not enough runoff events to significantly influence 7DADMs for temperature in the critical period of this TMDL.

7.1.1 Individual NPDES permitted point sources

There are 17 domestic or industrial facilities with individual NPDES permits in the Rogue Basin. Fifteen of these permitted facilities were identified as potential sources of thermal load[2] (**Table 7-1** and **Figure 7-1**). The point sources covered by individual NPDES permits that only discharge stormwater and/or landfill leachate water are listed in **Table 7-2**. As noted above, DEQ determined that these discharges do not have potential to discharge thermal loads that contribute to exceedances of applicable temperature criteria. Therefore, no additional TMDL requirements are needed for these two sources to control temperature, other than those included in the current individual NPDES permits. More specific thermal wasteload allocations can be considered if subsequent data and evaluation demonstrate a need and if reserve capacity is available.

Table 7-1: Individual NPDES permitted point source discharges that have the potential to contribute thermal loads to Rogue Basin streams at a frequency and magnitude to cause exceedances to the temperature standard.

Permittee	Permit type	DEQ WQ file number	EPA number	Receiving water name (AU ID)	River mile
Ashland STP – Outfall 001	NPDES-DOM-C1a	3780	OR0026255	Ashland Creek (OR_SR_1710030801_02_105548)	0.32
Ashland STP – Outfall 002	NPDES-DOM-C1a	3780	OR0026255	Bear Creek (OR_WS_171003080110_02_105552)	22.8
Boise – Medford Plywood – Outfall 001	NPDES-IW-B19	9539	OR0000850	Elk Creek to Bear Creek (OR_WS_171003080110_02_105768)	8.5
Boise – Medford Plywood – Outfall 002	NPDES-IW-B19	9539	OR0000850	Mingus Creek to Bear Creek (OR_WS_171003080110_02_105768)	6.0
Butte Falls STP	NPDES-DOM-Da	12800	OR0029891	South Fork Big Butte Creek (OR_SR_1710030704_02_105477)	1.00
Cascade Wood Products – White City	NPDES-IW-B20	101757	OR0032786	Military Slough (OR_WS_171003080202_02_105815)	1.61
Cave Junction Wastewater Treatment Facility	NPDES-DOM-Da	15243	OR0028339	Illinois River (OR_SR_1710031106_02_104840)	54.36
Country View Mobile Home Estates	NPDES-DOM-Db	96385	OR0029661	Cusick Creek to Rogue River (OR_WS_171003070702_02_105745)	147.20
Fleming Middle School STP	NPDES-DOM-Da	29920	OR0028355	Harris Creek (OR_WS_171003100103_02_106361)	2.80
Gold Hill STP	NPDES-DOM-Da	33901	OR0022594	Rogue River (OR_SR_1710030802_04_105816)	118.50
Grants Pass STP	NPDES-DOM-C1a	34630	OR0028843	Rogue River (OR_SR_1710030804_04_106341)	100.90
Hidden Valley High School STP	NPDES-DOM-Da	38625	OR0030210	Applegate River (OR_SR_1710030906_02_106343)	12.50

[2] Two of these facilities each have two separate discharge outfalls.

Permittee	Permit type	DEQ WQ file number	EPA number	Receiving water name (AU ID)	River mile
Medford RWRF	NPDES-DOM-A3	55125	OR0026263	Rogue River (OR_SR_1710030802_04_105816)	130.50
Riviera Mobile Park	NPDES-DOM-Da	75500	OR0030546	Rogue River (OR_SR_1710030804_04_106341)	96.00
Rogue River STP	NPDES-DOM-Da	76030	OR0023043	Rogue River (OR_SR_1710030804_04_106341)	110.00
Shady Cove STP	NPDES-DOM-Da	80535	OR0030660	Rogue River (OR_SR_1710030707_04_105507)	142.49
U.S Army Corp of Engineers - William L. Jess Dam Project	NPDES-DOM-Da	126718	Not Assigned	Rogue River (OR_SR_1710030703_04_105475)	156.70

Table 7-2: Individual NPDES permitted point sources that discharge stormwater and/or landfill leachate and do not have potential to contribute to exceedances of the applicable temperature criteria.

Permittee	Permit type	DEQ WQ file number	EPA number	Receiving water name (AU ID)	River mile
Allweather Wood, White City	NPDES-IW-B21	105365	OR0042391	Rogue River (OR_SR_1710030802_04_105816)	130.50
Valley View Landfill	NPDES-IW-B15	104019	OR0035441	Jeffery Creek (OR_WS_171003080107_02_105765)	1.41

Note: ODOT has a state-wide Municipal Separate Storm Sewer System (MS4) NPDES permit that also does require additional TMDL requirements.

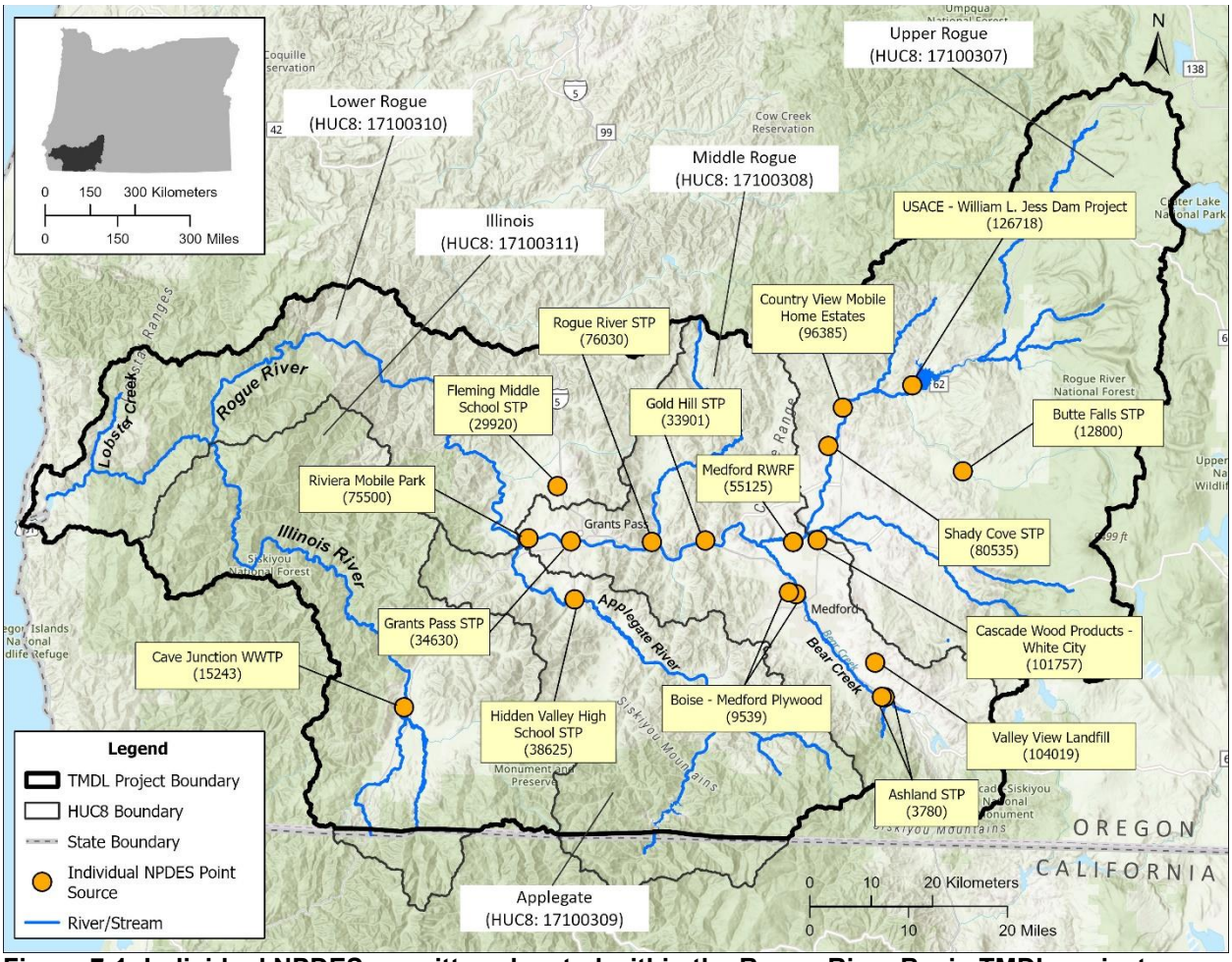


Figure 7-1: Individual NPDES permittees located within the Rogue River Basin TMDL project area.

7.1.2 General NPDES permitted point sources

There are multiple categories of general NPDES permit types in Oregon, including:

- 100-J Industrial Wastewater: NPDES cooling water (GEN01)
- 200-J Industrial Wastewater: NPDES filter backwash (GEN02)
- 300-J Industrial Wastewater: NPDES fish hatcheries (GEN03)
- 400-J Industrial Wastewater: NPDES log ponds (GEN04)
- 500-J Industrial Wastewater: NPDES boiler blowdown (GEN05)
- 700-PM Industrial Wastewater: NPDES suction dredges (GEN07PM)
- 1200-A Stormwater: NPDES sand & gravel mining (GEN12A)
- 1200-C and 1200-CA - Stormwater: NPDES construction more than 1 acre disturbed ground (GEN12C and GEN12CA)
- 1200-Z Stormwater: NPDES specific SIC codes (GEN12Z)
- 1500-A Industrial Wastewater: NPDES petroleum hydrocarbon cleanup (GEN15Z)
- 1700-A Industrial Wastewater: NPDES wash water (GEN17A)
- 2000-J and 2300-A Pesticide application (GEN20 and GEN23)
- CAFO Confined Animal Feeding Operations
- MS4 – Phase II – Stormwater: NPDES Municipal Separate Storm Sewer System (GEN40)

DEQ determined that, within the Rogue River Basin, the following general permit categories have potential to discharge thermal loads at a frequency and magnitude that contribute to exceedances of the applicable temperature criteria:

- 100-J Industrial Wastewater: NPDES cooling water
- 200-J Industrial Wastewater: NPDES filter backwash
- 300-J Industrial Wastewater: NPDES fish hatcheries

Discharges covered by certain industrial wastewater (400-J, 500-J, 700PM, 1500-A, 1700-A), stormwater, or other general NPDES permits (2000-J, 2300-A, and CAFO NPDES) will not contribute to exceedances of applicable temperature criteria and impact beneficial uses based on the permit requirements, available dilution, or frequency and magnitude of discharge. Therefore, no additional TMDL requirements are needed for these sources to control temperature, other than those included in the NPDES permits. More specific wasteload allocations can be considered if subsequent data and evaluation demonstrate a need and if reserve capacity is available. Temperature impacts from these sources are limited, as follows:

- The 400-J permit applies to log ponds. The 400-J permit specifies that log ponds, during the critical period (May 1 -- October 31), may only discharge during unseasonably wet weather or other reasons beyond the control of the permittee.

