TUALATIN RIVER FLOW MANAGEMENT TECHNICAL COMMITTEE

2019 Annual Report

prepared by
Bernie Bonn for

Clean Water Services

Cover Illustration: Technical Committee Agencies
Logos taken from their respective public websites.

Tualatin River Flow Management Technical Committee

2019 Annual Report

Prepared by: Bernie Bonn *For:* Clean Water Services

FLOW MANAGEMENT TECHNICAL COMMITTEE MEMBERS

Kristel Griffith, Chair	*City of Hillsboro Water Department*
John Goans	*Tualatin Valley Irrigation District*
Jake Constans	*Oregon Water Resources Department*
Jamie Hughes	*Clean Water Services*
Raj Kapur	*Clean Water Services*
Laura Porter	*Clean Water Services*
Chris Walsh	*Washington County — Emergency Management System*
Mark Rosenkranz	*Lake Oswego Corporation*
Brian Dixon	*City of Forest Grove*

ACRONYMS USED IN THIS REPORT

Full Name	Acronym
Facilities	
Spring Hill Pumping Plant	SHPP
Wastewater Treatment Facility	WWTF
Organization	
Barney Reservoir Joint Ownership Commission	BRJOC
Clean Water Services	CWS
Joint Water Commission	JWC
Lake Oswego Corporation	LOC
Oregon Department of Environmental Quality	ODEQ
Oregon Department of Fish and Wildlife	ODFW
Oregon Department of Forestry	ODF
Oregon Water Resources Department	OWRD
National Marine Fisheries Service	NMFS
Tualatin Valley Irrigation District	TVID
Tualatin Valley Water District	TVWD
Bureau of Reclamation	BOR
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey	USGS

Full Name	Acronym
Units of Measurement	
Acre-Feet	ac-ft
Cubic Feet per Second	cfs
Micrograms per liter	μg/L
Milligrams per Liter	mg/L
Million Gallons per Day	MGD
Pounds	lbs
River Mile	RM
Water Year	WY
Water Quality Parameters	
Biochemical Oxygen Demand	BOD
Dissolved Oxygen	DO
Sediment Oxygen Demand	SOD
Other	
Biological Opinion	BiOp
Total Maximum Daily Load	TMDL
Wasteload Allocation	WLA

Disclaimer

This report and the data presented herein are provided without any warranty, explicit or implied. The data presented in this report were supplied by the members of the committee. Although every effort was made to faithfully reproduce the data as provided, the data are not warranted to be accurate, appropriate for interpretation, merchantable, or suitable for any particular purpose.

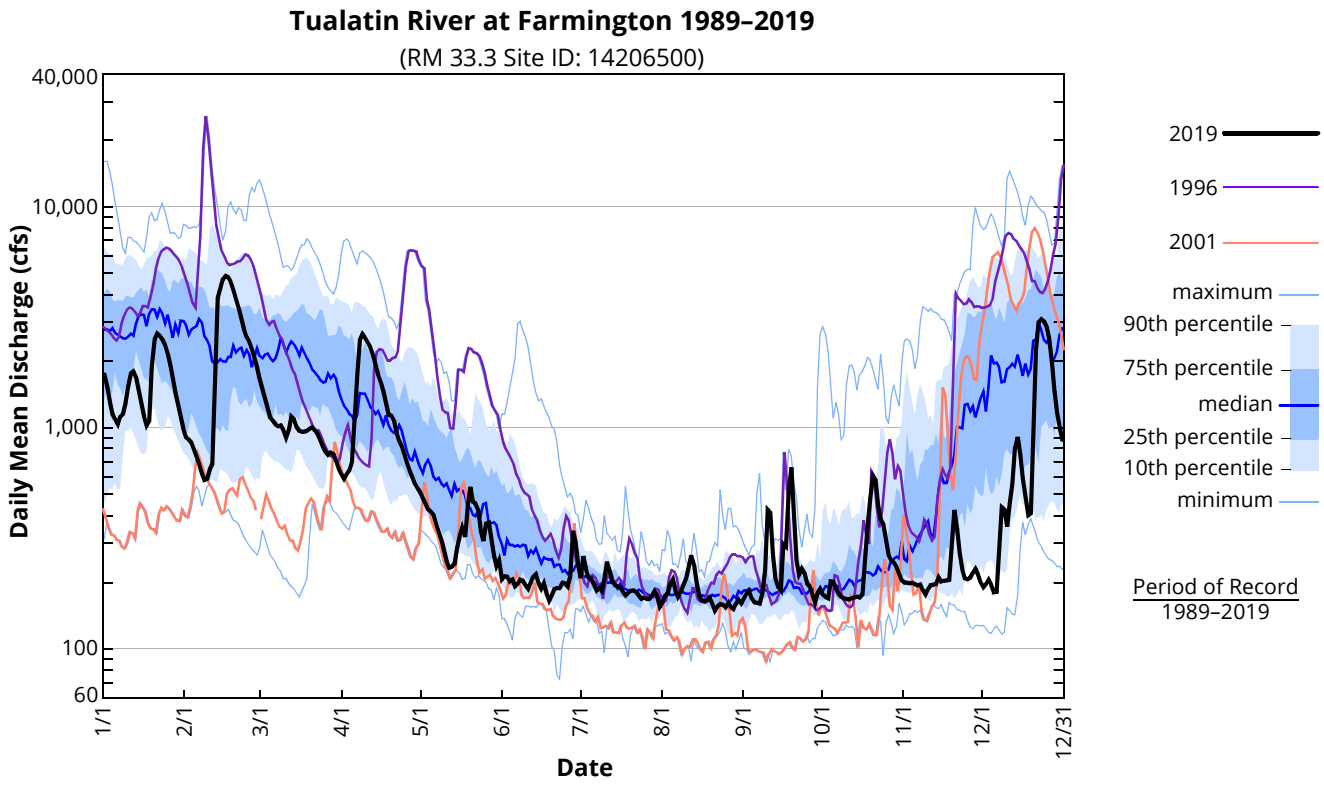
TABLE OF CONTENTS

2019 SUMMARY

This is the thirtieth year that the Tualatin River Flow Management Technical Committee has prepared an annual report documenting the flow management of the Tualatin River. Members of the committee include Clean Water Services (CWS), Tualatin Valley Irrigation District (TVID), Joint Water Commission (JWC), Lake Oswego Corporation (LOC) and Oregon Water Resources Department (OWRD).

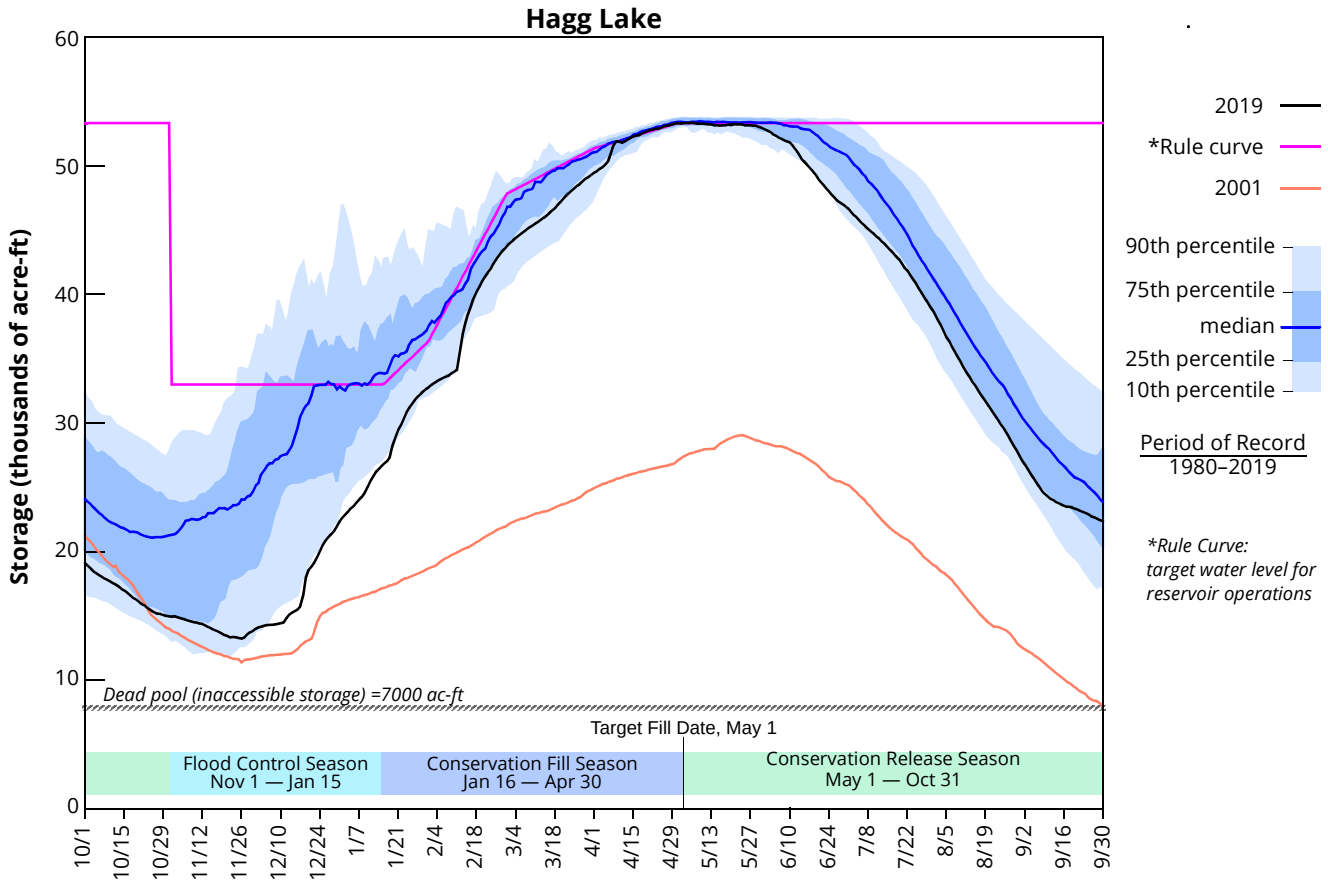
HIGHLIGHTS

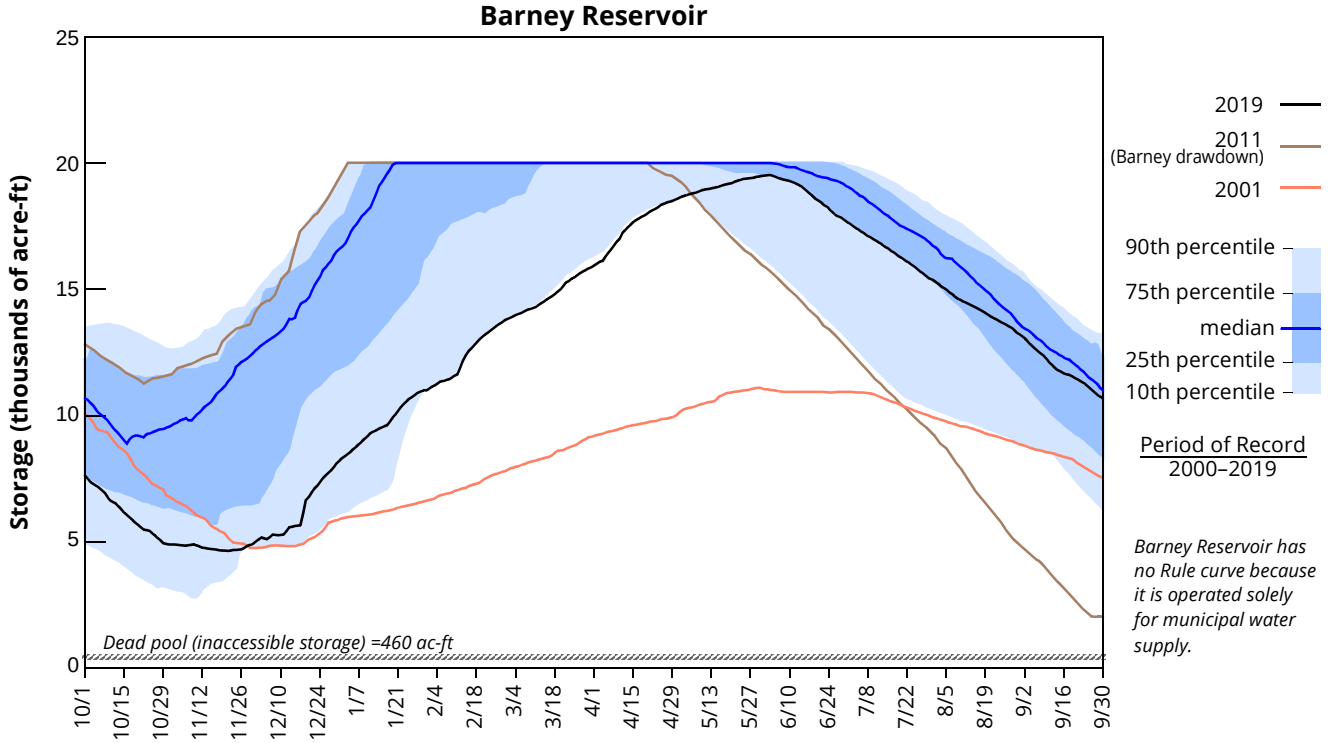
- Scoggins Reservoir filled. Barney Reservoir reached 97.6% full. The fill curves are on the following page.
- Regulation of river water began on May 30 and continued through December 12, without suspension, for a total of 196 days— the longest season on record. It was also the latest date of regulation. Previously, the longest season (2001) was 14 days shorter and the latest date of regulation was December 9 in 2002.
- Clean Water Services' releases of stored water began on May 14—10 days earlier than in 2018 which had been their earliest release date on record. CWS releases were discontinued after 3 days and resumed on May 30. Joint Water Commission released stored water for 196 days, their longest season on record.
- For the second year in a row, low flow in the Tualatin River persisted into November.
- Weather highlights:
  - —Total rainfall for the 2019 water year was lower than the period of record median at every site and lower than the 2018 water year total at most sites.
  - —March was unusually dry. Records for low monthly rainfall were set at some sites.
  - —The summer was cloudier, cooler and wetter than many recent years. September was wetter than average.
  - —Rainfall in November 2019 was especially low and set records at many sites.
- The cloudier summer weather suppressed algal activity. This was beneficial to Oswego Lake, but resulted in a long period of low dissolved oxygen levels in the Tualatin River and its tributaries.
- Continuous monitoring data revealed unknown discharges to the Tualatin River upstream of Dilley and to Beaverton Creek.



Reservoir Status

Barney Reservoir reached a maximum of 19,520 ac-ft (480 feet below full pool) on June 3, 2019. Hagg Lake reached full pool on May 5, 2019. The reservoir levels for WY 2019 and the filling histories are shown below.





BACKGROUND

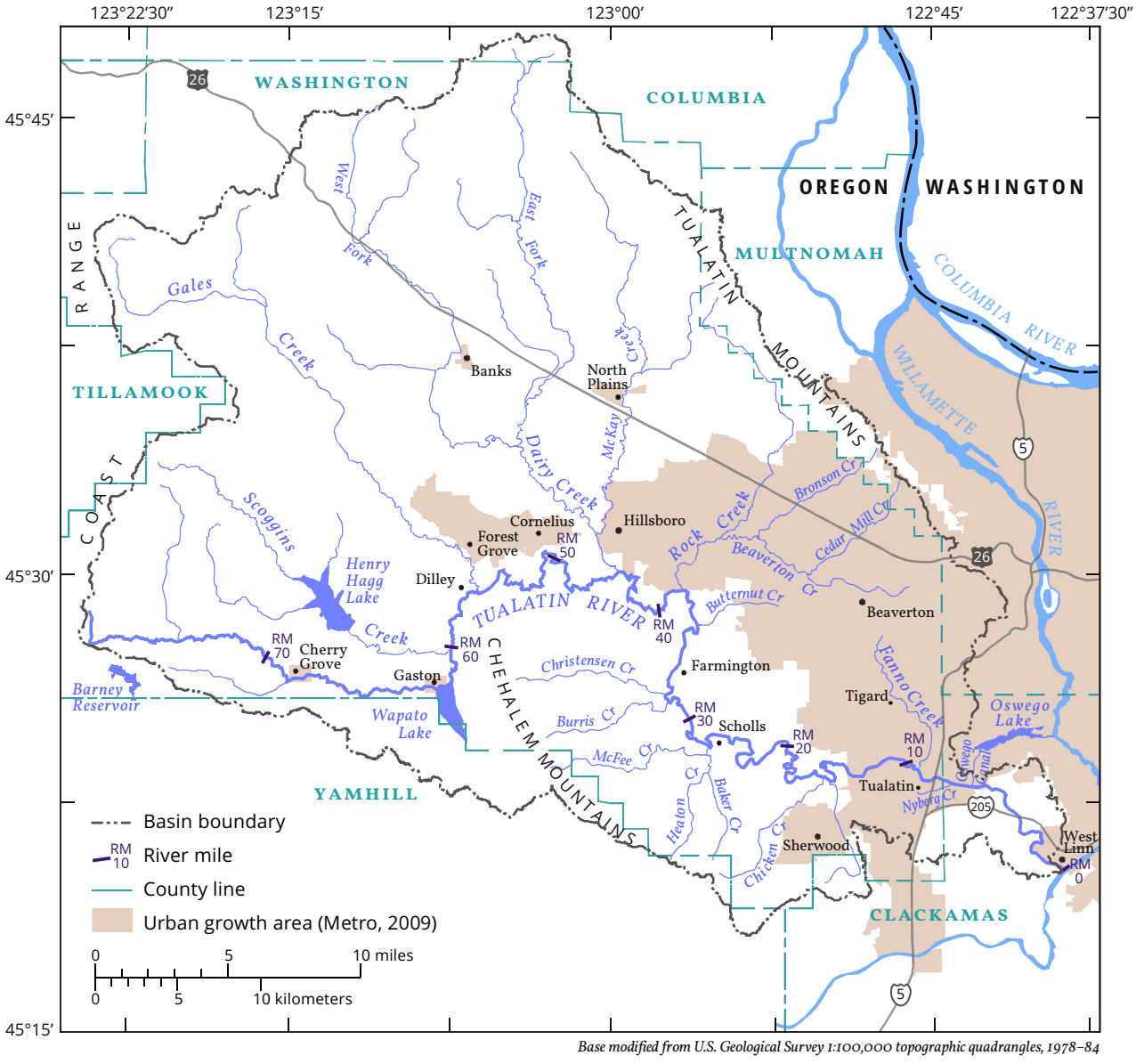
BASIN DESCRIPTION

The Tualatin River Basin consists of 712 square miles in the northwest corner of Oregon and is a subbasin of the Willamette River. The basin lies almost entirely in Washington County. (See map below.)

The Tualatin River flows in a generally easterly direction from its headwaters in the Coast Range to its confluence with the Willamette River just upstream of Willamette Falls near West Linn. It can be divided into 4 different reaches.

REACH	LOCATION	WIDTH	AVERAGE SLOPE	CHARACTERISTICS
Headwater	> RM 55	about 15 ft	74 ft/mi	fast moving, steep terrain
Meander	RM 55–33	about 20–50 ft	1.3 ft/mi	slow moving, meandering on valley bottom
Reservoir	RM 33–3.4	wide, up to 150 ft	0.08 ft/mi	slow moving, lake-like with deep pools
Riffle	RM 3.4–0	variable	10 ft/mi	short reservoir section to a narrow gorge

Tualatin River Basin



Base modified from U.S. Geological Survey 1:100,000 topographic quadrangles, 1978–84

Water sources to the Tualatin River

Precipitation: Seasonal rainfall accounts for most of the natural flow in the Tualatin Basin; streamflow from snowmelt is minimal. The amount of rainfall ranges from 110 inches on the eastern slopes of the Coast Range to 37 inches in the southeastern area of the drainage basin. Peak months for rainfall are November through February while the driest months are normally June through October. The peak streamflow month is usually February and the lowest streamflow month is August. Precipitation records can be found in Appendix G.

Barney Reservoir: Barney Reservoir is located behind Eldon Mills Dam on the Middle Fork of the North Fork of the Trask River (outside of the Tualatin Basin). A trans-basin aqueduct carries water over a low Coast Range divide to a pipeline that discharges into the Tualatin River at RM 78. Barney Reservoir has a capacity of 20,000 acre-feet and stores water for the Joint Water Commission (Cities of Hillsboro, Forest Grove and Beaverton, and the Tualatin Valley Water District) and Clean Water Services. The Barney Reservoir Joint Ownership Commission owns, operates and manages Barney Reservoir. Reservoir content is monitored through calibrated reservoir elevations; water releases are monitored using a stream gage located in the outlet flume. Water is released during the summer low-flow season to supplement shortages in natural flow. The water is used for municipal supply and for instream water quality. Storage in Barney Reservoir is also allocated to the Oregon Department of Fish and Wildlife. Those flows, to the Trask River, are measured using an instream weir. Reports on Barney Reservoir operation can be found in Appendix D.

Hagg Lake: In the early 1970s the Bureau of Reclamation built an earthen dam on Scoggins Creek (RM 5.1). Releases from Henry Hagg Lake (the reservoir behind Scoggins Dam) flow down Scoggins Creek and enter the Tualatin River at RM 60.0. Hagg Lake has an active storage capacity of 53,323 acre-feet. Its water is used for irrigation, municipal and industrial supply, and water quality enhancement.

Scoggins Dam is operated and maintained by the Tualatin Valley Irrigation District under contract with the Bureau of Reclamation. Flow into Scoggins Creek (RM 4.8) is monitored by a Bureau of Reclamation stream gage; Oregon Water Resources Department maintains the rating curve for this site. Reports on Scoggins Dam operation can be found in Appendix C.

Clean Water Services: Clean Water Services provides wastewater treatment, stormwater management, and watershed management services primarily in urban areas of Washington County. A watershed-based NPDES permit allows Clean Water Services to discharge treated wastewater into the Tualatin River from four wastewater treatment facilities (WWTFs). The Rock Creek and Durham WWTFs (RM 38.1 and 9.3, respectively) are the largest. The Forest Grove and Hillsboro WWTFs (RM 55.2 and 43.8, respectively) are much smaller and prior to 2017 did not discharge during the dry season (generally May–October). In 2017, Clean Water Services began treating wastewater from the Forest Grove and Hillsboro service areas during the dry season at the Forest Grove WWTF and then directing it through a 95-acre natural treatment system (NTS) at Forest Grove prior to discharge into the Tualatin River at RM 55.2. WWTF flow rates are continuously monitored at each WWTF. Clean Water Services also releases storage water from Hagg Lake and Barney Reservoir for flow augmentation during the summer and early fall. (River mile locations given here are based on USGS topographic maps and may be slightly different from those used in Clean Water Services' watershed-based NPDES permit which are from a different source.)

Water sources to the tributaries

Clean Water Services: Clean Water Services partners with the Tualatin Valley Irrigation District to deliver water to several tributaries for flow restoration in the summer. Approximately 1 to 2.5 cfs of water has been added to McKay Creek every year since 2005. Similar measures have been implemented for Gales Creek (2009), East Fork Dairy Creek (2010), and West Fork Dairy Creek (2011). The goal of the program is to increase base flows in the tributaries, thereby improving water quality— specifically increasing the dissolved oxygen concentration and decreasing stream temperature. The flow augmentation water for the tributaries is from Clean Water Services' allocation in Hagg Lake and is delivered by TVID transmission lines.

Water diversions from the Tualatin River

Cherry Grove Intake (RM 73.2): The City of Hillsboro diverts water for municipal and industrial uses at the Cherry Grove Intake. This water is delivered to the rural residents of the Dilley and Cherry Grove areas (served by the City of Hillsboro), as well as the City of Gaston and the LA Water Cooperative (as Hillsboro wholesale customers). The diversion is less than 3 cfs and is monitored via metered flows.

Spring Hill Pumping Plant (RM 56.3): The Spring Hill Pumping Plant is the largest diversion facility on the river. It is owned by the Bureau of Reclamation (BOR) and operated jointly by the Tualatin Valley Irrigation District (TVID) and the Joint Water Commission (JWC). TVID, with a pumping capacity of approximately 90 MGD (140 cfs), delivers water to about 12,000 acres of irrigated cropland via a pressure pipeline. JWC, with a pumping capacity of approximately 86 MGD (133 cfs), delivers water to the Cities of Hillsboro, Forest Grove and Beaverton, to the Tualatin Valley Water District, and to the wholesale customers of these entities. Both TVID and JWC have natural flow water rights. When natural flow is not adequate, the Washington County Watermaster (part of the Oregon Water Resources Department) curtails some water rights. At that time, TVID and JWC release contracted stored water from Hagg Lake and Barney Reservoir to augment the low natural flow. Pumping rates are monitored by TVID and JWC using telemetry-equipped flow meters. Additional monitoring is provided by real-time stream gages on the Tualatin River located above and below the pumping plant and on Gales Creek.

Wapato Canal Diversion: Historically, TVID diverted water from the Tualatin River at the Wapato Canal Diversion (near RM 62), to the Wapato Improvement District and to surrounding TVID customers. The Wapato Improvement District drained Wapato Lake each year and its members farmed the lake bed. From 2007–2013, ownership of Wapato Lake transitioned to the US Fish and Wildlife Service who now manages it as the Wapato Lake National Wildlife Refuge. The duties of the now defunct Wapato Improvement District have been split between USFWS (to maintain the dike and levee system), and TVID (to operate and maintain the irrigation water delivery system). At this time flow in the Wapato Canal Diversion is not monitored.

Irrigation Withdrawals: Water is obtained directly from the Tualatin River for irrigation purposes by members of the TVID and by irrigators with natural flow water rights. About 5,000 acres of cropland served by TVID is irrigated with water obtained directly from the Tualatin River. Some of the discharge from the Rock Creek WWTF (RM 38.1) is contracted to TVID to be used by downstream irrigators.

Patton Valley Pump Plant: Tualatin Valley Irrigation District pumps water from Scoggins Creek (RM 1.71) into a low-pressure pipeline that serves customers along Patton Valley Road. Historically, this pipeline also diverted water into the upper Tualatin River (at RM 63.1 and RM 64.3) to supplement low flows in this reach, but this has not been needed in recent years due to releases from Barney Reservoir.

Oswego Lake Canal Diversion: The Lake Oswego Corporation (LOC) diverts a portion of the Tualatin flow into the Oswego Lake Canal at RM 6.7. A headwork structure regulates the flow into this mile long canal that feeds into Oswego Lake. The Lake Oswego Corporation has several natural flow water rights, including rights for hydropower generation, irrigation, and lake level maintenance. At RM 3.4, a combination diversion dam/fish ladder structure is used during low flow periods to elevate the Tualatin River enough to divert the flow into the canal. During most of the year, river elevation is adequate to allow diversion of the LOC water right. Historically, flash boards were installed to increase the water level during the summer, but they have not been used since 2003. The dam plus several natural basalt sills cause the water to pool in the reservoir reach. Flow in Oswego Lake Canal was monitored during the summer by a gaging station operated by the Oregon Water Resources Department, but that site was discontinued partway through 2011 and is not currently monitored.

Water diversions from the tributaries

Irrigation withdrawals: Water is obtained directly from some tributaries for irrigation by irrigators with natural flow water rights.

Forest Grove withdrawal: The City of Forest Grove owns part of the Clear Creek watershed in the Gales Creek basin. The city diverts water for municipal use at several locations in that watershed.

Tualatin River Water Management

Tualatin River Flow Management Technical Committee: The Tualatin River Flow Management Technical Committee provides a mechanism for the coordination and management of flow in the Tualatin River. The members of the committee are technical staff with detailed knowledge of the specific characteristics of flow in this river. The committee meets monthly from April through November. Meetings focus on the current status of the reservoirs. In addition, a variety of other water issues and any problems are discussed. Each member updates the committee on changes that could impact the flow management of the Tualatin. The communication, coordination and cooperation among the partner agencies has proven invaluable in managing the resource.

Data collection system: Water in the Tualatin Basin is monitored by gages on streams and flow meters on major diversions and wastewater treatment facility discharges. Stream gages are present along the mainstem Tualatin and all major tributaries that affect water distribution. Various water quality parameters are monitored at several sites. Many of these monitors have telemetry, making the data available in real-time. Throughout the season, daily operations can be monitored by Clean Water Services (CWS), Joint Water Commission (JWC), Tualatin Valley Irrigation District (TVID), and the Lake Oswego Corporation (LOC). A map showing monitoring locations is shown on the next page. Selected data are in the appendices of this report.

A coordinated information system was developed to provide flow information to all members of the committee. Flow conditions and a summary of daily releases are reported via daily email by the superintendent of Scoggins Dam. The JWC provides a daily email containing information about the rate of intake at the Spring Hill Pump Plant, releases from Scoggins and Barney Reservoirs, and available natural flow. Because use or release of water by any one of the entities can impact the other users, coordination of flow information is an important aspect of the committee's work.

The monitoring effort makes it possible to proactively manage storage, instream flows, and diversions so that minimum instream flow requirements and general compliance with water rights and storage agreements are met. Flow data are also required to calculate pollutant loads, which are necessary for the Total Maximum Daily Load (TMDL) program. Monitoring includes temperature as well as flow at some sites. As water quality issues have come to the forefront, the monitoring system has provided information vital to understanding the Tualatin Basin, helped guide basin management, and been an excellent example of interagency cooperation. The members of the Flow Management Committee appreciate the efforts of all those who provide data.