- The 500-J permit applies to boiler blowdown discharge that does not exceed 40 gallons per minute. There are no active registrants of the 500-J in the Rogue River Basin.

- The 700PM permit applies to instream placer mining activities, including mobile gold mining activities. The 700PM permit provides conditions that are protective of temperature, including limitations on the size of permitted activities, particularly in areas identified as essential salmon habitat.

- The 1500-A permit (petroleum hydrocarbon cleanup permit) applies to surface water discharge of water contaminated with petroleum hydrocarbons from groundwater or surface water cleanup operations. The 1500-A permit is designed to minimize the discharge of petroleum products to surface water.

- The 1700-A permit regulates the washing of vehicles, equipment and structures from fixed and mobile washing operations. The 1700-A permit requires a temperature management plan to ensure that discharges do not cause measurable increases in stream temperatures.

- The 2300-A and 2000-J permits regulate pesticide applications in, over, or near water from the use of biological pesticides or chemical pesticides that leave a residue. 2300-A and 2000-J permits are designed to minimize the discharge of pesticides to surface water.

- CAFO NPDES General Permit No. 01-2016 applies to confined animal feeding operations (CAFOs). The permit specifies that CAFOs may only discharge during extreme rainfall events.

- Discussion of the potential temperature impacts from stormwater permittees is addressed in Section 7.1.1, above.

Discussions of the analyses pertaining to the 100-J, 200-J and 300-J general permit thermal impacts are included in Sections 7.1.2.1, 7.1.2.2, and 7.1.2.3, respectively.

7.1.2.1 100-J general permit - cooling water/heat pumps

The 100-J general permit, last renewed on April 15, 2024, covers discharges of non-contact cooling water, defrost water, heat pump transfer water, and cooling tower blowdown. Also included are cooling and sump water discharges from hydropower facilities. The relevant 100-J permit requirements are summarized in **Table 7-3**.

Table 7-3: 100-J general permit requirements relevant for temperature.

Parameter	Limit	Notes
Effluent Flow	0.5 MGD daily maximum	No limit for hydropower facilities
Effluent Temperature	32°C daily maximum 13.3°C 7-day rolling average during periods where salmon and steelhead spawning is a designated use 9.3ºC 7-day rolling average during periods where bull trout spawning is a designated use	
Excess Thermal Load Limit	Q_{ed} * S_{MZ}* 1.14 (as a 7-day rolling average in million kcal/day)	See permit Table A1-1 and Table A2-1 equation terms
Thermal Load Limit	25 daily maximum = Flow (MGD) x Effluent Temperature (°F)	No limit for hydropower facilities

For both 100-J permit types (hydropower and non-hydropower), the permit includes an excess thermal load limit that is designed to allow a maximum of 0.075°C heating of the receiving water at full mix with the 7Q10 low flow of the receiving stream.[3] These facilities have reasonable potential to increase stream temperature and are therefore assigned a HUA. It should be noted that the actual temperature increase from 100-J registrants may be less than the maximum allowed under the permit.

7.1.2.2 200-J general permit - filter backwash

The 200-J general permit covers discharge or land application of filter backwash, settling basin, and reservoir cleaning waters which have been adequately treated prior to discharge. Flushing of raw water intakes after storm events and spring runoff is also allowed.

To determine if registrants have potential to increase stream temperature, DEQ reviewed discharge data for all 200-J permit registrants in the basin using available discharge monitoring reports (DMRs) and permit application information. Maximum effluent flows during the TMDL critical period varied for each facility and are listed in Table 7-4. Effluent temperatures are not reported on 200-J DMRs, so an estimate was developed from effluent temperatures reported on 200-J NPDES permit applications for discharges in the Willamette Basin. On these applications, the maximum summer temperatures ranged up to 23°C. The sampling frequency (grab or continuous) for these reported temperatures is unknown so, as a conservative estimate, a maximum effluent temperature of 24°C was used when year-round criteria apply and 17°C was used during spawning periods. The current 200-J permit requirement includes a 30:1 minimum dilution ratio between river and effluent flow. This dilution ratio was used to estimate the maximum

[3] See the 2024 100-J NPDES General permit, schedule A1.1 and A2.1, and the associated permit fact sheet, Section 8.3.

effluent flow under critical condition 7Q10 river flows. During periods of no flow, the 200-J permit does not authorize discharge. If the annual 7Q10 was zero, a river flow of 0.1 cfs was used to determine the maximum effluent flow. If the DMR or permit application reported maximum effluent flow less than the dilution-based effluent flow, the reported maximum effluent flow was used instead. An estimated change in temperature was calculated using the 7Q10 river flow, maximum reported or dilution-based effluent flow, the estimated effluent temperature, and applicable temperature criteria. Based on the results, some 200-J registrants have potential to increase stream temperatures up to an estimated maximum of 5.681°C above the year-round temperature criterion and 0.13°C above the spawning criterion (Table 7-4). The Cave Junction, Chavner, Shady Cove, and USFS Upper Applegate WTP discharges are not expected to contribute to measurable exceedances of the temperature standard. (Their estimated temperature impact at critical conditions is <= 0.001°C.) Therefore, no additional TMDL requirements are needed to control temperature for these facilities, other than those included in the NPDES permit. The other facilities have reasonable potential to increase stream temperature and are provided a WLA. It should be noted that the actual temperature increase from 200-J registrants may be less than estimated here, particularly during the spawning period when river flows may be greater than the annual 7Q10.

Table 7-4: Summary of estimated temperature impacts from 200-J registrants in the Rogue Basin.

NPDES permittee WQ File# : EPA number	Annual 7Q10* river flow (cfs)	Temp criteria (°C)[1]	Maximum reported effluent flow (cfs)	Effluent flow used to calculate temperature impact (dilution-based or reported) (cfs)	Estimated maximum effluent temp (°C)[1]	Temp. change, non-spawning period (°C)	Temp. change, spawning period (°C)
ASHLAND WTP 3781: ORG383519	2.74	18.0 13.0	0.272[2]	0.091	24.0 17.0	0.194	0.13
CAVE JUNCTION, CITY OF 15253: ORG383525	0.1	18.0	0.000	0.00	24.0	0.000	N/A
CHAVNER WATER TREATMENT PLANT 33902: ORG383528	967	18.0	0.080	0.080	24.0	0.000	N/A
GOLD BEACH WATER TREATMENT PLANT 109728: ORG383553	2070	18.0	1.29	1.290	24.0	0.004	N/A
GRANTS PASS WTP 34631: ORG383508	0.1	18.0	1.782	0.003	24.0	0.194	N/A
ROBERT A. DUFF WATER TREATMENT PLANT 55370: ORG383504	948	16.0 13.0	1.841	1.841	24.0 17.0	0.016	0.008
SHADY COVE WATERWORKS 116351	0.1	18.0	0.000	0.000[4]	24.0	0.000	N/A
USFS - ROGUE RIVER NATIONAL FOREST; UPPER APPLEGATE OFFICE COMPLEX/MAINTENANCE YARD 109820	34.4	16.0 13.0	0.0060[2]	0.006	24.0 17.0	0.001	0.001

[1] If two values are present in this column, the 1st applies to non-spawning and the 2nd to the spawning period.

[2] This is the maximum estimated effluent flow stated in permit application.
[3] Estimated
[4] Facility does not discharge during the TMDL critical season; only during storms in late fall to early spring.

7.1.2.3 300-J general permit - fish hatcheries

The current 300-J general permit issued on October 3, 2002, covers treated discharges from aquatic animal production facilities which produce at least 20,000 pounds of fish per year but have less than 300,000 pounds on hand at any time.

DEQ reviewed effluent temperature and effluent flow data for the ODFW hatchery registered under the 300-J permit. Although instream temperatures at the facility's point of discharge did not exceed applicable criteria during the model period, DEQ determined that the facility discharge does have the potential to contribute to downstream exceedances and that the Protecting Cold Water criterion therefore applies. Therefore, DEQ proposed an allocation for this facility, which is discussed in Section 9.1.6.2.3.

7.1.2.4 General permit registrants with TMDL requirements

The facilities with general permits that were determined to have potential to discharge thermal loads that contribute to exceedances of the applicable temperature criteria – and therefore having requirements under the TMDL – are listed in Table 7-5. The facilities with general permits that were determined to not have potential to discharge thermal loads that contribute to exceedances of the applicable temperature criteria are listed in Table 7-6. The locations of the 100-J and 200-J general permit registrants in the basin are displayed in Figure 7-2.

Table 7-5: General NPDES permit registrants with the potential to contribute thermal loads to Rogue Basin streams at a frequency and magnitude to cause exceedances of the temperature standard.

Registrant	General Permit	DEQ WQ File Number	EPA Number	Receiving water name (AU ID)	River mile
Biomass One, Limited Partnership	100-J	100110	ORG253531	Rogue Sanitary Sewer to Military Slough (OR_WS_171003080202_02_105815)	-
Harry And David	100-J	37200	ORG253524	Ditch to Bear Creek	12.5
ODVA - Southern Oregon Rehabilitation Center and Clinics	100-J	117435		Military Slough (OR_WS_171003080202_02_105815)	-
Pacific Power & Light Company – Eagle Point	100-J	66600	ORG253521	Tributary to Nichols Branch (OR_WS_171003070812_02_105758)	2
Pacific Power & Light Co. – Prospect Plant #1	100-J	66620	ORG253514	Rogue River (OR_SR_1710030701_02_105465)	169.3
Pacific Power & Light Co. – Prospect Plant #2	100-J	66622	ORG253519	Rogue River (OR_SR_1710030701_02_105465)	169.4
Pacific Power & Light Co. - Prospect Plant #3	100-J	66624	ORG253518	Middle Fork Canal to N Fk Rogue R. (OR_SR_1710030701_02_105459)	1.46
Pacific Power & Light Co. – Prospect Plant #4	100-J	66626	ORG253517	Rogue River (OR_SR_1710030701_02_105465)	169.3
Ashland WTP	200-J	3781	ORG383519	Ashland Creek	0
Gold Beach WTP	200-J	109728	ORG383553	Rogue River (OR_SR_1710031008_04_104646)	5

Registrant	General Permit	DEQ WQ File Number	EPA Number	Receiving water name (AU ID)	River mile
Grants Pass WTP	200-J	34631	ORG383508	Skunk Creek (OR_WS_171003080402_02_106355)	0
Robert A. Duff WTP	200-J	55370	ORG383504	Rogue River (OR_SR_1710030802_04_105816)	131
ODFW - Cole M. Rivers Hatchery	300-J	64445	ORG133508	Rogue River (OR_SR_1710030703_04_105475)	157

Table 7-6: General NPDES permit 100-J,200-J and 300-J registrants that DEQ determined do not have the potential to contribute thermal loads to Rogue River Basin streams at a frequency and magnitude to cause temperature standard exceedances.