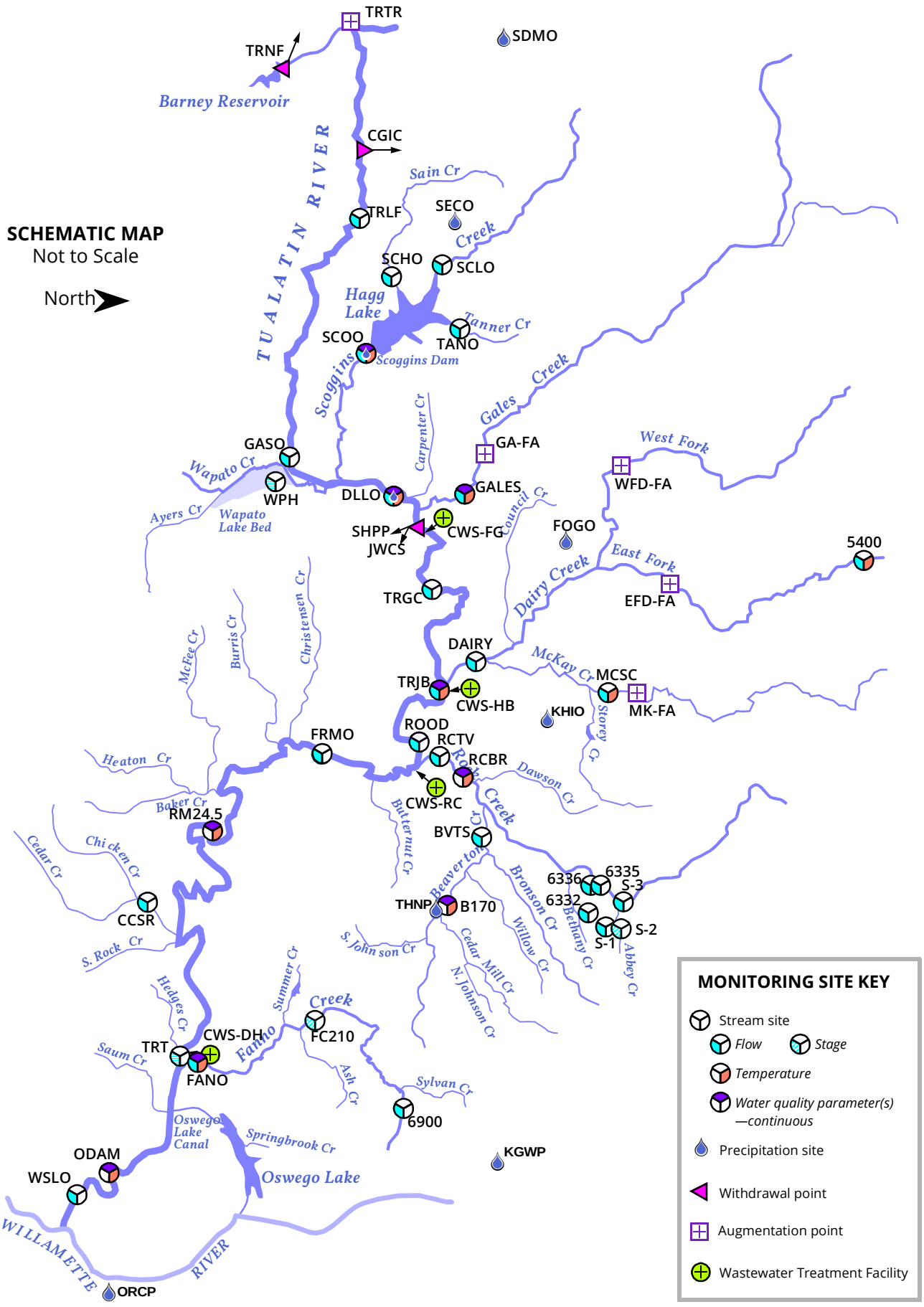
Some of the monitoring data for the Tualatin Basin can be accessed at the following web sites:

- Bureau of Reclamation data:
  `https://www.usbr.gov/pn/hydromet/tuatea.html`
- Jackson Bottom Wetlands Center data:
  https://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl?basin_id=tualatin&site_id=14206241
- Oregon Water Resources Department data:
  `https://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/`
- USGS data:
  `https://or.water.usgs.gov/tualatin/monitors/`

Annual Tualatin Basin Flow Management Report: This report is published annually and describes water management, accounting, storage, stream gaging, diversions, and effluent discharge for the Tualatin Basin. Annual reports dating from 1992 are available at:

https://www.co.washington.or.us/Watermaster/SurfaceWater/tualatin-river-flow-technical-committee-annual-report.cfm

Tualatin Basin Monitoring Sites



2019 MONITORING SITES — ALPHABETICAL LISTING BY SITE CODE

LOCATION IN REPORT

Main: Water Quality | Appendix A | Appendix B | Appendix F | Appendix G | Monitored, but not in report

CODE	SITE NAME	FLOW	PRECIPITATION	CONTINUOUS MONITORS: TEMP	DO	pH	COND	TURB	CHL-*a*	fDOM
Stream monitoring sites										
5400	East Fork Dairy Creek near Meacham Corner, OR	■		■						
6332	Bethany Creek at NW Springville Rd at Bethany, OR	■								
6335	Rock Creek at NW 185th Ave near Hillsboro, OR	■								
6336	Rock Creek Ditch at NW 185th Ave near Hillsboro, OR	■								
6900	Fanno Creek at 56th Avenue	■								
B170	Beaverton Creek at 170th Ave, Beaverton, OR			■	■	□	■	■		
BVTS	Beaverton Creek at Cornelius Pass Road (near Orenco)	■								
CCSR	Chicken Creek at Roy Rogers Rd near Sherwood, OR	■								
DAIRY	Dairy Creek at Hwy 8 near Hillsboro, Oregon	■								
DLLO	Tualatin River at Dilley, Oregon	■	■	■		□	□	□	■	□
FANO	Fanno Creek at Durham Road near Tigard, Oregon	■		■	■	■	□	■		
FC210	Fanno Creek at Hwy210 at Beaverton, OR	Stage								
FOGO	Forest Grove, Oregon AgriMet Weather Station (Verboort)		■							
FRMO	Tualatin River at Farmington, Oregon	■								
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	■		■	■	□	□	□		■
GASO	Tualatin River at Gaston, Oregon	■								
KGWP	KGW-TV Weather Station		■							
KHIO	Hillsboro Airport Weather Station		■							
MCSC	McKay Ck at Scotch Church Rd abv Waible Ck nr North Plains	■		■						
ODAM	Tualatin River at Oswego Dam near West Linn, Oregon			■	■	■	□	□	■	
ORCP	Oregon City Precipitation Station		■							
RCBR	Rock Creek at Brookwood Avenue, Hillsboro, Oregon			■	■	□	□	■		
RCTV	Rock Creek at Hwy 8 near Hillsboro, Oregon	■								
RM24.5	Tualatin River at RM 24.5 near Scholls, Oregon			■	■	□	□		■	
ROOD	Tualatin River at Rood Bridge Road near Hillsboro, Oregon	■								
SCHO	Sain Creek above Henry Hagg Lake near Gaston, Oregon	■								
S-1	South Fork Abbey Creek Downstream of NW Kaiser Rd at Bethany, OR	■								
S-2	Rock Creek at NW Germantown Rd at Bethany, OR	■								
S-3	Abbey Creek at NW Kaiser Rd at Bethany	Stage								
SCLO	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	■								
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	■	■	■	■	□	□	□		
SDMO	Saddle Mountain Precipitation Station (SNOTEL #726)		■							
SECO	Sain Creek Precipitation Station (SNOTEL #743)		■							
TANO	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	■								
THNP	Tualatin Hills Nature Park Precipitation Station		■							
TRGC	Tualatin River at Golf Course Road near Cornelius, Oregon	■								
TRJB	Tualatin River at Hwy 219 Bridge	■		■	■	□	□	□	■	
TRLF	Tualatin River below Lee Falls near Cherry Grove, Oregon	■								
TRT	Tualatin River at Tualatin, Oregon	Stage								
WPH	Wapato Canal at Pumphouse at Gaston, Oregon	Stage								
WSLO	Tualatin River at West Linn	■								
Monitored withdrawals and releases										
CGIC	City of Hillsboro Withdrawal at Cherry Grove	■								
CWS-DH	CWS Durham WWTF Discharge	■								
CWS-FG	CWS Forest Grove WWTF Discharge (with Fernhill NTS)	■		□	□	□	□	□	□	
CWS-HB	CWS Hillsboro WWTF Discharge	■		□	□	□				
CWS-RC	CWS Rock Creek WWTF Release	■		□	□	□				
EFD-FA	CWS East Fork Dairy Flow Augmentation with TVID	■								
GA-FA	CWS Gales Creek Flow Augmentation with TVID	■								
JWCS	Joint Water Commission Withdrawal at Spring Hill Pump Plant	■								
MK-FA	CWS McKay Creek Flow Augmentation with TVID	■								
SHPP	TVID–Withdrawal at Spring Hill Pump Plant	■								
TRNF	Barney Reservoir Measured Flow to North Fork Trask River	■								
TRTR	Barney Reservoir (Trask River) Release to Tualatin River	■								
WFD-FA	CWS West Fork Dairy Flow Augmentation with TVID	■								

Abbreviations: Temp=water temperature, DO=dissolved oxygen, Cond=conductance, Turb=turbidity, chl-*a*= =chlorophyll-*a*, fDOM=fluorescent dissolved organic matter;

CLEAN WATER SERVICES

by Raj Kapur, Water Resources Program Manager, Clean Water Services

Introduction

Clean Water Services (the District) provides wastewater treatment, stormwater management, and watershed management to more than 600,000 customers primarily in the urban areas of Washington County. The District implements these programs in cooperation with twelve cities (Banks, Beaverton, Cornelius, Durham, Forest Grove, Gaston, Hillsboro, King City, North Plains, Sherwood, Tigard, and Tualatin) and Washington County.

Wastewater treatment: The District owns and operates four wastewater treatment facilities (WWTFs) at sites in Forest Grove, Hillsboro, and Tigard. The Rock Creek and Durham WWTFs are the larger facilities and discharge directly to the Tualatin River year-round.

Rock Creek Wastewater Treatment Facility

The Forest Grove and Hillsboro WWTFs are considerably smaller than the other two facilities and discharge to the Tualatin River through their respective outfalls during the wet season. Since 2017, dry season wastewater from the Hillsboro and Forest Grove service areas is treated at the Forest Grove WWTF and then directed through a 95-acre natural treatment system (NTS) at Forest Grove before discharge to the Tualatin River at RM 55.2.

Durham Wastewater Treatment Facility

Stormwater management: Clean Water Services also implements the municipal separate storm sewer system (MS4) program in the urban parts of the Tualatin River watershed.

Watershed management: Activities occur across the entire Tualatin watershed and include streamflow enhancement in the mainstem Tualatin River and tributaries, and riparian and stream restoration.

Permits: The four WWTFs and the MS4 program are permitted by the Oregon Department of Environmental Quality (ODEQ) under a watershed-based National Pollutant Discharge Elimination System (NPDES) permit.

Flow augmentation program

During the summer low-flow season, Clean Water Services releases stored water to the Tualatin River and several tributaries. The District has rights to 24% of the water in Hagg Lake, which equates to 12,618 ac-ft. The District also owns 10% of the water in Barney Reservoir, which equates to 1,654 ac-ft after accounting for dead pool and required Oregon Department of Fish and Wildlife (ODFW) releases to the Trask River. In all, the District has 14,272 ac-ft of stored water available for use. The stored water releases serve multiple purposes including the following:

Offset thermal load from the District's WWTFs: The watershed-based permit provides Clean Water Services with a mechanism to offset a portion of the thermal load discharged from the Rock Creek and Durham WWTFs and the Forest Grove WWTF and NTS by releasing stored water from Hagg Lake and Barney Reservoir. Stored water releases in July and August form the basis of the flow augmentation credit. The District offsets the remainder of its thermal load by planting riparian areas in the Tualatin River basin to increase shading of the stream channel.

Maintain minimum stream flows: The District's NPDES Permit is based on maintaining minimum stream flows in the Tualatin River above each WWTF. The District uses its stored water releases to maintain minimum stream flows during the summer and fall low-flow period.

Provide sustainable base flows in the upper Tualatin River: During the dry season, Clean Water Services' releases from Hagg Lake and Barney Reservoir can account for more than half of the flow in the Tualatin River in the 15-mile stretch between the Spring Hill Pump Plant (where water is withdrawn for municipal and irrigation uses) and Highway 219, where Dairy Creek enters the Tualatin River. The stored water releases provide sustainable base flows that support habitat for aquatic life and result in cooler river temperatures and higher dissolved oxygen levels.

Improve dissolved oxygen levels and enhance overall water quality in the lower Tualatin River: During the low flow season (summer and early fall) oxygen levels in the lower Tualatin River are heavily influenced by sediment oxygen demand. Sediment oxygen demand is consumption of oxygen by decaying substances in river sediment. When days are long and sunny, photosynthetic production of oxygen by algae tends to offset the oxygen consumed by sediment oxygen demand. However, when days grow short (September-October), or when it is cloudy, photosynthetic production of oxygen does not keep up with consumption of oxygen by sediment oxygen demand, causing oxygen levels to decrease. Clean Water Services' stored water releases from Hagg Lake and Barney Reservoir decrease the effect of sediment oxygen demand, thereby limiting the declines in dissolved oxygen levels in the lower Tualatin River that usually occur during the late summer/early fall period when photosynthetic oxygen production wanes.

Maintaining adequate dissolved oxygen is important for aquatic life and the general health of the river. In addition, dissolved oxygen levels measured downstream of the WWTFs are used to calculate the ammonia limits specified in the watershed-based NPDES permit.

Restore stream flows in Tualatin River tributaries: Clean Water Services uses Tualatin Valley Irrigation District transmission lines to deliver stored water to select tributaries to restore flow and improve water quality. In 2019, Clean Water Services released stored water into Gales Creek, West Fork Dairy Creek, East Fork Dairy Creek, and McKay Creek. Details are in Appendix B.

Wastewater discharges

A watershed-based NPDES permit allows Clean Water Services to discharge treated wastewater into the Tualatin River from its WWTFs. A summary of the discharges is shown below. Details are in Appendix B.

WASTEWATER TREATMENT FACILITY DISCHARGES 2019

Rock Creek WWTF annual average	Durham WWTF annual average	Forest Grove WWTF and NTS* annual average	Hillsboro WWTF wet season average**
47.3 cfs [30.6 MGD]	30.0 cfs [19.4 MGD]	4.33 cfs [2.80 MGD]	6.83 cfs [4.41 MGD]

*Discharge during the dry season (generally May–October) is through the NTS. Discharge at other times could be either through the NTS or the WWTF outfall or both.
**Wet season is generally January–April plus November and December; dry season is generally May–October.

2019 Water releases for flow augmentation

Clean Water Services released flow augmentation water for 198 days in 2019. The total average daily release (for days with releases) was 25.9 cfs. In all, 11,581 acre-feet were released. This is 81% of the District's allocation. The amount of water available to and released by Clean Water Services during 2019 is summarized below.

CLEAN WATER SERVICES WATER AVAILABILITY AND USE — 2019

Reservoir		Maximum Available (acre-ft)	Available (acre-ft)	Total CWS Release (acre-ft)
Hagg Lake	Storage	12,618	12,618	9,972
	Natural flow credit	4,282	0	—
Barney Reservoir	Storage*	2,000	1,613	1,609
	Summer storage**	—	0	—
Total		**18,900**	**14,231**	**11,581**
Percent of available				**81.4%**

*Storage was reduced to 97.5% of normal (1,654 ac-ft) because Barney Reservoir did not fill in 2019.
**Summer storage is water from rain that is stored in Barney Reservoir after releases have begun for the season. Summer storage (when it occurs) is allocated among the members of the Barney Partnership.

Details by month and reservoir: Stored water releases (10 cfs) from Hagg Lake for Clean Water Services began on May 14 after Tualatin River flow had declined significantly. Releases were discontinued on May 17 after flow rebounded, then resumed on May 30, and increased over the course of the summer to a maximum of 53 cfs during August 1–8. Average daily releases were 42.0 cfs (July/August period) and 21.3 cfs (September). Because the weather remained dry, releases persisted well into fall. The last day was December 10, the latest date since 1987 when the District began actively managing stored water releases. The District began releasing water from Barney Reservoir at a rate of 14 cfs on August 30. Except for a brief period in mid-September, releases from Barney Reservoir remained constant at 14 cfs for the remainder of the season. The last release day for Barney Reservoir was November 3. Details of releases by month are shown below.

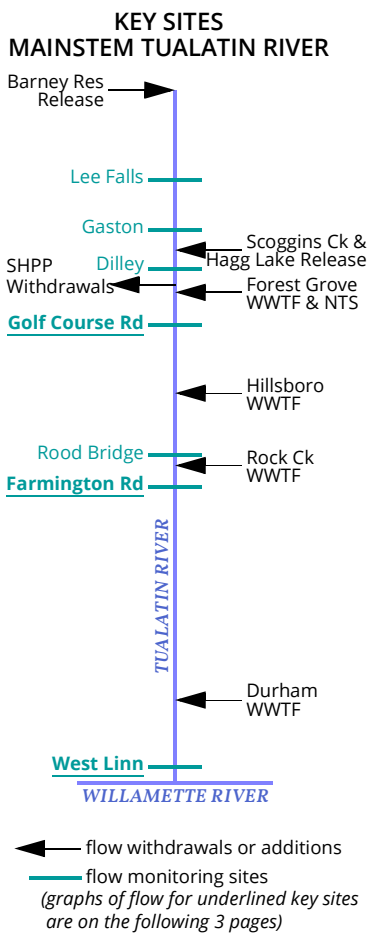
CLEAN WATER SERVICES WATER RELEASE SUMMARY — 2019

	Units	May	June	July	Aug	Sept	Oct	Nov	Dec 1-10	Total
Hagg Lake Release	acre-ft	99	982	2,333	2,839	1,268	1,042	1,121	288	9,972
	days	5	30	31	31	30	27	30	10	194
Barney Release	acre-ft	0	0	0	56	639	861	54	0	1,609
	days	0	0	0	2	23	31	3	0	59
Total Release	acre-ft	99	982	2,333	2,895	1,907	1,903	1,175	288	11,581
Daily Average Release (for days with releases)	cfs	10.0	16.5	37.9	47.1	32.0	30.9	19.7	14.5	29.5

Flow augmentation effects on Tualatin River flow— 2019

Flow is monitored in the upper, middle and lower reaches of the river and informs the management of stored water releases. The figure at the right illustrates the locations of several significant additions and withdrawals along with several key monitoring sites.

Flow targets in the Tualatin River have evolved as the understanding of the river has changed and new objectives were added. The District began managing stored water releases in 1987 with a goal of preventing the large nuisance algal blooms that were then common during the summer. In the early 1990s, work by the US Geological Survey showed that releasing water in the late fall could improve low oxygen conditions by lessening the expression of sediment oxygen demand and the District increased late season flow targets. Flow targets changed again in 2004 when stored water releases were allowed to offset some of the thermal loads from the WWTFs. New mixing zone studies have also affected flow targets as have effluent load limits which are calculated from river flows. The current flow targets are used at three key sites and are applied for the entire dry season (May–October).



FLOW TARGETS AND MEASURED FLOWS AT KEY SITES — 2019

	Golf Course Rd	Rood Bridge Rd	Farmington Rd
Flow target	60 cfs	110 cfs	160 cfs
Daily mean flow (May–October)			
minimum	58 cfs	102 cfs	150 cfs
average	106 cfs	172 cfs	241cfs

Low flow period: For the purposes of discharges from the WWTFs, the low flow period is defined as beginning on the first day after April 30 when the 7-day consecutive median flow in the Tualatin River at Farmington is less than 250 cfs or July 1, whichever is earlier. Similarly, the low flow period ends on the first day after September 30 when the 7-day consecutive median flow in the Tualatin River at Farmington is at least 350 cfs or November 15, whichever is earlier. The low flow period for the WWTFs was from June 4 through October 21 in 2019.

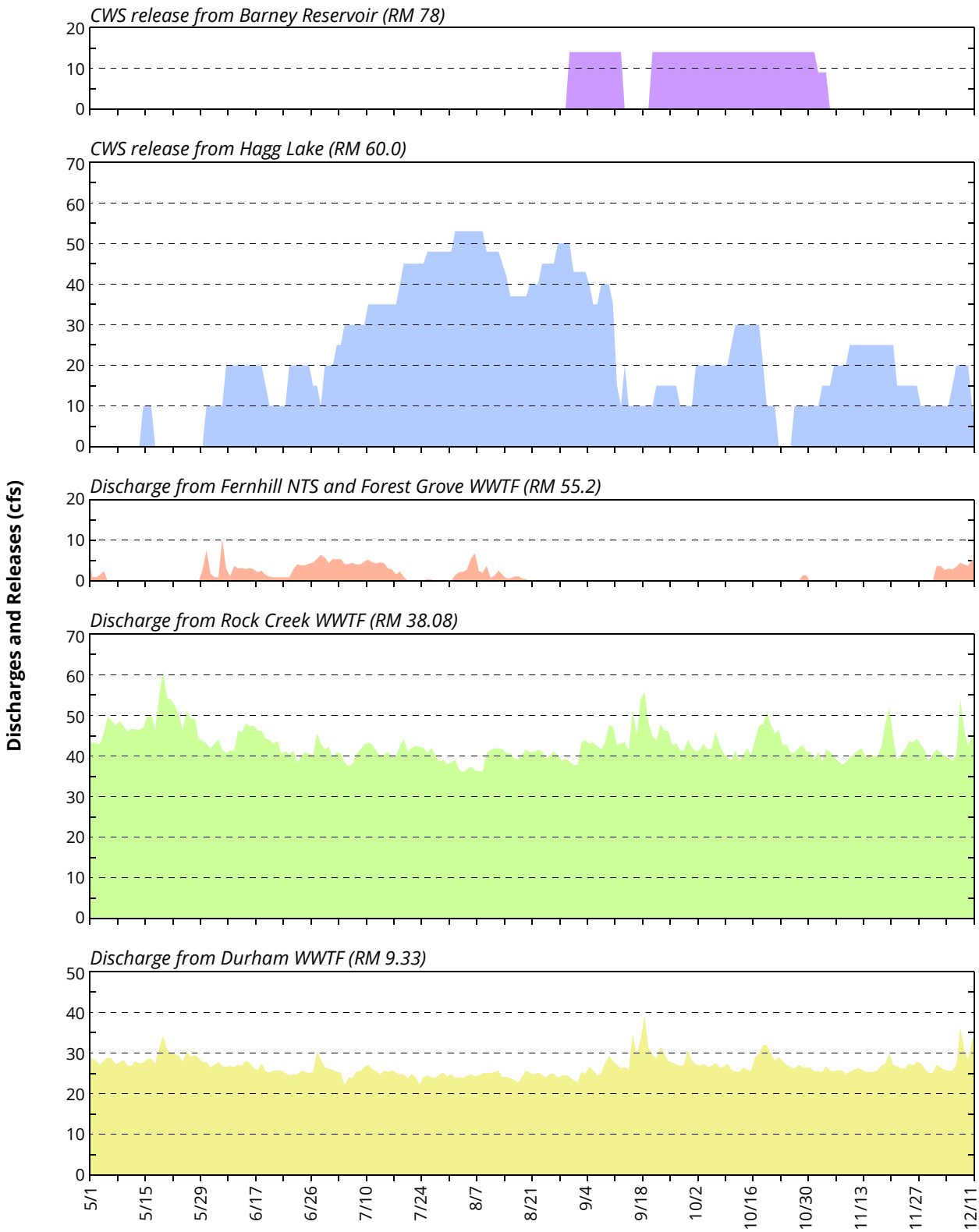
Rainfall was not sufficient to sustain higher flows through the remainder of fall-2019. Although recurring low flow periods after the high flow trigger do not alter the regulatory low flow period for the WWTFs, they affect decisions regarding flow augmentation for water quality management. Releases from Hagg Lake continued through December 10.

With its releases of stored water and discharge from the WWTFs, the District generally was able to maintain minimum stream flows, offset thermal loads from the WWTFs, provide sustainable base flows in the upper Tualatin River and key tributaries and improve overall water quality. Flow management will continue to be vital as the population in Washington County increases.

Releases and discharges: The graph on the following page shows Clean Water Services' flow augmentation from Barney Reservoir and Hagg Lake, and discharges from the WWTFs and NTS for May through November 2019. Graphs on pages 17, 18 and 19 illustrate the importance of the District's contributions to total flow at three key sites:

- Golf Course Road (RM 51.5) is located downstream of major withdrawals by JWC and TVID at the Spring Hill Pump Plant (RM 56.3) and small discharges from the Fernhill NTS and Forest Grove WWTF (RM 55.2).
- Farmington Road (RM 33.3) is located downstream of the Rock Creek WWTF (RM 38.08) and includes flows from Dairy and Rock Creeks and their tributaries.
- West Linn (RM 1.75) is located downstream of the Durham WWTF (RM 9.33). Several small tributaries also enter the Tualatin River between Farmington and West Linn.

Clean Water Services Releases and Discharges to Tualatin River — 2019

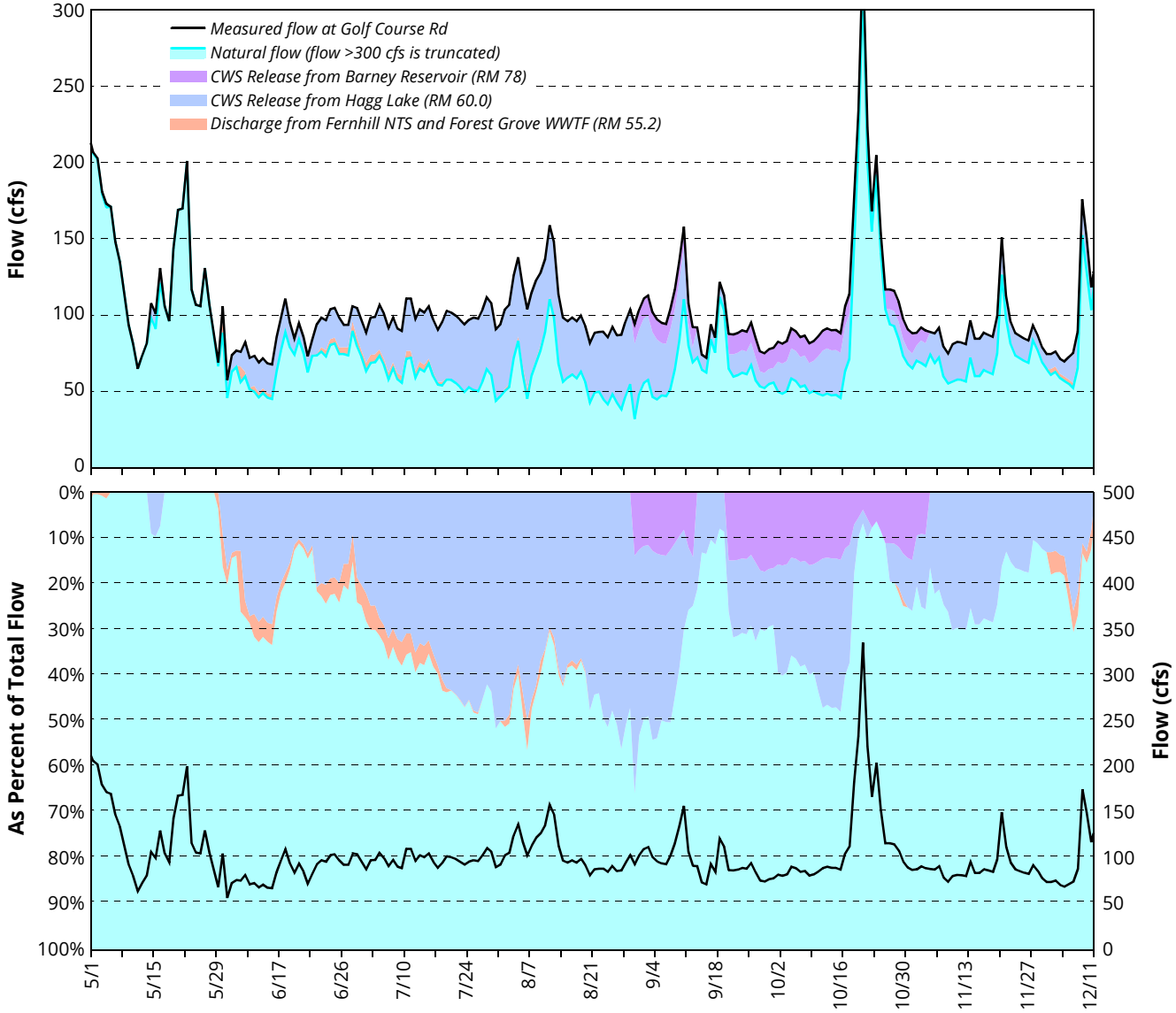


Upper Tualatin River — Golf Course Road site: The graph below shows flow at the Golf Course Rd site (RM 51.5). Flow at this site includes natural flow from the Tualatin River headwaters and Gales Creek plus storage water from Barney Reservoir and Hagg Lake that was not withdrawn at SHPP. The Forest Grove WWTF and Fernhill NTS (both RM 55.2) are upstream of this site. In 2019, the NTS discharged periodically from May 1 through October 31. The District tries to maintain a minimum stream flow target of 60 cfs at this site. The site is unaffected by discharges the District's two large WWTFs (they are downstream).