Permittee	General Permit	DEQ WQ File Number	EPA Number	Receiving water name (AU ID)	Approx. RM
Cave Juncton WTP	200-J	15253	ORG38352	East Fork Illinois River (OR_WS_171003110303_02_104903)	1
Chavner WTP	200-J	33902	ORG38352	Rogue River (OR_SR_1710030802_04_105816)	120.4
Shady Cove Waterworks	200-J	116351	-	Red Lick Creek (OR_WS_171003070702_02_105745)	0.7
USFS – Rogue River National Forest; Upper Applegate Office Complex/Maintenance Yard	200-J	109820	-	Applegate River (OR_SR_1710030902_02_105603)	38.3

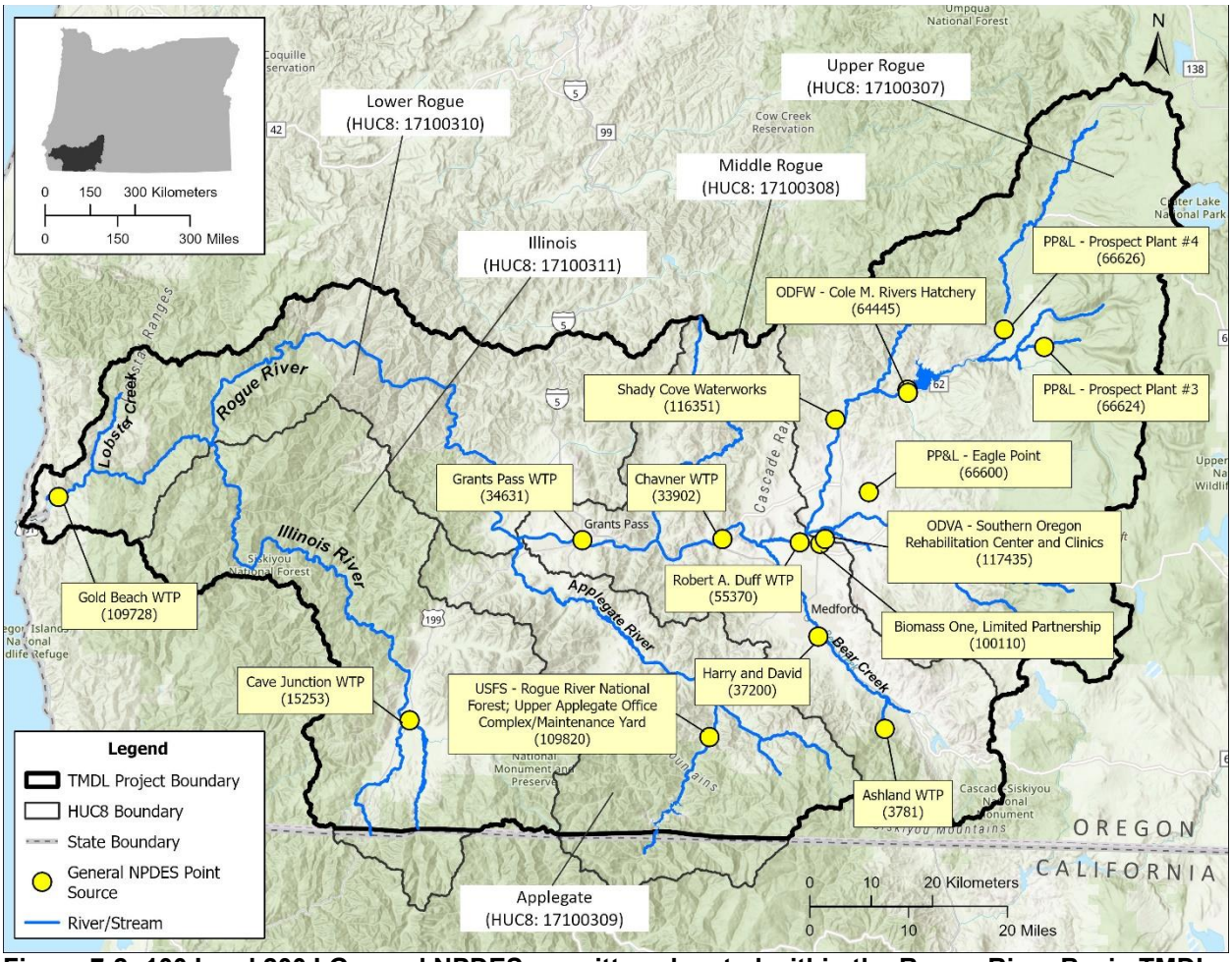


Figure 7-2: 100J and 200J General NPDES permittees located within the Rogue River Basin TMDL project area.

7.2 Nonpoint and background sources

OAR 340-41-0002 (42) defines nonpoint sources as “diffuse or unconfined sources of pollution where wastes can either enter, or be conveyed by the movement of water, into waters of the state.” Generally, nonpoint thermal sources in the Rogue River Basin include activities associated with agriculture, forestry, dam and reservoir management, and development. Example sources and/or activities that contribute nonpoint thermal loads that increase stream temperature include:

- Background sources, including natural sources and anthropogenic sources defined as background sources;
- Increases in solar radiation loading from the disturbance or removal of near-stream vegetation;
- Channel modification and widening;
- Nonpoint Source dam and reservoir operation; and
- Consumptive water management activities and water withdrawals.

7.2.1 Background sources

Background sources as defined in OAR 340-042-0030(1) include all sources of pollution or pollutants not originating from human activities. Background sources may also include anthropogenic sources of a pollutant that DEQ or another Oregon state agency does not have authority to regulate, such as pollutants emanating from another state, tribal lands, or sources otherwise beyond the jurisdiction of the state. Stream temperature warming from climate change is a background source because the majority of the climate change causing pollutants emanate from outside of Oregon.

DEQ completed a literature review to assess climate change-driven stream temperature impacts. Based on that review (DEQ, 2025), since the late 1970s, stream temperature impacts from climate change ranged from +0.05°C to +0.27°C per decade on unregulated streams and -0.48°C to +0.52°C per decade on regulated streams. Stream temperature trends in regulated systems are more variable, as upstream flow and temperature management can confound natural long-term warming trends in the data (Isaak et al., 2012). The temperature impact in the summer months (June, July, and August) is greater relative to the annual average impact.

Non-human caused background thermal loading is influenced by a number of landscape and meteorological characteristics, such as: substrate and channel morphology conditions; streambank and channel elevations; near-stream vegetation; groundwater, tributary inflows; precipitation; cloudiness; air temperature; relative humidity and other factors. Many of these factors can be influenced by anthropogenic impacts.

It was not possible to develop a model in which all human or background influences were controlled or accounted for. As a best estimate, background thermal sources were quantified for the modeled stream segments by removing the thermal loading from point sources, removing the dam and reservoirs, and restoring streamside vegetation to the estimated site potential conditions. The setup and configuration details of this model, called the background scenario, is further described in Appendix C.

In some of the modeled stream segments, thermal loading from background sources contributed to exceedances of the applicable temperature criteria and therefore were identified as a significant source of thermal loading. Reductions from background sources will be required to attain the applicable temperature criteria. The contribution from background sources for each modeled stream segment is summarized in Table 7-7 below.

(Note: The remainder of this section will be completed as part of the final draft TMDL.)

Table 7-7: Maximum 7DADM increases above the applicable temperature criteria associated with background nonpoint sources.

Subbasin	River	Maximum 7DADM Temperature Increase (°C)	Point of Maximum Impact

7.2.2 Solar loading from disturbance or removal of near stream vegetation

Vegetation removal or disturbance in the Rogue River Basin increases 7DADM temperatures. Restored vegetation conditions were used in stream temperature model scenarios to quantify the impacts of nonpoint source solar radiation loads, and ultimately to develop nonpoint source load allocations for the TMDL. For example, on the Rogue River the increase is as much as 3.19°C at the POMI and 1.70°C at the most downstream model node (Table 7-8).

Table 7-8: Rogue River: Maximum 7DADM stream temperature changes between Restored Vegetation and Current Condition model scenarios for the over the model period.

Model km	Stream temperature change (°C)	Location
9.25	1.70	Downstream boundary
153.4	3.19	POMI

7.2.3 Channel modification and widening

Stream channel modification and simplification for flood control or navigation and watershed development also influences stream temperature. Historically, floodplains have not been treated as an integral part of the stream channel and this has led to development in areas prone to channel migration and flooding (Kondolf and Keller, 1991). Channelization and bank armoring to protect these areas exacerbates erosion and flooding elsewhere in the basin unless much of the channel is armored (Sear 1994). Bank armoring and the loss of floodplain connectivity diminish over-bank flows that create and maintain channel complexity. Without access to floodplains high streamflows can cause channel down cutting and lower seasonal water tables. Riparian vegetation, off channel habitats and cold water refugia may all be negatively affected by such actions.

Upland and floodplain development also result in high levels of impervious areas in some areas of the basin. Increased impervious area within a watershed results in greater stormwater runoff and diminished groundwater recharge. Summer base flows are lower in small watersheds with substantial impervious area as a result of this loss of groundwater contribution during dry periods. This contributes to warmer stream temperatures and poorer water quality.

For the 2008 TMDL, Tetra Tech, an EPA-funded project consultant, examined the Little Butte Creek watershed for historic changes in morphology (see TSD Appendix C). This watershed was targeted because of the availability of historic information. The magnitude of changes in geomorphology and groundwater connectivity in Little Butte Creek from 2008 conditions to natural conditions was estimated to be generally moderate. Results show that on average the hyporheic exchange of the natural conditions (predevelopment) was 5.7% (-2% to 10%) greater than current conditions. Actual hyporheic flow exchanges can vary widely spatially and temporally based on flow regime and variations in stream bank and substrate conditions, among other factors. The range of uncertainty in the estimates could be on the order of 5 to 10% or higher. There have been several land-use based causes of changes over time in the geomorphology and groundwater connectivity in Little Butte Creek. These include agricultural development, other types of development such as roadways and residential development, water diversions and their associated physical structures and channel modifications, and water supply reservoirs. Based on review of previous studies, observations within the watershed, and analysis of current and

historical aerial photographs, the most prominent causes of change are believed to be (1) channel modifications associated with roadways adjacent to the stream and (2) channel and flow modifications related to water diversions and their structures.