During the dry periods between July and October, the District's stored water releases accounted for about 50% of the total flow in the upper Tualatin River. Without these releases, flow in the upper Tualatin would have dropped below 50 cfs, making the river considerably slower and warmer.

Note that flow at this site shows a wavy pattern with high flows and low flows repeating approximately every week. This pattern is due to decreased withdrawals by TVID from the SHPP that occur on Sundays, when the demand for irrigation water is generally lower than other days. Releases from Hagg Lake and Barney Reservoir are mostly influenced by weather conditions and do not exhibit a weekly cycle.

Calculated* Clean Water Services Releases in Tualatin River at Golf Course Rd (RM 51.5) — 2019



*The following formula was used to calculate flows in this figure, assuming constant travel time and a uniform evaporative loss (0.25% per mile).

Natural Flow at Golf Course w/o CWS releases =
+ Measured flow at Golf Course (OWRD data)
– Calculated flow from Fernhill NTS or Forest Grove WWTF (= 0.978 x discharge from the same day)
– Calculated flow from Hagg Lake (= 0.979 x CWS Hagg Lake release from the same day)
– Calculated flow from Barney Reservoir (= 0.934 x CWS Barney Reservoir release from the same day)

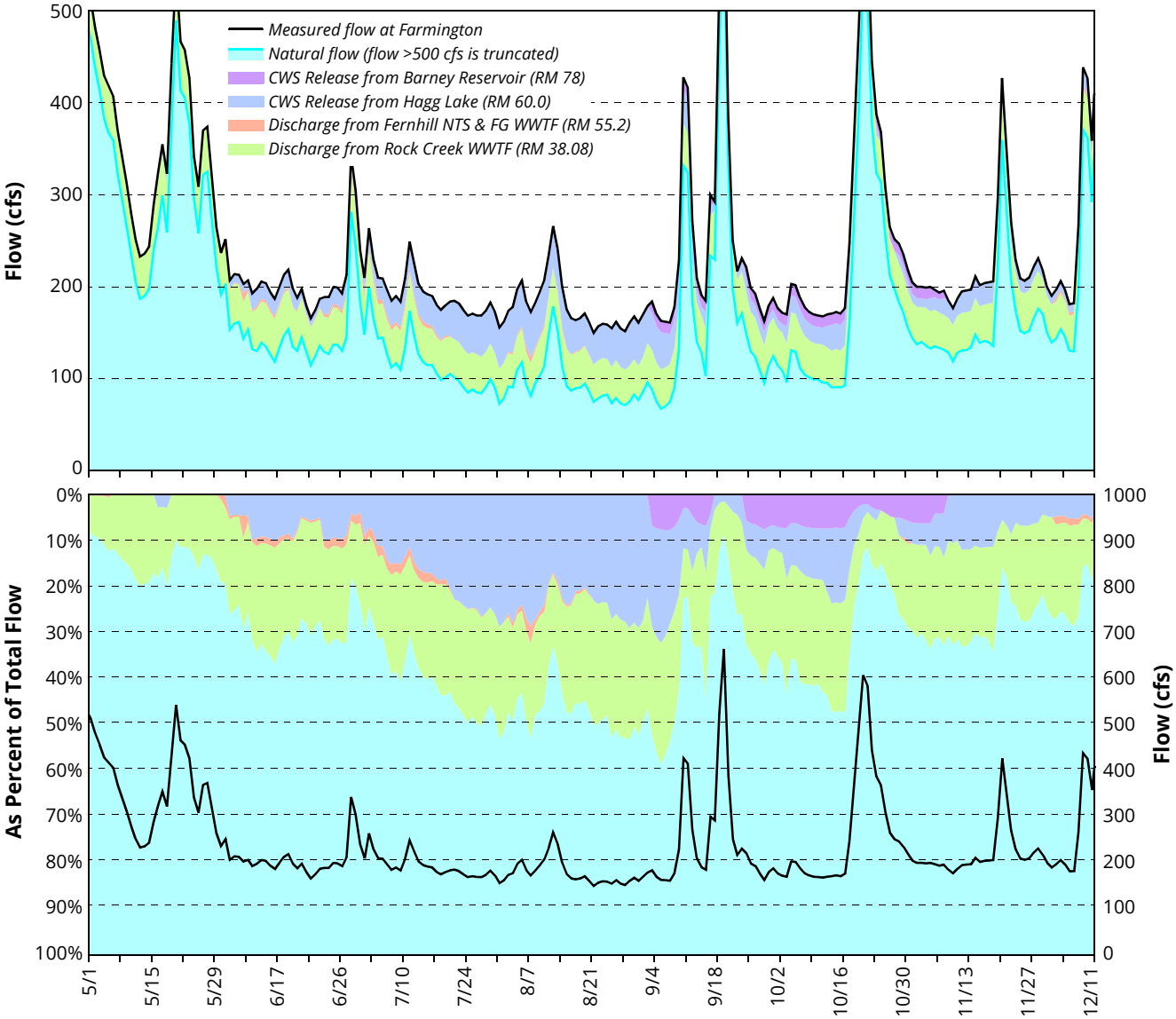
Middle Tualatin River — Farmington Road site: The graph below shows flows at the Farmington Road site (RM 33.3). Flow at this site affects water quality in the middle and lower parts of the river. Keeping Farmington flow from becoming very low (below 120 cfs) can mostly prevent the large scale algal blooms that were a recurring problem in the lower river in the 1990s.

Stream flow measurements at this site are also used to define ammonia limits at the treatment facilities, as well as when dry and wet season limits apply at the District's treatment facilities.

During the summer low flow period, the District's stored water releases plus the Rock Creek WWTF discharge accounted for about 50% of the flow at the Farmington Road site. Without this additional water, flow in the Tualatin River at this site would average less than 100 cfs during the July-August period. In 2019, flows in most of June, plus parts of October and November would have been less than 150 cfs without Clean Water Services releases. Flows this low would almost certainly be associated with significant water quality problems down river, such as those that were common in the 1990s and before.

Note that the weekly cyclical signature of decreased irrigation withdrawals on Sundays is still clearly evident at this site.

Calculated* Clean Water Services Releases in Tualatin River at Farmington Rd (RM 33.3) — 2019



*The following formula was used to calculate flows in this figure, assuming constant travel time and a uniform evaporative loss (0.25% per mile).

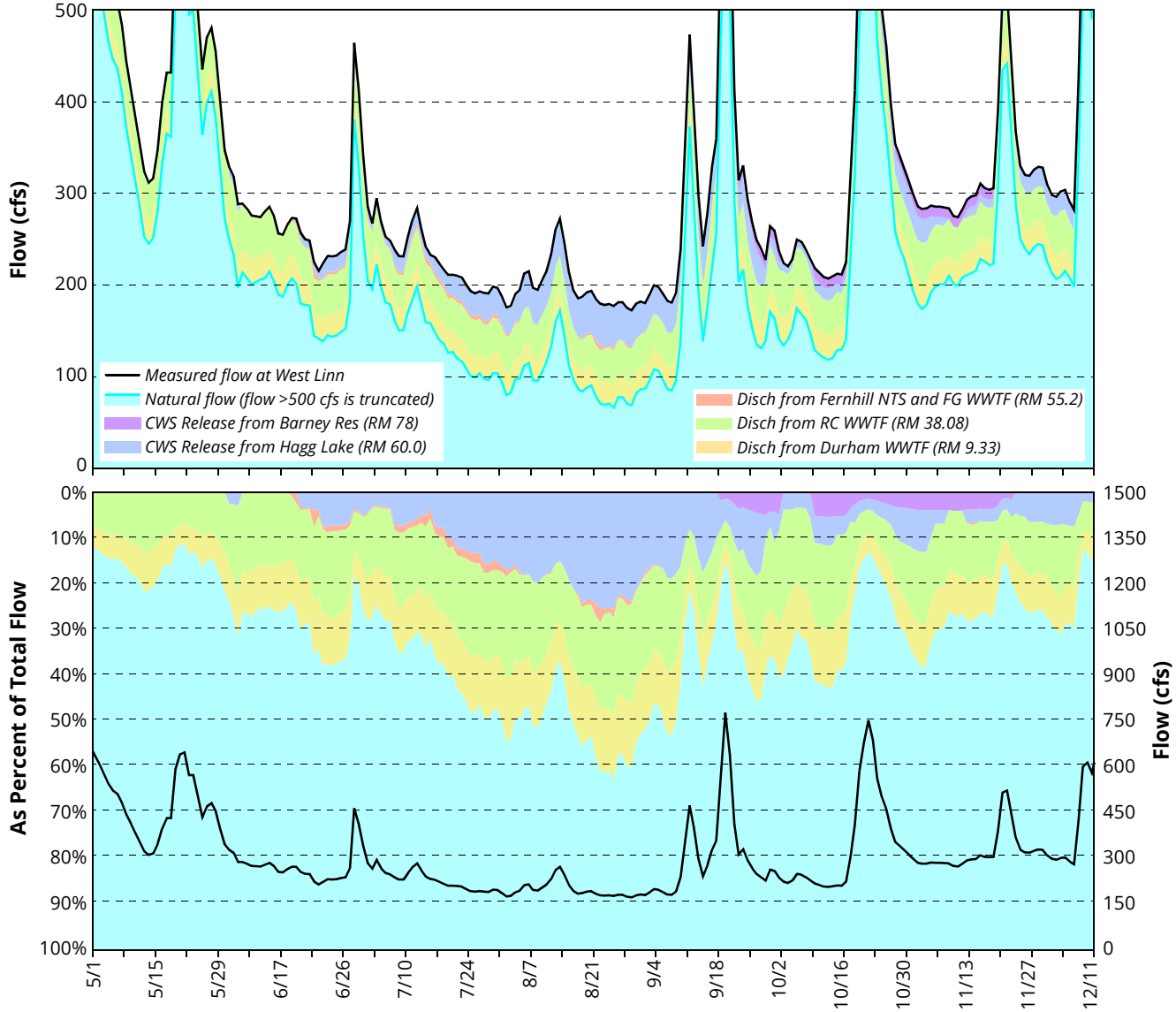
Natural Flow at Farmington w/o CWS releases =
+ Measured flow at Farmington (OWRD data)
– Calculated flow from Rock Creek WWTF (= 0.988 x Rock Creek WWTF discharge from the same day)
– Calculated flow from Fernhill NTS and Forest Grove WWTF (= 0.933 x discharge from 1 day before)
– Calculated flow from Hagg Lake (= 0.933 x CWS Hagg Lake release from 2 days before)
– Calculated flow from Barney Reservoir (= 0.888 x CWS Barney Reservoir release from 4 days before)

Lower Tualatin River — West Linn site: Flows at the West Linn site (RM 1.75) are shown below. Flow at this site during July–August averaged only 28 cfs higher than those at Farmington; almost 90% of that increase is discharge from the Durham WWTF.

The District's stored water releases account for more than 20% of the flow during the low flow season. When discharges from the WWTFs are included, Clean Water Services' contributions account for 50-60% of the flow. Without this additional water, at times flows at the West Linn site would drop below 100 cfs during the summer. Flows this low would be associated with significant water quality problems such as:

- high temperatures,
- severe algal blooms that would likely increase the pH to levels that exceed the criteria for aquatic health, and
- very low dissolved oxygen concentrations caused by an increased expression of sediment oxygen demand, especially during cloudy days when photosynthetic production of oxygen is decreased.

Calculated* Clean Water Services Releases in Tualatin River at West Linn (RM 1.75) — 2019



*The following formula was used to calculate flows in this figure, assuming constant travel time and a uniform evaporative loss (0.25% per mile).

Natural Flow at West Linn without CWS releases =
+ Measured flow at West Linn (USGS data)
– Calculated flow from Durham WWTF (= 0.981 x Durham WWTF discharge from 3 days before)
– Calculated flow from Rock Creek WWTF (= 0.909 x Rock Creek WWTF discharge from 14 days before)
– Calculated flow from Fernhill NTS and Forest Grove WWTF (= 0.854 x discharge from 16 days before)
– Calculated flow from Hagg Lake (= 0.854 x CWS Hagg Lake release from 17 days before)
– Calculated flow from Barney Reservoir (= 0.809 x CWS Barney Reservoir release from 19 days before)

HISTORICAL RECORD OF STORED WATER RELEASES

Hagg Lake: Water releases from Hagg Lake usually began in June or July and continued until high natural flow resumed. During the low-flow period, release rates were adjusted as needed to meet the flow targets at that time. Clean Water Services' allocation is 12,618 ac-ft at full pool.

CLEAN WATER SERVICES — HAGG LAKE RELEASES

YEAR	START DATE	END DATE	TOTAL RELEASE DAYS†	TOTAL RELEASE (acre-ft)	AVERAGE PER RELEASE DAY (cfs)	COMMENTS
1987	6/9	11/30	175	*16,722	48.2	*Bureau of Reclamation allowed Clean Water Services to release its entire allocation (stored and natural flow).
1988	7/2	11/4	126	*15,071	60.3	
1989	6/27	11/15	141	*16,586	59.3	
1990	7/12	11/1	113	11,889	53.0	
1991	7/12	11/4	116	13,024	56.6	
1992	6/5	11/19	168	12,730	38.2	
1993	7/3	12/1	150	11,486	38.6	
1994	6/21	10/27	129	10,917	42.7	
1995	6/24	11/8	138	9,824	35.9	
1996	7/27	11/10	114	10,952	48.4	
1997	7/4	10/2	91	6,716	37.2	
1998	8/12	11/7	87	9,407	54.5	
1999	7/27	11/12	109	12,001	55.5	
2000	7/21	11/27	130	15,275	59.2	CWS purchased additional water because low flow conditions persisted until late November
2001	9/25	11/14	50	2,403	24.0	Allocations were severely decreased because Hagg Lake did not fill in 2001
2002	6/12	11/9	151	12,618	42.0	
2003	7/11	11/17	130	11,765	52.4	
2004	7/1	11/2	125	8,650	34.9	
2005	7/8	10/31	116	9,918	43.1	
2006	7/1	11/3	126	9,634	38.5	
2007	7/3	11/13	119	10,134	42.9	
2008	7/1	11/4	127	11,896	47.2	
2009	7/1	10/27	119	10,614	45.0	
2010	7/24	10/25	94	8,392	45.0	
2011	7/23	11/18	119	10,464	44.3	
2012	7/7	10/22	106	10,950	52.1	
2013	7/2	11/4	103	6,884	33.7	
2014	7/1	10/22	114	9,037	40.0	
2015	6/9	11/5	150	12,307	41.4	CWS purchased an additional 600 ac-ft from TVID, but it was not released
2016	6/21	10/13	115	9,692	47.5	
2017	6/21	10/23	125	10,585	42.7	
2018	5/24	11/26	176	12,132	34.7	
2019	5/14	12/10	194	9,972	25.9	

†In some years, releases may temporarily lapse between the start date and end date.

Barney Reservoir: Water usually is released from Barney Reservoir during the late summer. Accounting for dead pool volume and the 15% allocation to the Oregon Department of Fish and Wildlife, Clean Water Services has 1,654 ac-ft available at full pool.

CLEAN WATER SERVICES — BARNEY RESERVOIR RELEASES

Year	Start Date	End Date	Total Release Days	Total Release (acre-ft)	Average per Release Day (cfs)	Comment
1998	7/12	8/27	47	2,779	24.6	extra water released to draw down reservoir
1999	9/1	10/19	49	1,025	10	10 cfs also released 6/4–6/10
2000	9/8	10/23	46	1,461	18	—
2001	9/18	10/29	42	1,416	17	1000 acre-ft purchased in addition to allocation; reservoir did not fill; 4,000 acre-ft held in reserve
2002	8/26	10/24	60	1,667	14.0	—
2003	8/15	10/14	61	1,742	14.0	—
2004	9/1	11/2	63	1,777	14.0	—
2005	9/1	11/8	69	1,874	14.0	miscommunication about end date; extra water released
2006	9/1	11/3	64	1,638	14.0	—
2007	9/1	10/30	60	1,667	14.0	—
2008	9/4	10/31	58	1,611	14.0	—
2009	9/1	10/30	60	1,667	14.0	—
2010	9/1	10/30	58	1,653	13.9	7 cfs on 9/1 only, all other days 14 cfs
2011	7/1	8/30	61	1,089	9.0	Barney Reservoir was drawn down for maintenance which resulted in a reduced allocation
2012	8/31	10/29	60	1,667	14.0	—
2013	8/30	11/5	58	1,611	14.0	release suspended 9/30 – 10/9
2014	9/2	10/23	52	1,438	14.0	—
2015	8/14	10/28	76	1,569	10.4	14 cfs (8/14–8/22), 10 cfs (8/23–10/27), 5 cfs (10/28)
2016	8/31	10/14	45	1,250	14.0	
2017	9/1	10/24	54	1,524	14.2	
2018	8/29	10/28	61	1,674	13.8	4 cfs (8/29), 14 cfs (rest of season)
2019	8/30	11/3	59	1,609	13.7	release suspended (9/13–19), 9 cfs (11/1–3), 14 cfs (rest of season)

Natural flow credit

When Scoggins Dam was constructed, Clean Water Services was granted a natural flow credit of up to 4,282 acre-ft. The credit applies only in May, June, October and November, and only if the monthly mean daily natural flow in the Tualatin River measured at West Linn is less than the flow targets specified for each month. Natural flow is calculated as the monthly mean daily flow measured at West Linn minus Clean Water Services' mean daily release of stored water. Clean Water Services was not entitled to a natural flow credit in 2019 because the natural flow exceeded the target flow for months in question (see table below). Clean Water Services last received a natural flow credit in 1994.

BUREAU OF RECLAMATION NATURAL FLOW CREDIT 2019

Month	Mean Daily Measured Flow at West Linn (cfs)	Mean Daily CWS Release (cfs)	Calculated Natural Flow at West Linn (cfs)	Target Natural Flow at West Linn (cfs)	Maximum Possible CWS Natural Flow Credit (cfs)	*[acre-ft]*	CWS Natural Flow Credit (cfs)
May	467	10	457	85	13		0
June	275	16.5	258	140	21	*[1,250]*	0
October	341	31	310	95	16	*[984]*	0
November	324	20	304	110	21	*[1,250]*	0

JOINT WATER COMMISSION

by Kristel Griffith, Water Resources Program Coordinator, Joint Water Commission/City of Hillsboro

INTRODUCTION

Over 365,000 people in Washington County receive at least a portion of their drinking water from the Joint Water Commission (JWC). The JWC provides water to its member agencies: the Cities of Hillsboro (the managing and operating agency), Forest Grove, Beaverton, and the Tualatin Valley Water District. JWC also provides wholesale service directly to the City of North Plains, and to Cornelius, Gaston, and the LA Water Cooperative as wholesale customers of Hillsboro.

JWC's water treatment plant (WTP) is supplied with water from the nearby Tualatin River. An intake facility at Spring Hill constructed by the Bureau of Reclamation, and shared with the Tualatin Valley Irrigation District (TVID), pumps river water to the JWC WTP.

Flows in the Tualatin River are supplemented during the summer with water from two impoundments—Hagg Lake and Barney Reservoir. Hagg Lake is located on Scoggins Creek behind Scoggins Dam. Scoggins Dam is owned by the Bureau of Reclamation (BOR) and operated by TVID under contract to the BOR. Barney Reservoir is located on the upper Trask River behind the Eldon S. Mills Dam. The reservoir and dam are owned and operated by the Barney Reservoir Joint Ownership Commission (BRJOC). The BRJOC includes the Cities of Hillsboro (the managing and operating agency), Forest Grove, and Beaverton, the Tualatin Valley Water District, and Clean Water Services.

The JWC WTP uses conventional dual media filtration plus disinfection to produce high quality potable water. Treated water is pumped from the plant to the member agencies either directly through finished water pipelines or via the Fern Hill Reservoirs. The Fern Hill Reservoirs are located about one-third mile to the east of the treatment plant and can store up to 40 million gallons of finished water (in two 20 million gallon covered concrete tanks). The JWC finished water pipelines include flow meters and pressure reducing stations at the connection points to the member agencies.

2019 OPERATIONS

Production and demands: In 2019 the JWC WTP produced an average of 32.3 million gallons per day (MGD) of finished water. A maximum day production of 62.6 MG occurred on June 13, which is slightly greater than the 2018 maximum day production of 61.2 MG. A minimum day production of 12.7 MG occurred on December 16.

2019 Stored water releases: The amount of stored water released by JWC for 2019 is summarized in the tables below. In all, 71% of the total allocation was released (74% for Hagg Lake and 69% for Barney Reservoir). Typical average use is 40–60% of allocation, although higher usage has occurred in the recent past. Particularly warm weather in 2015 increased demand and usage that year was also 75% of allocation. Like 2018, 2019 was distinguished by the length of the regulated season.

STORED WATER RELEASE FROM EACH RESERVOIR — 2019

DESCRIPTION	BEGINNING BALANCE (acre-ft)	AMOUNT RELEASED (acre-ft)	ENDING BALANCE (acre-ft)	DAYS OF RELEASE	AVERAGE RELEASE	
					acre-ft/day	cfs
Barney (M&I)	14,520	9,963	4,557	192	51.9	26.2
Scoggins	13,500	9,964	3,536	188	53.0	26.7
Total	**28,020**	**19,927**	**8,093**	**196**	**101.7**	**51.3**

OWRD imposed regulation of natural flow on May 30, about a week earlier than average. Regulation continued until being lifted on December 12th. This regulation season set records for the longest duration (196 days) and the latest end date.

COMPARISON OF STORED WATER RELEASES— 10-YEAR RECORD

Year	Dates of Stored Water Use			Stored Water Release (acre-ft)			Average Release (acre-ft/day)
	First Day*	Last Day*	Days**	Barney	Scoggins	Total	
2019	5/30	12/12	196	9,963	9,964	19,927	102
2018	5/26	11/28	187	12,159	9,513	21,672	116
2017	6/22	10/24	125	7,819	6,425	14,244	114
2016	5/11	10/12	153	7,476	9,465	16,941	111
2015	5/8	10/29	173	11,730	9,904	21,633	124
2014	6/5	10/24	142	6,548	9,090	15,638	110
2013	5/4	10/1	141	6,387	7,490	13,877	98
2012	6/23	10/30	129	6,557	7,016	13,573	105
2011	6/28	11/7	132	8,848	3,945	12,794	97
2010	6/30	10/22	114	5,647	5,171	10,818	95
10-yr average	**6/3**	**10/30**	**149**	**8,313**	**7,798**	**16,112**	**107**

*First and last day of Regulated Use releases lag OWRD regulation dates by 1 day because releases are adjusted the day after OWRD imposed or lifted regulation.
**Days of Regulated Use does not equal the elapsed days between the start and end dates for regulation if regulation was temporarily suspended during the period.

STORED WATER RELEASE TO EACH AGENCY — 2019

Description	Beginning Storage (acre-ft)	Amount Released (acre-ft)			Ending Balance* (acre-ft)	Average Release (acre-ft/day)
		from Barney	from Scoggins	Total		
Hillsboro	10,001	4,300	4,657	8,957	1,044	45,7
Forest Grove	4,323	22	**1,249	1,271	3,052	6.5
Beaverton	7,469	2,814	3,477	6,292	1,177	32.1
TVWD	6,227	2,827	**580	3,407	2,820	17.4
Total	**28,020**	**9,963**	**9,964**	**19,927**	**8,093**	**101.7**

*North Plains and Tigard: usage is reflected in the values for JWC partners.
**580 ac-ft of Hagg Lake water was leased to TVWD from Forest Grove in 2019.

Efficiency: JWC maximizes the capture of released water by coordination with partner agencies to anticipate and track system demands, and by leveraging finished water storage at the Fern Hill Reservoirs. During the peak season, the JWC and Cherry Grove pump station (at the City of Hillsboro's slow sand filter plant) recovered an average of 98% of the water available for municipal use from natural flow rights and releases from impounded supplies.

ESTIMATED WATER CAPTURE RATES – 2019

Water Available		Raw Water Pumped			Finished Water Produced			
					Total		Average Daily	Peak Day
Source	(acre-ft)	Facility	(acre-ft)	(MG)	(acre-ft)	(MG)	(MGD)	(MGD)
Reservoir releases	19,927	JWC WTP* (Spring Hill)	22,969	7,484	21,990	7,165	36.2	62.6
Natural flow	4,038	Slow Sand Filter Plant (Cherry Grove)	494	161	495	161	0.08	1.3
Total	23,965		23,463	7,645	22,485	7,327		
		Capture rate	98%		94%			

*The values shown here were measured and reported by JWC.

Facility expansion

Major construction activity to expand JWC water treatment plant (WTP) capacity from 75 MGD to 85 MGD concluded in 2019. During expansion, the WTP was upgraded with new filter capacity, enhanced flocculation/sedimentation features, new pumps, mechanical systems, increased solids handling capacity, and enhanced chemical feed systems.

Raw water pumps: To achieve 85 MGD, raw water pumping capacity was increased in 2019 with the installation of four new vertical turbine pumps and motors. Each pump is designed for a maximum flow rate of 15,500 gpm. Additionally, two new variable frequency electrical drives were installed on raw water pumps #3 and #4 to provide greater operation control, pump efficiency, and maintenance planning.

Filtration: Filtration capacity was increased in 2019 with the construction of two, deep media sand and anthracite beds. Each filter is comprised of two 462 sq. ft. bays capable of producing 13 mgd. The new filter structure is founded on a network of auger cast piles that tie the concrete filter to structurally competent soils more than 50 ft below the filter gallery floor thereby providing the new filters seismic resiliency.

With the added filtration capacity, solids handling capabilities were increased to allow for the capture, recovery, and recycling of filter media wash water. Solids handling improvements included the installation of two 4,000 gpm backwash pumps that use potable water to rinse filter media, and remove sediment that has accumulated in the deep bed filters. This backwash is recovered by a new, concrete surge basin structure with a capacity of 256,000 gallons of water. The surge basin is adjacent to the filter structure and designed to allow backwash water to flow by gravity where it is allowed to be pumped slowly to a series of drying beds. From the drying beds, water is recycled back to the start of the treatment process. Two new earthen berm drying beds were constructed as a part of this project.

New filters (top left) and surge basin (bottom left) were constructed near the existing sedimentation basins at the JWC water treatment plant to expand capacity from 75 to 85 MGD.

New piping in the filter gallery located below the new filters shown in the image above.

2019 Maintenance

Screens: Preventative maintenance and cleaning were performed on the traveling screens on a routine basis. For example: greasing bearings and checking operation of the traveling screens occurs on a weekly basis. Cleaning of the screens is automated and typically runs every 24 hours but is adjusted based upon debris load. The trash racks were manually raked clean on an as needed basis throughout the year.

Underwater inspection: In February 2019, divers performed a brief inspection of the intake pump wetwell and forebay. No issues were identified.

Regulatory matters

Water Right Activity: In 2018, the Joint Water Commission applied for a water right to withdraw 44.0 cfs at the Spring Hill Pump Plant (application S-88506). Withdrawal under the new permit will be supplemental to the usage under permit S-54737, meaning the total combined usage will not exceed 75 cfs. Permit S-54737 is authorized for use between October 1 and May 31. Both of these permits are for usage between November 1 and April 30. OWRD's initial review of application S-88506 indicated that water was not available for withdrawal in October, November, and May. JWC modified the application to limit the requested time period of use to December 1 through April 30.

Fish Monitoring: Mt. Hood Environmental conducted fish surveys at the Spring Hill Pump Plant (SHPP) several times in Winter/Spring 2018.

A final report detailing the monitoring methods and entrainment results was completed in 2019. This report informs the development of a mitigation project to offset detrimental impacts. In December 2019 site visits were conducted on 4 culverts to assess the potential for replacement and associated benefits to fish and wildlife.

This work is being done to comply with conditions imposed by Oregon Department of Fish & Wildlife regarding JWC's water rights (both currently held and applied for). The JWC's intake screens at the SHPP do not meet the current size criteria and the approach/sweeping velocities are unknown.

Acknowledgements

The Joint Water Commission appreciates the efforts of the Watermaster and our partners on the Tualatin River Flow Management Technical Committee. We extend our thanks for their involvement and cooperation. The communication and coordination among the committee members is invaluable.

MILLS DAM/BARNEY RESERVOIR

by Kristel Griffith, Water Resources Program Coordinator, Joint Water Commission/City of Hillsboro

OVERVIEW

Mills Dam/Barney Reservoir is a rock and earth impoundment on the Middle Fork of the North Fork of the Trask River. The original structure, known as the Trask Dam, was built in 1970 by the Cities of Hillsboro and Forest Grove; the reservoir held 4,000 ac-ft of water. In 1999, the dam height was raised to accommodate 20,000 ac-ft of storage and renamed the Mills Dam. Barney Reservoir is named for J.W. Barney and Mills Dam is named for Eldon S. Mills, both former Hillsboro City Managers and key leaders in the original dam construction and its later expansion.