7.2.4 Dam and reservoir operations

Reservoirs attenuate flood flows and hold spring runoff. Stored water is released when reservoir capacity is met or to augment stream flows during the dry months of summer and early fall. As currently constructed and operated, the release of water from many reservoirs modifies natural temperature patterns downstream during late summer and early fall, but also during spring and early summer. The temperature seasonal shifts occur because stored water in reservoirs stratifies, and the reservoirs were typically constructed with regulating outlets near the bottom of each structure.

Seasonal pattern shifts are of concern because water temperature triggers aquatic life activities such as spawning, length of time needed for incubation, and fry emergence. The food supplies (macroinvertebrates) that salmonids rely on are also affected by seasonal temperature shifts. In late summer and early autumn, the reservoirs are drawn down to provide flood storage capacity for the coming winter precipitation. During this time, thermal stratification in the reservoirs breaks down but reservoir water temperatures remain warmer than inflowing upstream tributary temperatures. This is also the season when fall spawning fish have moved into reaches below the reservoirs to wait for spawning. Salmon and trout will hold in the coldest water they can find to wait for stream temperatures to cool enough to trigger their spawning migration.

Alternately, colder winter waters are released during spring and early summer when inflowing upstream tributary temperatures are warmer than stored reservoir waters. This is the season when fall-spawned fry should be emerging, but the colder water shifts the timing of their emergence. Spring spawning is also delayed until winter water temperatures warm up enough to trigger spawning. Late spring spawning can indicate that fry emergence occurs when summer water temperatures are too warm for emerging fry.

Within the Rogue River Basin, several model scenarios were developed to evaluate stream temperature response from removing dams. The small, low head dams in the basin have been removed and no longer affect Rogue River temperatures. The stream temperature response from removing small dams was evaluated with the results summarized in Section 5.11.7 of TSD Appendix A. The stream temperature impacts of the William L. Jess Dam (Loss Creek Reservoir) were also evaluated (see Section 5.11.8 of TSD Appendix A), The maximum modeled stream temperature change between the scenario with the dam and the scenario without the dam was 0.18°C at the most downstream node and 1.64°C at the POMI (model km 222.4) (see Table 7-9). Thus, the model results indicate that the river temperatures would be warmer under the “No Lost Creek Dam” scenario than under current condition scenario with the dam; i.e., the river temperatures are typically cooler with the dam and reservoir present than if they were not present.

Table 7-9: Rogue River: Maximum 7DADM stream temperature changes between No Lost Creek Reservoir and Current Condition scenarios over the model extent.

Model km	Stream temperature change (°C)	Location
9.25	0.18	Downstream boundary
222.4	1.64	POMI

7.2.5 Water management activities and water withdrawals

Water management activities and water withdrawals is a source category that accounts for nonpoint source temperature impacts associated with the withdrawal of water that is intended for consumptive uses (such as irrigation or domestic use) and the warming that might occur as that water moves through a canal or ditch before being returned to the natural river.

Water withdrawals decrease the capacity of streams to assimilate thermal loads and result in warmer stream temperatures. In waterbodies where temperatures are already known to exceed standards, further withdrawals from the stream will reduce the stream's assimilative capacity and cause greater fluctuation in daytime and nighttime stream temperatures.

DEQ evaluated stream temperature impacts of water withdrawals with a modeling scenario where permitted water withdrawals were changed to instream flow and then comparing its results to those of the Current Conditions model scenario (see TSD Section 4.5).

(Note: The remainder of this section will be completed as part of the final draft TMDL.)

- Example: to be completed.

8. Loading capacity and excess loads

Thermal loading capacity, **Error! Reference source not found.**excess temperature, percent load reduction, and the equations used for their calculation are discussed in Section 8 of the TMDL.

Table 8-1 of the TMDL provides 7Q10-based loading capacities for example AUs in the TMDL area that are category 5 impaired and/or receive NPDES-permitted discharge. TMDL Table 8-2 provides excess temperature and percent load reduction results for each AU with available temperature data.

9. Allocations, reserve capacity and margin of safety

OAR 340-042-0040(6) identifies the factors that DEQ or EQC may consider when distributing wasteload and load allocations. The factors include:

a) Contributions from sources;
b) Costs of implementing measures;
c) Ease of implementation;
d) Timelines for attainment of water quality standards;
e) Environmental impacts of allocations;
f) Unintended consequences;

g) Reasonable assurances of implementation;
h) Any other relevant factor.

Oregon's temperature standard provides a framework for how the loading capacity is distributed between human sources of warming and background sources. The HUA at OAR 340-041-0028(12)(b)(B) identifies the portion of the loading capacity reserved for human uses. The rule requires that wasteload and load allocations restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.30°C (0.5°F) above the applicable criteria after complete mixing in the waterbody, and at the point of maximum impact. DEQ allocated a thermal load equivalent to a 0.30°C increase to current and future loading from human sources and the remainder of the loading capacity to background sources. Distribution of the human use allowance is discussed in Section 0. The margin of safety is discussed in Section 9.6 of the TMDL. Factors used when assigning allocations included the relative contribution from existing sources, the environmental impact of the allocations and the regulatory requirement to attain water quality standards, and the policy goal to retain some of the loading capacity for future use as reserve capacity.

9.1 Human use allowance assignments

Refer to the [final date] Rogue River Basin Temperature TMDL rule (OAR ….) Section 9 for tables of the human use allowance assignments to each source category on each assessment unit within the basin. The discussions below describe the processes DEQ used to make these assignments.

When distributing the thermal loads associated with a 0.30°C increase, DEQ considered the magnitude of the thermal load contributed from known sources, the allocation assigned in the older TMDLs being replaced, ease of implementing the allocations, the environmental impact of those contributions including where the impact occurs, and how the source contribution impacts cumulative warming.

A portion of the HUA was assigned to each relevant anthropogenic source category in each AU in the TMDL project area. These source categories, which are further discussed in the sections below, are:

- Nonpoint source (NPS) dam and reservoir operations,
- Anthropogenic warming from tributaries,
- Consumptive use water management and withdrawals,
- Solar loading from existing transportation corridors, buildings, and utility infrastructure,
- Solar loading from other nonpoint sectors, and
- NPDES point sources

A portion of the HUA is also assigned to reserve capacity. Temperature impacts associated with climate change sources are assigned a zero HUA.

Some source categories were assigned a zero human use allowance or no increase in temperature. A zero human use allowance should not be interpreted as zero total thermal loading or zero discharge. Thermal loads from source categories assigned a zero human use allowance may still have a discharge but cannot contribute to temperature increases above the applicable criteria when 7DADM temperature exceed the criteria.

9.1.1 Nonpoint source (NPS) dam and reservoir operations

DEQ assigned a load allocation and HUA of 0.00°C (no warming above the BBNC) to all dam and reservoir operations. This nonpoint source category accounts for warming from dam impoundment and other activity associated with reservoir operations and the release of impounded water back to the natural channel. In addition, a surrogate measure temperature target was developed to implement the dam and reservoir HUA and corresponding load allocation.

9.1.2 Anthropogenic warming from tributaries

For AUs with tributary streams having point sources with HUAs assigned, an HUA was determined for the cumulative anthropogenic warming from the tributaries. These HUA assignments were based on a heat load balance approach. This approach used the critical flow from each tributary along with any point source HUAs assigned within each tributary. These values were then used to calculate the temperature increase above the BBNC within the receiving stream due to the combined effects of the tributaries. Anthropogenic warming from tributaries that do not have point sources with HUAs assigned is accounted for through the HUAs in the other source categories within the tributary AU.

9.1.3 Solar loading from existing transportation corridors, buildings, and utility infrastructure, and from other nonpoint sources

As summarized in Section 7.2.2, lack of streamside vegetation is one of the largest sources of stream warming contributing warming where it was assessed. Except streamside vegetation reduction caused by existing infrastructure (roads, railroads, buildings, and utility infrastructure), all other nonpoint sources of solar loading were assigned a zero human use allowance, meaning a reduction in streamside vegetation may not cause an increase in temperature above the applicable criterion.

DEQ chose to assign a portion of the human use allowance to existing infrastructure (roads, railroads, buildings, and utility infrastructure) over other land uses because moving, rebuilding, or modifying this infrastructure in addition to restoring streamside vegetation is a much more complex and potentially costly endeavor compared to restoring or protecting existing streamside vegetation in areas without infrastructure constraints. In the past, DEQ heard from municipalities commenting on TMDLs that these land uses are difficult constraints to restore. In addition, other land uses without infrastructure constraints represent a much higher percentage of streamside area raising issues related to the appropriate amount of vegetation reduction that could occur spatially and over time while still attaining a small HUA increase such as < 0.05°C, that does not contribute to cumulative temperature impacts downstream.

The solar loading allocation is implemented through an effective shade target. Effective shade can be easily measured in the field and is simpler to monitor relative to a thermal load. Based on an extensive literature review, DEQ determined that a vegetation buffer width based on a slope distance of 120 ft would be sufficient in most cases to have no warming and attain the shade targets.[4] Effective shade surrogate measure targets represent a surrogate for the amount of solar

[4] See the 2025 Willamette River Mainstem and Major Tributaries TMDL TSD for supporting documentation.

loading that will attain the HUA and load allocations for nonpoint sources managing streamside vegetation.

9.1.4 Consumptive use water management and withdrawals

DEQ assigned a load allocation and HUA of up to 0.05°C for temperature impacts associated with surface water withdrawals. This nonpoint source category accounts for warming from the withdrawal of water that is intended for consumptive uses (such as irrigation), and the warming that might occur as that water moves through a canal or ditch before being returned to the natural river. Section 7.2.5 summarizes the temperature impacts from consumptive uses evaluated by DEQ.

9.1.5 Reserve Capacity

DEQ set aside remaining human use allowance for reserve capacity to accommodate future growth, new sources, or to make allocation corrections to any existing source(s) that were assigned an erroneous allocation or may not have been identified during the development of this TMDL. Where possible, DEQ tried to maintain at least 0.05°C for reserve capacity, but in some cases this was reduced as low as 0.02°C to accommodate existing sources without placing undue burden on NPDES permittees.

9.1.6 Human use allowances and wasteload allocations for point sources

The Rogue River and its tributaries receive effluent from several municipal and industrial discharges that impact river temperature. In general, DEQ's approach to assigning HUAs to point sources which discharge within the Rogue River Basin was as follows:

The allocation approach for point sources was to use the HUAs assigned to point sources within the old TMDLs as the starting point to calculate HUA. These draft HUAs were then compared with facility effluent data from available discharge monitoring reports (DMRs). If no expected exceedances were indicated, the draft HUAs were used in the next step. If expected exceedances were indicated for any specific source, the HUA for this source was increased until no exceedances were indicated. The resulting HUAs were then considered the new draft HUA assignments.

The cumulative effects from all draft HUAs for each tributary AU were assessed to determine if exceedances were indicated. Exceedances were indicated by an increase of stream temperature within the AU of greater than the total allowable HUA (0.3°C). If no exceedances were indicated, the process continued to the next step. If exceedances were indicated, the draft HUAs were decreased until the cumulative temperature increases were less than 0.3°C. The decreased HUAs were then used in the next step.

The cumulative effects model scenarios were then used to determine if the draft HUAs assigned on the modeled tributaries resulted in exceedances on the mainstem. Exceedances are indicated by an increase of mainstem stream temperature greater than the total allowable HUA, which is always 0.3°C. If no exceedances were indicated, the HUAs to sectors as well as to specific point sources were finalized. If exceedances were indicated, the HUAs to source sectors and/or to specific point sources were modified until the modeled stream temperature

increases were less than 0.3°C. Once this was accomplished, the HUAs to sectors and specific point sources were finalized.

The following describes other factors DEQ considered when assigning an HUA to point sources:

- If a point source is not authorized to discharge in the current NPDES permit (maximum effluent flow = 0), for most facilities an HUA of 0.00°C was assigned during the no discharge period. This was done so other sources could be assigned a portion of the loading capacity and maintain any remainder in reserve for future use. A human use assignment of zero means there may be no warming above the applicable temperature criteria.

- When an analysis completed for the TMDL indicated current thermal loads are less than 0.075°C, the HUA assigned was reduced to be consistent with the current thermal load.

- The assigned HUA was increased above 0.075°C to a maximum of 0.20°C for any single point source when analysis indicated that 0.075 would result in immediate noncompliance and there was sufficient loading capacity available. Point sources were not assigned more than 0.20°C in order to have capacity available for other point sources, nonpoint sources and reserve capacity. DEQ prioritized source assessment for point sources discharging to modeled streams and for facilities that DEQ staff knew or suspected an allocation based on an assigned 0.075 HUA would result in immediate noncompliance.

- On temperature modeled streams (TSD Appendix A, Figure 1-1), DEQ evaluated attainment with a cumulative effects analyses. The model analysis consisted of setting point source effluent discharges at their respective WLAs. The stream temperature from this model scenario were then compared to stream temperatures from a model scenario without point sources. The difference is the change in temperature caused by point sources discharging at their WLAs. This analysis allow DEQ to assess how warming from point sources occurred over space and time, and to confirm that the applicable temperature criteria would be attained.

- On temperature modeled streams (TSD Appendix A, Figure 1-1), a characterization of point source discharge and cumulative effects analysis was completed. The results of the characterization and modeling informed the portion of the HUA assigned. Model based analyses were completed for point sources discharging to the Rogue River. As a result of these analyses, the total portion of the HUA allocated to the point source sector within a specific AU may be different than the sum of the individual point source HUA assignments within that AU since impacts due to heat dissipation, upstream sources, and other factors are considered.

- On streams that were unmodeled or were modeled for shade only (where a cumulative effects modeling analysis was not completed), it was assumed that warming impacts from individual point sources did not dissipate with distance from the outfall (TSD Appendix A, Figure 1-1). This means that the total portion of the HUA allocated to the point source sector generally represents the sum of the individual HUA assignments.[5] For example, a

[5] The exception to this is where the NPDES discharges are to two or more separate streams within an AU. In this case, the total portion of the HUA allocated to point sources is not the sum of the individual HUA assignments. This situation exists in the Larson Creek – Bear Creek AU. See discussion in Section 9.1.6.1.3.

stream with two NPDES discharges that each have 0.075°C assigned at the point of discharge would have a point source sector allocation of 0.15°C cumulatively at the POMI. DEQ considered the sum of HUA assignments from upstream NPDES discharges when assigning the point source sector for downstream AUs, including AUs that did not have point sources. This was done to ensure there would be no exceedance to the allocated portion of the HUA. The approach is protective based on model results from other streams that show the temperature impacts dissipating moving downstream from the outfall.

Section 9.1.6.1 summarizes the assigned portion of the HUA for each point source, the findings from the assessment of current thermal loading, and the source of effluent discharge flow value used in the wasteload allocation (WLA) equation.

9.1.6.1 Individual NPDES Permits

The following is a discussion of the human use allowance assignments and wasteload allocations for each individual NPDES permit identified in Section 7.1.1.

9.1.6.1.1 Allweather Wood, White City (105365)

Allweather Wood, White City (WQ File#: 105635, EPA File Number: OR0042391) is not assigned a portion of the HUA. This individual NPDES permit covers stormwater runoff discharge, which is not considered a significant thermal source. Thus, HUAs are not assigned and WLAs are not calculated for this discharge. The TMDL does not include any additional requirements for this permit related to temperature.

9.1.6.1.2 Ashland STP (3780)

The Ashland STP Outfall 001 (WQ File#: 3780, EPA File Number: OR0026255) on Ashland Creek is no longer the primary discharge location for Ashland STP. The facility currently discharges to Bear Creek through Outfall 002. Outfall 001 is maintained only as an emergency discharge location for use during high flow events. For this reason, Ashland STP Outfall 001 is assigned a nominal HUA of 0.025°C. The WLA calculation used an effluent flow of 2.3 MGD, which is the average dry weather design flow, and an annual 7Q10 of 1.94 cfs as estimated with StreamStats.

The Ashland STP Outfall 002 on Bear Creek is the primary discharge location for Ashland STP. The thermal loading assessment for this outfall found that the HUA assigned in the 2007 Bear Creek Temperature TMDL (0.10°C) would result in noncompliance. The assigned HUA is increased to 0.20°C, which reduces the noncompliance days based on the available data. This analysis used DMR data from 2016-2020. The maximum effluent temperature reported was 24.7°C in August 2016, when effluent flow was 1.86 MGD. The maximum effluent flow reported was 3.33 MGD in March 2017, when effluent temperature was 11°C. The WLA calculation used an effluent flow of 2.3 MGD, which is the average dry weather design flow, and an annual 7Q10 used of 4.73 cfs as calculated with data from USGS Station 14354200 (Bear Creek Below Ashland Creek at Ashland, OR).

9.1.6.1.3 Boise – Medford Plywood (9539)

Boise - Medford Plywood (WQ File#: 9539, EPA Number: OR0000850) Outfall 001 is assigned an HUA of 0.20°C. The permit fact sheet (dated 08/23/2018) states that Outfall 001 is managed to

minimize discharge, which only occurs during periods of heavy precipitation and excessive stormwater. From 2016-2020, discharge from Outfall 001 was only reported in the January 2017 and March 2017 DMRs. In January 2017, the maximum effluent flow was 0.302 MGD and the maximum effluent temperature was 8°C. In March 2017, the maximum effluent flow was 0.086 MGD and the maximum effluent temperature was 12°C. The WLA calculation used an effluent flow of 0.129 MGD, which is the 90th percentile of measured effluent flows for the discharge period flow and was used in the temperature standard RPA analysis for Outfall 001 in the permit fact sheet Appendix F. The WLA calculation used an annual 7Q10 of 1.09 cfs, which is the 10th percentile of measured wintertime streamflow as described in the permit fact sheet Appendix B.

Boise - Medford Plywood Outfall 002 is assigned an HUA of 0.20°C. The thermal loading assessment for Boise - Medford Plywood Outfall 002 found that an HUA of 0.20°C would minimize but not eliminate exceedances based on 2016-2020 DMR data. During this DMR period, the maximum effluent flow was 0.262 MGD (March 2016) when effluent temperature was 17°C. The maximum effluent temperature was 22°C (October 2016) when effluent flow was 0.233 MGD. The WLA calculation used an effluent flow of 0.271 MGD, which is the 90th percentile of measured summertime effluent flows and was used in the thermal plume RPA analysis for outfall 002 in permit fact sheet Appendix D. The WLA calculation used an annual 7Q10 of 0.167 cfs, which is the 10th percentile of measured summertime stream flow as described in permit fact sheet Appendix D.

(Note that an HUA of 0.20°C is provided to each of the two outfalls since they discharge to two different receiving streams. The combined HUA once the streams merge [at the AU level] is also 0.20°C.)

9.1.6.1.4 Butte Falls STP (12800)

Butte Falls STP (WQ File#: 12800, EPA Number: OR0029891) is assigned an HUA of 0.04°C. The thermal loading assessment found that an HUA of 0.04°C would not result in exceedances based on available data (DMRs for March-April 2019). The facility's NPDES permit specifies a no discharge period of May 1 - Oct. 31. The average dry weather design flow of this facility is 0.07 MGD. The WLA calculation used the facility's maximum reported flow (0.247 MGD, 4/12/2019) and an annual 7Q10 of 33.1 cfs based on data from USGS Station 14335500 (South Fork Big Butte Creek near Butte Falls, OR).

9.1.6.1.5 Cascade Wood Products – White City (101757)

Cascade Wood Products (WQ File#: 101757, EPA Number: OR0032786) is assigned an HUA of 0.075°C. The thermal loading assessment for this facility utilized monthly average DMR data for October 2018, March – Oct. 2019, and March – Oct. 2020. The assessment found that an HUA of 0.075°C would reduce but not eliminate exceedances. The WLA calculation used the facility's maximum reported effluent flow (0.054 cfs, 6/2/2020) and an annual 7Q10 of 0.00 cfs as estimated with StreamStats.