Water stored in Barney Reservoir is released to both the Trask and Tualatin Rivers. Flows to the Trask River include all storage overflows and 15% of the stored water, which is allocated to Oregon Department of Fish and Wildlife (ODFW). A gravity flow diversion pipeline conveys water from the Trask River to the headwaters of the Tualatin River. The additional flow in the Tualatin River is used for municipal purposes and flow augmentation to improve water quality.

Release from Barney Reservoir to the Trask River through a Howell-Bunger Valve

The current owners of Barney Reservoir are the Cities of Hillsboro, Forest Grove, Beaverton, the Tualatin Valley Water District (the same entities that form the Joint Water Commission) and Clean Water Services. Collectively they form the Barney Reservoir Joint Ownership Commission (BRJOC). As with the Joint Water Commission, the City of Hillsboro serves as the managing and operating agency for the BRJOC.

RESERVOIR OWNERSHIP AND WATER ALLOCATION FOR BARNEY RESERVOIR

		Water Allocation (percent)	Storage at Full Capacity (acre-ft)	Reservoir Ownership (percent)
Reserved	Dead pool	2.3%	460	—
	Oregon Department of Fish and Wildlife (ODFW)	15.0%	3,000	0.0%
BRJOC Partners	Clean Water Services	8.3%	1,654	10.0%
	JWC Partners	74.4%	14,886	90.0%
	City of Hillsboro	*25.6%*	*5,127*	*31.0%*
	City of Forest Grove	*2.1%*	*414*	*2.5%*
	City of Beaverton	*17.8%*	*3,556*	*21.5%*
	Tualatin Valley Water District (TVWD)	*28.9%*	*5,789*	*35.0%*
	TOTAL	100.0%	20,000	100.0%

2019 Operations

Barney Reservoir did not completely fill in 2019. Maximum storage volume was 19,520 ac-ft (97.5% of full pool) and occurred on June 3. This was only the second time that the reservoir did not completely fill, 2000-2001 being the other. By the end of the release season, 74% of the total allocated water was released.

Releases to the Tualatin River: The majority of the JWC's natural flow rights were regulated off on May 30, 2019. Releases from Barney Reservoir to the Tualatin River began on June 3rd. JWC releases from Barney Reservoir continued uninterrupted for a for a total of 192 release days until natural flow rights were restored on December 12. This is the longest release season for the JWC. Clean Water Services used their entire allotment and the JWC partners used 69%.

Releases to the Trask River: Releases from Barney Reservoir to the Trask River for ODFW began on June 3 and continued through December 10 for a total of 191 release days. All of the stored water for ODFW was released to the Trask River.

STORED WATER ALLOCATION AND RELEASES FOR BARNEY RESERVOIR — 2019

	Total Storage	Oregon Dept of Fish and Wildlife	BRJOC Partners					
			Clean Water Services	JWC Total	JWC Partners			
					City of Hillsboro	*City of Forest Grove*	*City of Beaverton*	*TVWD*
Water allocation (acre-ft)	*19,520	2,926	1,613	14,520	*5,001*	*403*	*3,469*	*5,647*
Water released (acre-ft)	14,501	2,929	1,609	9,963	*4,300*	*22*	*2,814*	*2,827*
Percent allocation used	74%	100%	100%	69%	*86%*	*5%*	*81%*	*50%*
First day of release		Jun-3	Aug-30	Jun-3				
Last day of release		Dec-10	Nov-3	Dec-11				
Number of Days with Releases		191	59	192				
Average Daily Release (cfs)		7.7	13.8	26.2				

*Water allocations were decreased in 2019 because Barney Reservoir did not completely fill.

Maintenance

Dam inspection: Oregon Water Resources Department (OWRD) did not inspect Mills Dam in 2019.

Fence repairs: Construction began on a chain link fence replacement project along the Mills Dam spillway structure. Approximately 1,600 feet of galvanized chain link fence will be replaced using custom fabricated fence post brackets mounted to the side of the concrete spillway. Fence replacement began in April 2019 and will be concluded during the summer of 2020. These improvements were recommended in previous dam inspections to improve security and reduce concrete deterioration.

Spillway at Mills Dam showing fence to be replaced.

Water Right Activity

In 2019, OWRD issued a new water right permit (S-55219) for the release stored water at 30 cfs for municipal purposes. All other primary and secondary water rights for Barney Reservoir are certificated.

The pipeline capacity to move the stored water from Barney Reservoir to the Tualatin River is 68.7 cfs (44.4 mgd). When the water rights were acquired that capacity was divided between municipal and flow augmentation purposes—38.7 cfs for municipal and 30 cfs for flow augmentation.

New water right permit: In recent years, the drinking water providers occasionally released water at a higher rate than authorized by their water right certificate. The higher release rate was possible because CWS was not releasing water at its maximum authorized rate at that time. To date, OWRD has not objected to these higher release rates because they involved stored water for municipal use. JWC, however, wanted to operate in full compliance with it's water rights.

On December 27, 2017, the drinking water providers, under the name JWC, submitted an application to OWRD for a change in the authorized release rate. The proposed maximum authorized release rate would vary and be calculated as 68.7 cfs (44.4 MGD) minus the actual CWS release at any given time. The change only would affect how releases are shared and would not affect allocations, total storage or use. CWS's access to their stored water or release capacity to the Tualatin River would not be hindered. Releases to the Trask River for ODFW would be unaffected.

After OWRD's initial review of the permit application (S-88492) was completed, the BRJOC requested that the application be placed on administrative hold. The delay was to allow time to complete of a fish monitoring survey of JWC's portion of the Spring Hill Pumping Plant and to develop a mitigation plan to offset any detrimental effects that were identified. In July 2019, OWRD approved the application and issued the final order for Permit S-55219.

LAKE OSWEGO CORPORATION

by Mark Rosenkranz, Water Resource Specialist, Lake Oswego Corporation

Introduction

The Lake Oswego Corporation (LOC), a non-profit organization, owns and manages Oswego Lake, a 163-hectare (403 acre) reservoir located 10 miles south of Portland, Oregon. LOC was formed in 1942 when the Oregon Iron and Steel Company, then owner of the land around the Lake, deeded to LOC the land, three dam structures, and all water rights. The original dam was constructed in 1871 and later upgraded in 1921. Oswego Lake is a private water body whose primary water right is hydropower generation. Secondary uses include irrigation, aesthetic viewing, contact recreation, fishing, and boating.

Oswego Lake and Watershed Morphology

The original natural lake, called Waluga, was formed 10,000 years ago by the Missoula glacial floods which altered the old Tualatin River channel. Today, the Lake has three basins: West Bay, the Main Lake, and Lakewood Bay. There are also two shallow, man-made canals, Blue Heron Canal and Oswego Canal. Oswego Canal is the 2.4-km conduit from the Tualatin River (RM 6.7). Total lake surface area and volume is 1.63 km^2 (403 acres) and 12.7 x 10^6 m^3 (10,300 acre-feet). Shoreline length, including bays and canals, is 18.62 km (11.56 mi). Oswego Lake has a 5.08-km (3.15-mi) fetch and a narrow 0.56-km width (0.34-mi). The hydraulic residence time is 390 days.

Oswego Lake's two watersheds include the natural, 7.5-mi^2 urban basin around the Lake (10:1 watershed to lake-area ratio) and the larger 700-mi^2 Tualatin River basin (1,000:1 ratio) when the LOC Headgate is open. Major inflows from the watershed include Springbrook Creek, Lostdog Creek, Blue Heron Creek, and 70-plus storm drains from the City of Lake Oswego.

Aerial view of the West Bay of Oswego Lake looking to the East

LOC Water Rights and Contracts

Hydropower Generation: The primary hydropower water right is 57.5 cubic feet per second (cfs) obtained in 1906 that allows year-round diversion. To guarantee this flow during the dry season, LOC owns and operates a diversion dam located downstream of the Oswego Canal (RM 3.4). Flaps are erected on an "as needed" basis. No flaps have been used since 2004.

Irrigation: A contract between LOC and the Bureau of Reclamation (Oct 20, 1972) provides for up to 500 acre-feet from Hagg Lake for irrigation use during March through November. The largest irrigator on the Lake is the Lake Oswego Country Club (approximately 175 acre-feet).

Maintenance/Evaporation: LOC also has a maintenance/evaporation water right of 3.36 cfs dating from 1985. This water can be diverted between September 16th and July 30th.

Oswego Lake Watershed Management Plan

Water quality improvements and safety are the top priorities for LOC. For many years, Oswego Lake has had issues with overgrowth of cyanobacteria that can impair lake aesthetics. Under extreme conditions cyanobacteria also can be harmful to health. The goal of the annual LOC Water Quality Management Plan is to reduce cyanobacteria productivity and maximize the aesthetic value of the lake. In order to accomplish this goal and provide long-term water quality solutions, LOC conducts a variety of watershed activities as part of the management plan.

Conditions that favor cyanobacteria: All algae require sunlight and nutrients (nitrogen and phosphorus) in order to grow. Because cyanobacteria are capable of fixing nitrogen, they can outcompete other algal species when nitrogen is limited. Cyanobacteria grow better than other freshwater algae because they are adapted to higher temperatures and can adjust their buoyancy to optimize nutrient uptake. Cyanobacteria are present in Oswego Lake every year and without phosphorus control the lake would experience severe blooms. Nutrient control may become even more important in the future because warmer conditions caused by climate change favor cyanobacteria.

Role of phosphorus: A healthy lake includes moderate plant and algae growth to support aquatic life. Excessive phosphorus can cause rampant proliferation of plants or algae, and in many instances cyanobacteria. To maintain a healthy level of plants and algae and limit cyanobacteria in Oswego Lake, LOC has focused its efforts on reducing the availability of phosphorus. The LOC has targeted 20 μg/L as the maximum phosphorus concentration in the lake that would substantially limit cyanobacteria growth. They use several strategies and have successfully decreased phosphorus concentrations in the lake, although not always to the target level of 20 μg/L. The strategies include:

- *Reduce phosphorus loading to the lake from the Tualatin River*— Oswego Lake is fed in part by water from the Tualatin River that is conveyed via the Oswego Canal. Flow into the lake from the Oswego Canal is regulated by a headgate. In recent years, LOC has tried to minimize or eliminate flow from the Tualatin River into the lake because the phosphorus concentrations in the Tualatin River exceed LOC's target level for the lake. The regulated level of phosphorus in the river is 100 μg/L, five times the target for Oswego Lake.

  The Tualatin River receives phosphorus from several sources. The highest total phosphorus concentrations often occur near the beginning of storms when high flow causes spikes in particulate phosphorus. High flow resuspends bed sediment and transports particles entrained in stormwater. Groundwater that is naturally high in phosphorus is a source of dissolved phosphorus that is particularly important during low flow. In addition, Clean Water Services (CWS) facilities discharge treated wastewater into the river. During the dry season, CWS employs strict phosphorus control at its wastewater treatment facilities (WWTFs) and their discharges have lower phosphate concentrations than the river at that time.

- *Reduce phosphorus loading to the lake from stormwater runoff*— Stormwater runoff contributes phosphorus directly to the lake. LOC discourages the use of phosphorus-containing fertilizers in the local area.

- *Decrease phosphorus release from sediment*— Sediment at the bottom of Oswego Lake contains phosphorus that is chemically bound to various mineral surfaces. When the oxygen level at the bottom of the lake (hypolimnion) is very low or zero, the minerals dissolve and the phosphorus is released. LOC has used hypolimnetic aeration to maintain oxygen levels, thereby reducing phosphorus release.

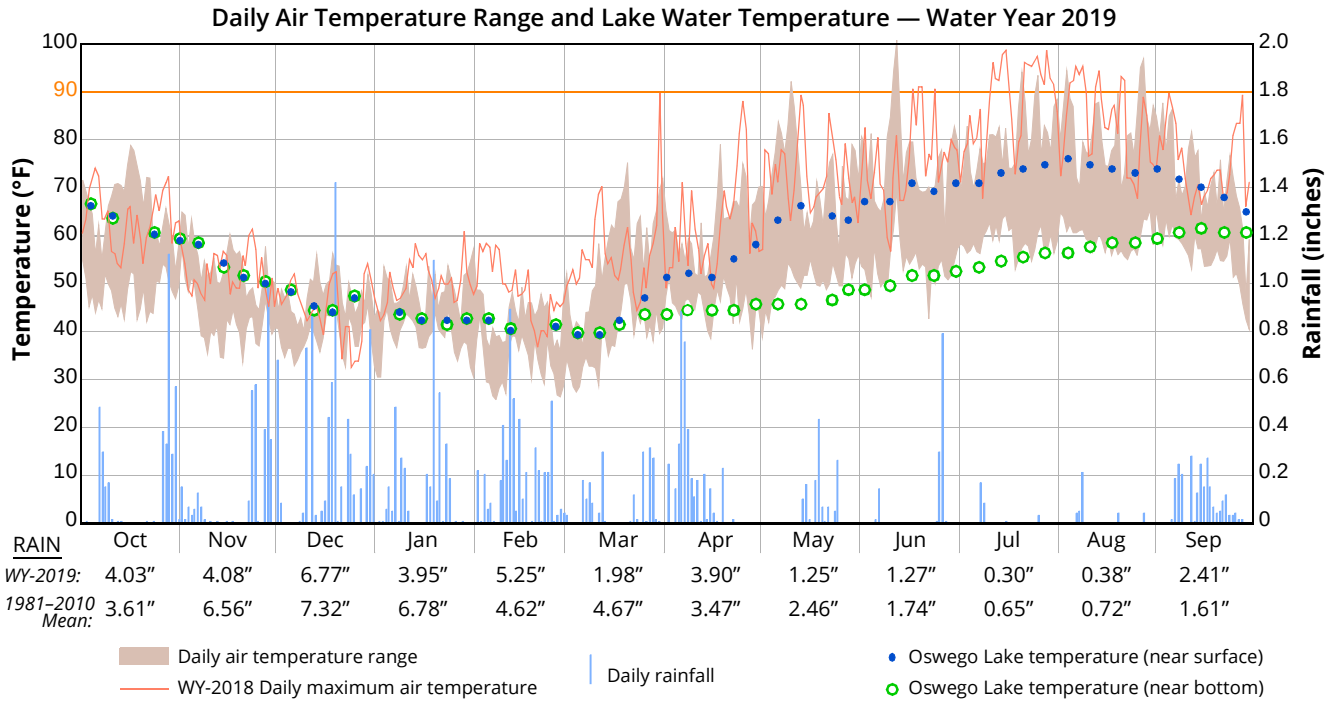
  Warm temperatures increase the rate of oxygen consumption by biological activity, including sediment oxygen demand at the sediment/water interface. The result is a rapid loss of oxygen in the hypolimnion and subsequent release of phosphorus. Although hypolimnetic aeration helps to counter this effect, it is not always able maintain dissolved oxygen concentrations high enough to prevent phosphorus release.