9.1.6.1.6 Cave Junction Wastewater Treatment Facility (15243)

Cave Junction Wastewater Treatment Facility (WQ File#: 15243, EPA Number: OR0028339) is assigned an HUA of 0.00°C from July 1 – Sept. 30 based on the no discharge period described in the NPDES permit, which is from June 1 - Oct. 31 with conditional June and October exceptions that may allow discharge. When discharge may occur during the allocation period (May 1 - June 30 and Oct. 1 - Oct. 31), the assigned HUA is 0.10°C. The thermal loading assessment found that

an HUA of 0.10°C would not result in exceedances based on DMR data from 2018 - 2020. The maximum effluent temperature reported was 22.1°C in June 2018, when effluent flow was 0.22 MGD. The maximum effluent flow reported was 1.4 MGD in April 2019, when effluent temperature was 13.3°C. The May-June WLA calculation used an effluent flow of 0.68 cfs, which is maximum reported effluent flow (5/21/2019), and a 7Q10 of 148, which was the May 7Q10 reported in the facility NPDES permit. The October WLA calculation used an effluent flow of 0.080 cfs, which is the ADWDF reported in the facility NPDES permit (there were no actual discharges reported in October DMRs).

9.1.6.1.7 Country View Mobile Home Estates (96385)

Country View Mobile Home Estates (WQ File#: 96385, EPA Number: OR0029661) is assigned an HUA of 0.075°C. This facility's NPDES permit specifies a no discharge period from May 1 - Oct. 31, unless discharge is approved in writing by DEQ. The thermal loading assessment found that an HUA of 0.075°C would not result in exceedances based on 2019 – 2023 DMR data. In available DMRs, the maximum reported effluent temperature was 4.0°C and the maximum effluent flow reported was 0.0096 MGD. The WLA calculation used an effluent flow of 0.009 MGD (0.014 cfs), which is the average dry weather design flow, and an annual 7Q10 of 0.00 cfs as estimated with StreamStats.

9.1.6.1.8 Fleming Middle School (29920)

Fleming Middle School STP (WQ File#: 29920, EPA Number: OR0028355) is assigned an HUA of 0.075°C. Available DMRs from this facility (2019 - 2020) reported that all discharge was land-applied. The WLA calculation used an effluent flow of 0.056 cfs, which is the weekly dry weather design flow identified in the permit fact sheet Attachment 2 (dated 9/23/2020), and an annual 7Q10 of 0.0 cfs as estimated with StreamStats.

9.1.6.1.9 Gold Hill STP (33901)

Gold Hill STP (WQ File#: 33901, EPA Number: OR0022594) is assigned an HUA of 0.0057°C. The thermal loading assessment for this facility found that this HUA would not result in exceedances based on available 2016 – 2020 DMR data. The WLA calculation used an effluent flow of 0.542 cfs, which is the average dry weather design flow, and an annual 7Q10 of 969 cfs based on data from USGS Station 14359000 (Rogue River at Raygold near Central Point, OR).

9.1.6.1.10 Grants Pass STP (34630)

Grants Pass STP (WQ File#: 34630, EPA Number: OR0028843) is assigned an HUA of 0.038°C. during the period of 4/1 – 10/14 and 0.052°C for the period of 10/15 – 10/31. The thermal loading assessment for this facility found that this HUA would reduce but not eliminate exceedances based on available 2016 – 2020 DMR data. The WLA calculations used an effluent flow of 33.4 cfs, which was the maximum flow reported (4/8/2019) in available DMRs, and an annual 7Q10 of 962 cfs based on data from USGS Station 14361500 (Rogue River at Grants Pass, OR).

9.1.6.1.11 Hidden Valley High School (38625)

Hidden Valley High School STP (WQ File#: 38625, EPA File Number: OR0030210) is assigned an HUA of 0.01°C. The thermal loading assessment for this facility indicates that this HUA would not result in exceedances, based on available data (2016 – 2021 DMRs) with conservative

assumptions (i.e., summer effluent temperatures of 27°C, discharge at average wet weather design flow (0.037 MGD)). The maximum reported effluent temperature was 26.8°C (6/11/2019). Such discharge to the receiving water is unlikely, however, because the facility NPDES permit specifies a no discharge period of May 1 - Oct. 31; effluent must be land-applied during that period. The WLA calculation used an effluent flow of 0.037 MGD (0.057 cfs), which is the average wet weather design flow, and an annual 7Q10 of 60.5 cfs based on data from USGS Station 14369500 (Applegate River Near Wilderville, OR).

9.1.6.1.12 Medford RWRF (55125)

Medford RWRF (WQ File#: 55125, EPA Number: OR0026263) is assigned an HUA of 0.13°C during the period of 4/1 – 9/14 and 0.20°C.for the period of 9/15 – 10/31. The thermal loading assessment for this facility found that this HUA would reduce but not eliminate exceedances based on available 2016 - 2024 DMRs. The WLA equation used an effluent flow of 67.6 cfs, which was the maximum flow reported in available DMRs (4/8/2023), and an annual 7Q10 of 948 cfs based on data from USGS Station 14359000 (Rogue River At Raygold Near Central Point, OR) and OWRD Station 14358800 (Bear Cr at Mouth Near Central Point, OR).

9.1.6.1.13 Riviera Mobile Park (75500)

Riviera Mobile Park (WQ File#: 75500, EPA Number: OR0030546) is assigned an HUA of 0.000089°C from April 1 – April 30. The assigned HUA is 0.00°C for the rest of the critical period (May 1 - Oct. 31) because the facility NPDES permit specifies no discharge during that period (effluent must be land-applied). The WLA calculation used an effluent flow of 0.056 cfs, which is the average dry weather design flow, and an annual 7Q10 of 962 cfs based on data from USGS Station 14361500 (Rogue River at Grants Pass, OR).

9.1.6.1.14 Rogue River STP (76030)

Rogue River STP (WQ File#: 76030, EPA Number: OR0023043) is assigned an HUA of 0.0046°C. The WLA calculation used an effluent flow of 1.702 cfs, which is the maximum reported in available 2016 – 2019 DMRs, and an annual 7Q10 of 969 cfs based on data from USGS Station 14359000 (Rogue River at Raygold near Central Point, OR).

9.1.6.1.15 Shady Cove STP (80535)

Shady Cove STP (WQ File#: 80535, EPA Number: OR0030660) is assigned an HUA of 0.0092°C. The WLA calculation used an effluent flow of 2.36 cfs, which is the maximum reported in available 2016 – 2020 DMRs (4/9/2019), and an annual 7Q10 of 887 cfs based on data from USGS Station 14339000 (Rogue River at Dodge Bridge near Eagle Point, OR).

9.1.6.1.16 U.S. Army Corps of Engineers – William L. Jess Dam Project (126718)

U.S. Army Corps of Engineers – Wiliam L. Jess Dam Project (WQ File#: 126718, EPA Number: NA) is assigned an HUA of 0.03°C. The WLA calculation used an effluent flow of 3.586 cfs, which is the sum of discharges from all outfalls reported in the permit application, and an annual 7Q10 of 502 based on data from USGS Station 14335072 (Rogue River at Cole M River Fish Hatchery near Mcleod, OR).

9.1.6.1.17 Valley View Landfill (104019)

Valley View Landfill (WQ File#: 104019, EPA File Number: OR0035441) is not assigned a portion of the HUA. The type of waste covered by the individual NPDES permit is landfill leachate, which is not considered a significant source of warming. For this reason, HUAs are not assigned and WLAs are not calculated for this discharge type. The TMDL does not include any additional requirements for this permit related to temperature.

9.1.6.2 General Permits

The following is a discussion of the human use allowance assignments and wasteload allocations for the general NPDES permits and registrants that were identified as having a potential to discharge thermal loads that contribute to exceedances of the applicable temperature criteria (see discussion in Section 7.1.2). For all other general NPDES permit types and registrants, the TMDL does not include any additional requirements.

9.1.6.2.1 100-J general permit registrants

The existing 100-J general permit requirements relevant to water temperature are described in Section 7.1.2.1. Because permit registrants have reasonable potential to increase stream temperature, the TMDL includes wasteload allocation requirements for registrants to the 100-J general permit. The wasteload allocation requirements for the current 100-J general permit are equal to loads permitted by the 100-J general permit and the TMDL requirements identified in TMDL Section 9.2.1. Wasteload allocations are not included for any future 100-J general permit registrants.

A HUA of 0.075°C was assigned to each current 100-J registrant in the basin (see TMDL Table 9-7). An HUA of 0.075°C will address any warming authorized by the 100-J (see Section 7.1.2.1 for analysis of warming). New 100-J registrants may be allowed if they do not increase stream temperature above the applicable temperature criteria or reserve capacity is assigned.

9.1.6.2.2 200-J general permit registrants

As discussed in Section 7.1.2, four 200-J general permit registrants were determined to have the potential to contribute thermal loads to Rogue Basin streams at a frequency and magnitude to cause exceedances of the temperature standard (Table 7-5) and four were determined to not have the potential (Table 7-6). The registrants with the potential to contribute thermal loads were assigned wasteload allocations as listed in TMDL Table 9-6.

9.1.6.2.2.1 Ashland WTP (3781)

Ashland WTP (WQ File#: 3781, EPA Number: ORG383519) has not discharged to Ashland Creek under the current permit during the reporting period; instead, it discharges backwash to the sewer. The facility does not plan to discharge to Ashland Creek until a new water treatment plant is constructed. Ashland WTP is assigned an HUA of 0.075°C to account for any unplanned discharges from the current facility to Ashland Creek and for future discharge from the new water treatment plant. The WLA calculation used an effluent flow of 0.176 MGD, which was the maximum estimated in the permit application, and an annual 7Q10 of 2.74 cfs as estimated with StreamStats.

9.1.6.2.2.2 Cave Junction WTP (15253)

Cave Junction WTP (WQ File#:15253, EPA Number: ORG383525) is not assigned a portion of the HUA. This facility is a registrant to the 200J General Permit, and while 200-J dischargers as a group have been identified as sources in the TMDL, site-specific conditions are also considered. The thermal loading analysis indicated that this facility is unlikely to be a significant thermal source to the receiving water. The facility reported mean monthly discharges of 0 MGD in all 2021 and 2023 DMRs. Thus, HUAs are not assigned and WLAs are not calculated for this discharge. The TMDL does not include any additional requirements for this permit related to temperature.

9.1.6.2.2.3 Chavner Water Treatment Plant (33902)

Chavner Water Treatment Plant (WQ File#: 33902, EPA Number: ORG383528) is not assigned a portion of the HUA. This facility is a registrant to the 200J General Permit, and while 200-J dischargers as a group have been identified as sources in the TMDL, site-specific conditions are also considered. The thermal loading analysis used the maximum reported effluent flow of 0.08 cfs (July 2021) from 2021-2022 DMRs and an annual 7Q10 of 967 cfs. The 7Q10 was based on data from USGS Station 14359000 (Rogue River at Raygold near Central Point, OR) and USGS Station 14361500 (Rogue River at Grants Pass, OR). The thermal loading analysis indicated that this facility is unlikely to be a significant thermal source to the receiving water. Thus, HUAs are not assigned and WLAs are not calculated for this discharge. The TMDL does not include any additional requirements for this permit related to temperature.

9.1.6.2.2.4 Gold Beach Water Treatment Plant (109728)

Gold Beach Water Treatment Plant (WQ File#: 109728, EPA Number: ORG383553) is assigned an HUA of 0.005°C. The thermal loading assessment for this facility found that this HUA would not result in exceedances based on available 2021 DMR data. The WLA equation used an effluent flow of 1.29 cfs, which is the maximum flow reported in available DMRs (July 2021), and an annual 7Q10 of 2070 cfs as estimated with StreamStats.

9.1.6.2.2.5 Grants Pass WTP (34631)

Grants Pass WTP (WQ File#: 34631, EPA Number: ORG383508) is assigned an HUA of 0.20°C. This facility is a registrant to the 200J General Permit and the assigned HUA represents the typical assumption for such permittees on receiving waters that do not receive discharge from multiple facilities. Skunk Creek is the receiving water for this facility. The effluent flow used in the WLA equation is 1.782 cfs, which is the maximum flow reported (personal communication, 2025-10-29), and an annual 7Q10 of 0.00 cfs as estimated with StreamStats.

9.1.6.2.2.6 Robert A. Duff Water Treatment Plant (55370)

The Robert A. Duff Water Treatment Plant (WQ File#: 55370, EPA Number: ORG383504) is assigned an HUA of 0.03°C. The WLA calculation used an effluent flow of 1.841 cfs, which is the maximum reported in available (2021) DMRs (July 2021), and an annual 7Q10 of 948 cfs based on data from USGS Station 14359000 (Rogue River at Raygold near Central Point, OR) and OWRD Station 14358800 (Bear Cr at Mouth near Central Point, OR).

9.1.6.2.2.7 Shady Cove Waterworks (116351)

Shady Cove Waterworks (WQ File#: 116351, EPA Number: N/A) is not assigned a portion of the HUA. This facility is a registrant to the 200J General Permit, and while 200-J dischargers as a group have been identified as sources in the TMDL, site-specific conditions are also considered.

The permit application reports that facility discharge is routed to a settling pond that does not discharge to the receiving water during the critical period. Thus, this facility is not considered a significant thermal source to the receiving water. Thus, HUAs are not assigned and WLAs are not calculated for this facility. The TMDL does not include any additional requirements for this permit related to temperature.

9.1.6.2.2.8 USFS – Rogue River National Forest; Upper Applegate Office Complex/Maintenance Yard (109820)

USFS – Rogue River National Forest; Upper Applegate Office Complex/Maintenance Yard (WQ File#: 109820) is not assigned a portion of the HUA. This facility is a registrant to the 200J General Permit, and while 200-J dischargers as a group have been identified as sources in the TMDL, site-specific conditions are also considered.

Per the permit application, this facility discharges for roughly six minutes per month at 0.006 cfs (a total of 1000 gallons), which equates to a continual average rate of 0.000051 cfs, at maximum temperatures of 12°C in summer and 10°C in winter. This discharge is routed to a drywell situated 100' from the receiving stream; the drywell storage exceeds 1000 gallons. Thus, any facility discharge that reaches the receiving water will do so via subsurface transport at accordingly moderated temperatures. The annual 7Q10 in the receiving water is 34.4 cfs as estimated with StreamStats.

Using conservatively high estimates, a thermal loading assessment found that a maximum warming of 0.001°C would result from 0.006 cfs continual effluent flow at 17°C effluent temperature during the spawning period or at 24°C effluent temperature during the non-spawning period at the 7Q10 river flow (34.4 cfs). These effluent temperatures represent typical maximum discharge temperatures reported by 200J General Permit registrants for the specified use periods. Thus, considering that both the discharge rate and temperature from this facility are substantially lower than these conservative assumptions, any actual warming in the receiving water would be less than 0.001°C. Thus, DEQ concluded that this facility is not a significant thermal source and did not assign a portion of the HUA or calculate a WLA for this discharge. The TMDL does not include any additional requirements for this permit related to temperature. If new or additional data indicate that this facility contributes to thermal warming, DEQ may reevaluate and allocate a portion of the HUA reserve capacity to this facility.

9.1.6.2.3 300-J general permit registrant: ODFW – Cole M. Rivers Hatchery (64445)

ODFW – Cole M. Rivers Hatchery (WQ File#: 64445, EPA Number: ORG133508) is assigned an HUA of 0.11°C at the POMI. The corresponding HUA at the point of discharge is 0.00°C. This facility is a registrant to the 300J General Permit. The thermal loading assessment for this facility was based on effluent temperature and effluent flow data available in 2021 – 2024 DMRs. The thermal loading assessment used an effluent flow of 225 cfs, which is the maximum flow reported in available DMRs, and an annual 7Q10 of 502 cfs based on data from USGS Station 14335072 (Rogue River at Cole M River Fish Hatchery near Mcleod, OR).

Although applicable temperature criteria were not exceeded by instream temperatures at the facility's point of discharge during the model period, nor by the facility effluent as reported in DMRs, DEQ determined that the facility discharge does have the potential to contribute to downstream exceedances and that the Protecting Cold Water criterion therefore applies. Therefore, DEQ proposes an HUA of is 0.11°C for this facility based on the maximum instream temperature change estimated with the available data.

9.1.7 Wasteload allocation equations

The following sections include the equations related to wasteload allocations.

9.1.7.1 Wasteload allocation equation

Equation 9-1 and Equation 9-2 were used to calculate the thermal wasteload allocations in the Rogue River Basin Temperature TMDL rule.

$WLA = \Delta T \cdot (Q_E + Q_R) \cdot C_F$ ***Equation 9-1***

$WLA = \Delta T \cdot Q_E \cdot D_F \cdot C_F$ ***Equation 9-2***

where,

$WLA =$ Wasteload allocation (kilocalories/day), expressed as a rolling seven-day average.

$\Delta T =$ The assigned portion of the HUA at the point of discharge. Represents the maximum temperature increase (°C) above the applicable temperature criterion using 100% of river flow not to be exceeded by each individual source from all outfalls combined.

$Q_E =$ The daily mean effluent flow (cfs).
When effluent flow is in million gallons per day (MGD) convert to cfs:
$\frac{1{,}000{,}000\ gallons}{1\ day} \cdot \frac{0.13368 ft^3}{1\ \text{gallon}} \cdot \frac{1\ day}{86{,}400\ sec} = 1.5472\ ft^3/sec$

$Q_R =$ The daily mean river flow rate, upstream (cfs).
When flow is <= 7Q10, Q_R = 7Q10. When flow is > 7Q10, Q_R equals the daily mean river flow, upstream.

$D_F =$ Dilution factor $(Q_E + Q_R)/Q_E$ For lakes, the dilution factor is 1 unless determined using another method.

$C_F =$ Conversion factor using flow in cfs: 2,446,665
$\left(\frac{1\ m}{3.2808\ ft}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$

9.1.7.2 Wasteload allocation attainment equation

DEQ evaluated attainment of a wasteload allocation (WLA) at the point of discharge using Equation 9-3, which calculates the excess thermal loading (ETL). The ETL was compared against the wasteload allocation (WLA) to assess attainment.

$ETL = (T_E - T_C) \cdot Q_E \cdot C_F$ ***Equation 9-3***

where,

$ETL =$ The daily excess thermal load (kilocalories/day), expressed as a rolling seven-day average.

$T_C =$ The point of discharge applicable river temperature criterion (°C).

$T_E =$ The daily maximum effluent temperature (°C)

$Q_E =$ The daily mean effluent flow (cfs or MGD)

$C_F =$ Conversion factor for flow in cfs: 2,446,665
$\left(\frac{1\ \text{m}}{3.2808\ \text{ft}}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$

Conversion factor for flow in millions of gallons per day (MGD): 3,785,411
$\frac{1\ m^3}{264.17\ gal} \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{1000000\ gal}{1\ million\ gal} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 3{,}785{,}441$

9.1.7.3 Calculating current change in temperature

Equation 9-4 and Equation 9-5 were used to assess the change in temperature based on point source effluent discharge, river flow, and the applicable temperature criteria.

$$\Delta T_{ps} = \left(\frac{Q_E}{Q_E + Q_R}\right) \cdot (T_E - T_C) \qquad \textbf{Equation 9-4}$$

$$\Delta T_{ps} = \left(\frac{T_E - T_C}{D_F}\right) \qquad \textbf{Equation 9-5}$$

where,

$\Delta T_{ps} =$ The river temperature increase (ºC) above the applicable river temperature criterion using 100% of river flow.

$Q_E =$ The daily mean effluent flow (cfs).
When effluent flow is in million gallons per day (MGD) convert to cfs:
$\frac{1{,}000{,}000\ gallons}{1\ day} \cdot \frac{0.13368 ft^3}{1\ \text{gallon}} \cdot \frac{1\ day}{86{,}400\ sec} = 1.5472\ ft^3/sec$

$Q_R =$ The daily mean river flow rate, upstream (cfs).
When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$D_F =$ Dilution factor $(Q_E + Q_R)/Q_E$ For lakes, the dilution factor is 1 unless determined using another method.

$T_E =$ The daily maximum effluent temperature (ºC)

$T_C =$ The point of discharge applicable river temperature criterion (ºC)

9.1.7.4 Calculating acceptable effluent temperatures

Equation 9-6 (using ΔT) and Equation 9-7 (using WLA) were used to calculate the daily maximum effluent temperatures (ºC) acceptable under the assigned portion of the HUA (ΔT) and the wasteload allocation (WLA).

$$T_{E_WLA} = \frac{(Q_E + Q_R) \cdot (T_C + \Delta T) - (Q_R \cdot T_C)}{Q_E} \qquad \textbf{Equation 9-6} \text{ (using ΔT)}$$

$$T_{E_WLA} = \frac{(WLA)}{Q_E \cdot C_F} + T_C \qquad \textbf{Equation 9-7} \text{ (using WLA)}$$

where,

$T_{E_WLA} =$ Daily maximum effluent temperature (ºC) allowed under the wasteload allocation.
When T_{E_WLA} is > 32°C, T_{E_WLA} = 32°C as required by the thermal plume limitations in OAR 340-041-0053(2)(d)(B).

$WLA =$ Wasteload allocation (kilocalories/day) from Equation 9-1.

$\Delta T =$ The assigned portion of the HUA at the point of discharge. Represents the maximum temperature increase (ºC) above the applicable river temperature criterion using 100% of river flow not to be exceeded by each individual source from all outfalls combined.

$Q_E =$ The daily mean effluent flow (cfs).
When effluent flow is in million gallons per day (MGD) convert to cfs:
$\frac{1{,}000{,}000\ gallons}{1\ day} \cdot \frac{0.13368 ft^3}{1\ \text{gallon}} \cdot \frac{1\ day}{86{,}400\ sec} = 1.5472\ ft^3/sec$

$Q_R =$ The daily mean river flow rate, upstream (cfs).
When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$T_C =$ The point of discharge applicable river temperature criterion (ºC)

$C_F =$ Conversion factor for flow in cfs: 2,446,665

$$\left(\frac{1\ m}{3.2808\ ft}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

9.1.7.5 Calculating acceptable effluent flows

Equation 9-8 (using ∆T) and Equation 9-9 *(using WLA)* can be used to calculate the daily mean effluent flow (cfs) acceptable under the assigned portion of the HUA (∆*T*) and the wasteload allocation (WLA).

$$Q_{E_WLA} = \frac{(Q_R \cdot T_C) - ((T_C + \Delta T) * Q_R)}{T_C + \Delta T - T_E}$$ ***Equation 9-8*** (using ∆T)

$$Q_{E_WLA} = \frac{(WLA)}{(T_E - T_C) * C_F}$$ ***Equation 9-9*** (using WLA)

where,

$Q_{E_WLA} =$ Daily mean effluent flow (cfs) allowed under the wasteload allocation.

$WLA =$ Wasteload allocation (kilocalories/day) from Equation 9-1.

$\Delta T =$ The assigned portion of the HUA at the point of discharge. Represents maximum temperature increase (°C) above the applicable river temperature criterion using 100% of river flow not to be exceeded by each individual source from all outfalls combined.

$T_E =$ The daily maximum effluent temperature (°C).

$Q_R =$ The daily mean river flow rate, upstream (cfs).
When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$T_C =$ The point of discharge applicable river temperature criterion (°C)

$C_F =$ Conversion factor for flow in cfs: 2,446,665

$$\left(\frac{1\ m}{3.2808\ ft}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

9.1.8 Determination of when minimum duties provision applies

The minimum duties provision at OAR 340-041-0028(12)(a) states there is no duty for anthropogenic sources to reduce heating of the waters of the State below their natural condition. Similarly, each anthropogenic point and nonpoint source is responsible only for controlling the thermal effects of their own discharge or activity in accordance with its overall heat contribution. See TMDL Section 4.7 for additional background and summary of how DEQ implements this rule provision.

In the Rogue River Basin, DEQ determined that the ODFW – Cole M. Rivers Hatchery operate as a flow through facilities and thus, where the minimum duties provision may be applicable. For new facilities or facilities where the intake or outfall locations have been moved, DEQ will use the approach described above to determine if the minimum duties provision is applicable.
When assessing the wasteload allocation for attainment, DEQ used the approach described in **Error! Reference source not found.** to implement the minimum duties provision.

The minimum duties provision applies on days when $T_{E_WLA} < T_i$. ***Equation 9-10***
When the minimum duties applies, there may be no increase in temperature above the intake temperature (T_i) and the assigned portion of the HUA is zero (ΔT = 0.0).
where,

T_{E_WLA} = Daily maximum effluent temperature (°C) allowed under the wasteload allocation as calculated using **Equation 9-7** (using WLA) where $T_{C,i}$ equals the applicable temperature criteria.

T_i = The daily maximum influent temperature (°C) measured at the facility intake.

9.2 Load allocations for nonpoint sources

Refer to the [final date] Rogue River Basin Temperature TMDL rule (OAR ….) for the load allocations assigned to nonpoint sources.

Load allocations are assigned to background sources and anthropogenic nonpoint sources on all waters in the Rogue River Basin. Load allocations for background sources are calculated using Equation 9-11.

$$LA_{BG} = (T_C) \cdot (Q_R) \cdot C_F$$ **Equation 9-11**

where,

LA_{BG} = Load allocation to background sources (kilocalories/day).

T_C = The applicable temperature criteria, not including the HUA. When there are two year-round applicable temperature criteria that apply to the same AU, the more stringent criteria shall be used.

Q_R = The daily average river flow rate (cfs). For a lake, a dilution factor of 1 may be used for Q_R unless determined using another method.

C_F = Conversion factor using flow in cfs: 2,446,665

$$\left(\frac{1\text{ m}}{3.2808\text{ ft}}\right)^3 \cdot \frac{1\ m^3}{35.31\ ft^3} \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

Equation 9-11 shall be used to calculate the load allocation to background sources for any AU or stream location in the Rogue River Basin not identified in the TMDL or when river flows are greater than 7Q10. Equation 9-11 may also be used to calculate the load allocations for background nonpoint sources if in the future the applicable temperature criteria are updated and approved by EPA.

Load allocations assigned to anthropogenic nonpoint sources on any AU or stream location in the Willamette Subbasins are calculated using Equation 9-12. The portions of the HUA (ΔT) assigned to nonpoint sources or source categories are presented in Section 9.1**Error! Reference source not found.** of the TMDL.

$$LA_{NPS} = (\Delta T) \cdot (Q_R) \cdot C_F$$ **Equation 9-12**

where,

LA_{NPS} = Load allocation to anthropogenic nonpoint sources (kilocalories/day).

ΔT = The portion of the HUA assigned to each nonpoint source or source category representing the maximum cumulative temperature increase (°C) from the nonpoint source or source category. When the minimum duties provision at OAR 340-041-0028(12)(a) applies, ΔT = 0.0.

Q_R = The daily average river flow rate (cfs). For a lake, a dilution factor of 1 may be used for Q_R unless determined using another method.

C_F = Conversion factor using flow in cfs: 2,446,665

$$\left(\frac{1\text{ m}}{3.2808\text{ ft}}\right)^3 \cdot \frac{1\ m^3}{35.31\ ft^3} \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

9.3 Surrogate measures

EPA regulations (40 CFR 130.2(i)) and OAR 340-042-0040(O)(5)(b) allow for TMDLs to utilize other appropriate measures (or surrogate measures). See Section 9.4 of the TMDL for a discussion of the surrogate measures that implement the TMDL load allocations.

10. Water quality standards attainment

10.1 Point sources

DEQ's approach to point source allocations is summarized in TSD sections 0 and 9.1.6. The facility-specific HUA and WLA and assignments are summarized in sections 9.1.6.1 and 9.1.6.2. For point sources, attainment of the temperature criteria is demonstrated by attaining the assigned HUA and equivalent WLA at the point of discharge and cumulatively at the point of maximum impact.

On unmodeled streams and where a model based cumulative effects analysis was not completed (TSD Appendix A, Figure 1-1), it was assumed that warming impacts from individual point sources did not dissipate with distance from the outfall. This means that the total portion of the HUA assigned to the point source sector on any singe stream represents the sum of the HUA assignments to individual point sources. For example, if a stream has two NPDES point sources that each have an HUA assignment of 0.075°C, the HUA assignment to all NPDES point sources at the point of maximum impact on that stream is 0.15°C. This approach is protective based on model results from other streams that show temperature impacts from point sources dissipating moving downstream from the outfall. DEQ also mapped the outfall locations to AUs and adjusted the HUA assignments on AUs that did not have point sources, but that were downstream of AUs with dischargers, to ensure that there would be no warming above the HUA assigned to point sources. This ensures cumulative warming from all point sources will not exceed the portion of the HUA assigned to the point source sector.

On temperature modeled streams where a model based cumulative effects analysis was completed (TSD Appendix A, Figure 1-1), DEQ evaluated attainment with a cumulative effects analyses. The model analysis consisted of setting point source effluent discharges at their respective WLAs. The stream temperature from this model scenario were then compared to stream temperatures from a model scenario without point sources. The difference is the change in temperature caused by point sources discharging at their WLAs. This analysis allow DEQ to assess how warming from point sources occurred over space and time, and to confirm that the applicable temperature criteria would be attained.

Model results confirm that cumulative warming from point sources will not exceed the portion of the HUA assigned to point sources on the Molalla River, Pudding River, or the Willamette River and major tributaries, including the McKenzie River.

Note: The above section will be edited in the final TSD to include specifics related to the cumulative effects analyses performed for the TMDL.

10.2 Nonpoint sources

DEQ's approach to nonpoint source allocations is to distribute portions of the HUA to four nonpoint source categories: Nonpoint source dam and reservoir operations; Consumptive use water management and withdrawals: Solar loading from existing transportation corridors, buildings, and utility infrastructure; and Solar loading from all other nonpoint source sectors.

The portion of the HUA allocated to nonpoint source categories was set to ensure no more than 0.3°C of cumulative warming from all NPDES point sources and nonpoint sources on a given waterbody. The nonpoint source HUA allocation will be implemented by assessing the cumulative warming of a waterbody by all nonpoint sources. This ensures cumulative warming from all nonpoint sources will not exceed the portion of the HUA allocated to nonpoint sources.

DMAs responsible for nonpoint source categories are expected to meet their HUA assignments, which were calculated to attain water quality standards. The HUA allocations for nonpoint source categories are achieved through the implementation of load allocations and surrogate measures. DMAs are responsible for implementing management activities that achieve the surrogate measure targets appropriate to their source category and location. A DMA has achieved their load allocation when surrogate measure targets are met. When all DMAs within a nonpoint source category have met their surrogate measure targets and achieved their load allocations, the HUA allocation to that nonpoint source category is achieved.

The dam and reservoir surrogate measure will attain the assigned HUA and load allocation because it targets 7DADM temperatures no warmer than those upstream of the reservoir. The surrogate measure also implements the minimum duties provision in rule at OAR 340-041-0028(12)(a). This provision states that anthropogenic sources are only responsible for controlling the thermal effects of their own discharge or activity in accordance with their overall heat contribution. For dam and reservoir operations, the surrogate measure reflects temperatures upstream of the reservoir (or no dam temperatures), thus ensuring dam operators are only responsible for temperature increases caused by the dam and reservoir operations.
Effective shade surrogate measure targets are set at levels that assume no anthropogenic warming of the stream. When effective shade targets are met, the HUA assignments and load allocations to solar loading from nonpoint sources are achieved.

(Note: The following section will be completed as part of the final draft TMDL.)

11. References

12. Appendices

This TSD includes the following appendices:

Appendix A: Model Report

Appendix B: Assessment Units Addressed by the TMDL

Appendix C: Little Butte Creek Geomorphology and Groundwater Connectivity Assessment

Appendix D: Shade Results