- *Reduce bioavailability of dissolved phosphorus*— Despite implementation of the strategies just described, dissolved phosphorus is still present in the water of Oswego Lake. The dissolved forms of phosphorus are highly bioavailable to algae and aquatic plants and can lead to significant algal blooms. LOC adds alum (aluminum sulfate) to the lake to decrease dissolved phosphorus. Alum forms tiny particles of aluminum hydroxide in the water. These particles bind to the dissolved phosphorus making it biologically unavailable and eventually causing it to sink to the bottom of the lake.

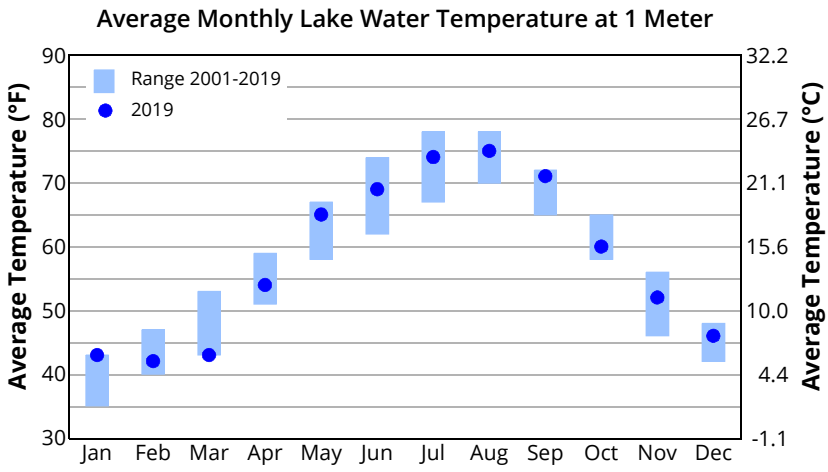
Conditions in 2019

Weather: Weather plays a particularly large role in water quality on Oswego Lake just as it does for other waterbodies. As climate change alters weather patterns, management of lakes and reservoirs is becoming more difficult.

We had a reprieve from the hot summers of the past three years, enjoying a summer with mild temperatures associated with onshore flow. The morning fog layer that had been mostly absent the last few summers was back, moderating daytime high temperatures. This summer we had only 10 days of 90 degrees and above, compared to 34 in 2018 and 30 in 2017.



Average monthly water temperatures in the lake in July and August were about two degrees Farenheit cooler in 2019 than in the past two years. In general, average water temperatures during the summer of 2019 were closer to the middle of the range since 2001, unlike those of recent years which were often at the high end of the range.



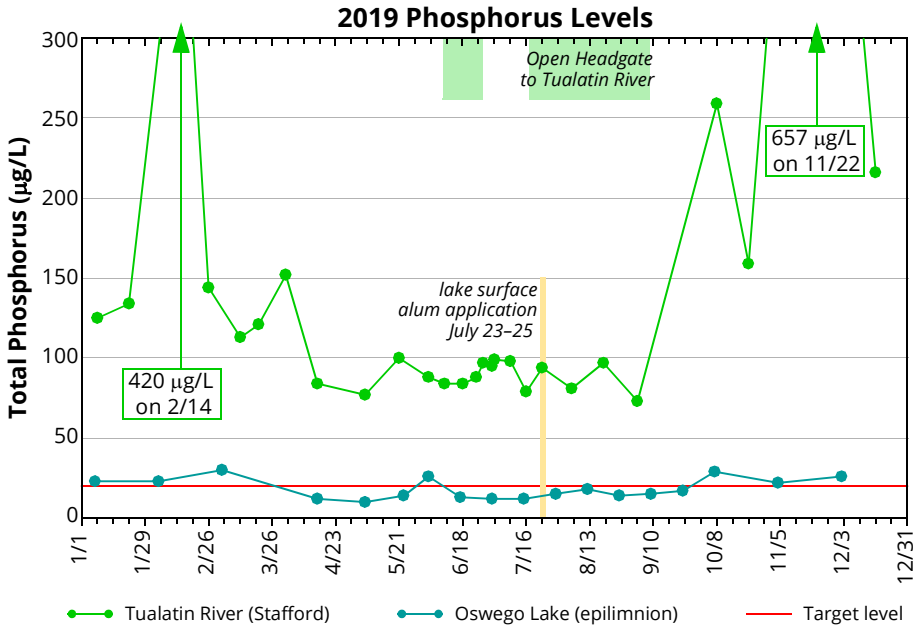
2019 Lake Management

Maintaining a healthy lake depends on controlling phosphorus to limit overgrowth of algae and particularly cyanobacteria. The goal is to keep the phosphorus level in Oswego Lake below 20 µg/L during summer when long days and sunshine create conditions favorable to algal growth.

Water quality requirements for the Tualatin River in the summer only limit phosphorus levels to below 100 µg/L. This means that during the summer the inflow of Tualatin River water via Oswego Canal provides phosphorus to the lake that is up to five times more than the concentration necessary to limit algae and cyanobacteria blooms. If the headgate is opened during long, sunny days it creates a trifecta of phytoplankton growing stimulus—warm water, sunshine and sufficient phosphorus. Consequently, the timing of water intake from the Tualatin River via the Oswego Canal is important. It cannot be stressed enough how important it is to forestall opening the headgate as long as possible.

Inflow from Tualatin River: Dry weather beginning May 26 led to the headgate opening for the 2019 season on June 10. A hot spell during June 11 and 12 did not persist and the rest of the month had moderate temperatures. The dry streak ended when more than an inch of rain fell from June 26 to 27, allowing the headgate to be closed until July 18.

The headgate was reopened on July 18 and remained so through September 9.



Old Barge

New Barge

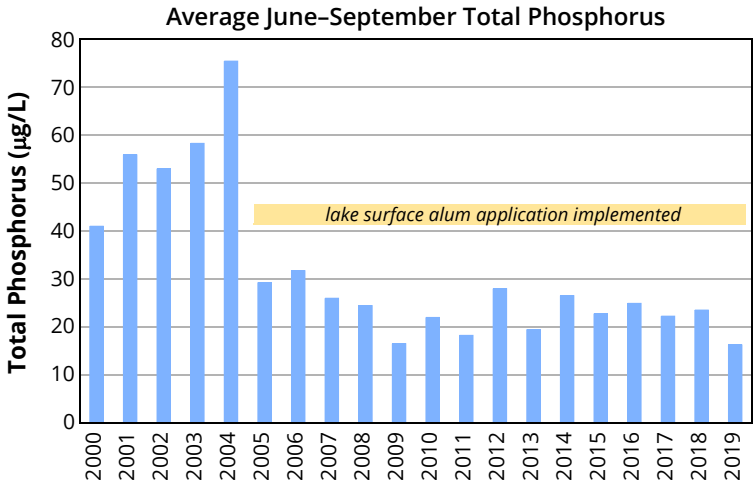
Alum treatment: Alum was applied July 23–25.

In 2019, the LOC upgraded their alum application barge. The old barge (surplus World War II) had been used since 2005. The alum was contained in four 750 gallon tanks which occupied most of the deck. The barge worked well for almost 15 years, but eventually leaks became so numerous that the barge needed to be replaced. The new barge was constructed using three HDPE tubes as flotation. Each tube is separated into three sections, with the center section serving as the alum tank. Total capacity is approximately 2800 gallons.

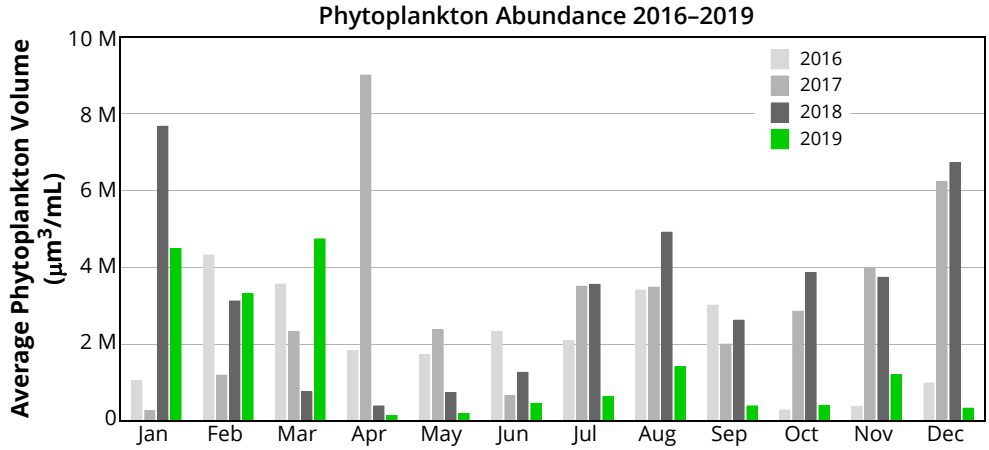
Having the alum stored below the water line results in a very low center of gravity that minimizes the risk of capsizing. This is important on Oswego Lake because boaters have been known to wakeboard in front of the barge during an application. The tank-free deck also increases visibility in front of the barge and makes the application process safer.

2019 Lake Water Quality

Mild weather had many positive effects on water quality. Although the headgate was opened in early June, rain late that month allowed the gate to be closed from June 27 to July 18. Mild summer temperatures reduced evaporation and irrigation requirements, so less Tualatin River water was needed to make up for these losses. As a result, the target phosphorus concentration was maintained for most of the summer. The average total phosphorus concentration in 2019 was 16 µg/L —the lowest in 20 years. Phosphorus was much higher in the years before alum use started in 2005.

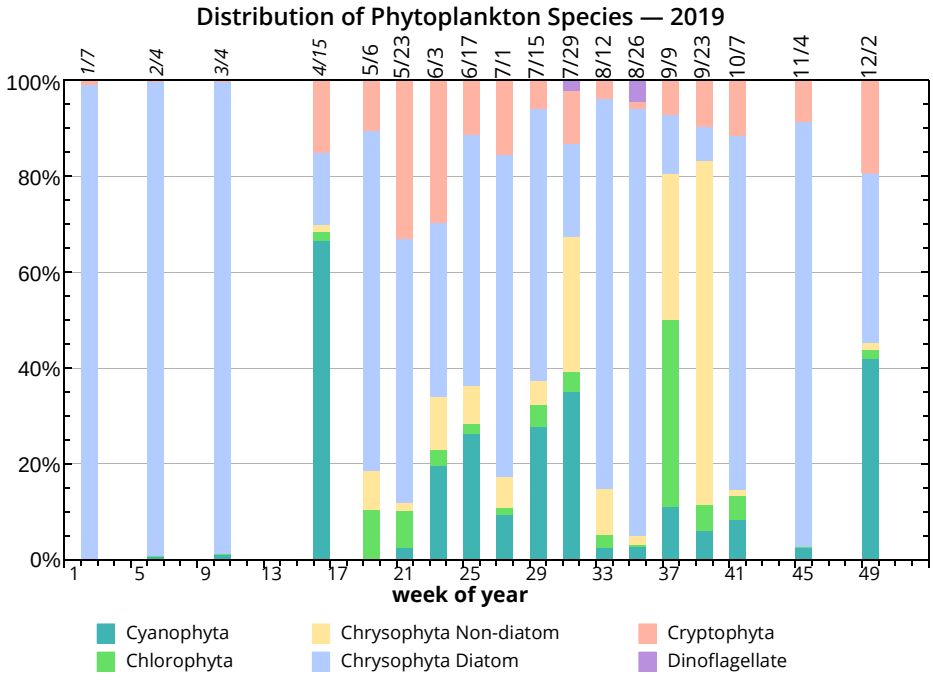


The cooler summer weather was associated with an onshore flow weather pattern that brought frequent morning clouds. Full sunlight did not occur until late morning, which reduced the amount of solar input that warms the lake and feeds cyanobacteria blooms.



The lower temperatures, reduced sunlight and lower phosphorus resulted in a very nice year for water quality on Oswego Lake. Phytoplankton volume was much lower than it was in the past four years.

In addition, 2019 was the first year in a long time that cyanobacteria were not the dominant phytoplankton species during summer. They did dominate in mid-April, but the total phytoplankton volume was so low at that time, that the cyanobacteria present were inconsequential. During most of the summer, the lake was overwhelmingly populated by diatoms.



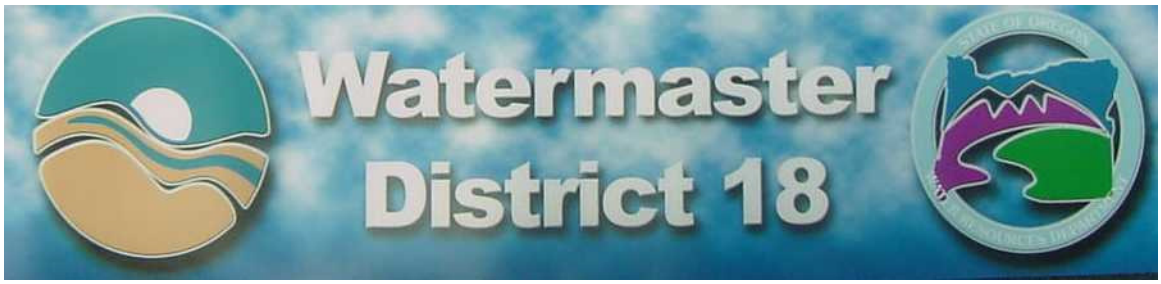
Data for nutrient concentrations in the lake and lake clarity are shown in the table below.

2019 OSWEGO LAKE WATER QUALITY — MEASUREMENT AVERAGES

	Location	Chlorophyll-*a* (µg/L)	Total P (µg/L)	SRP (µg/L)	Total N (µg/L)	Secchi (m)	Turbidity (NTU)
Summer	Lakewood Bay (depth 3.2 m)	11	42	1	467	1.37	5.0
	Main Lake (depth 16 m)	10	16	1	348	3.76	1.3
	West Bay (depth 1.4 m)	30	94	2	805	0.69	14
	Oswego Canal (depth 1.2 m)	5.3	81	20	4440	0.77	3.1
	Blue Heron Canal (depth 1.3 m)	26	128	2	1037	0.57	11
	Outlet (depth 6 m)	15	26	1	350	2.69	2.1
Annual	Lakewood Bay (depth 3.2 m)	10	34	1	388	1.80	4.6
	Main Lake (depth 16 m)	16	18	1	401	3.60	1.8
	West Bay (depth 1.4 m)	23	75	7	869	0.80	12
	Oswego Canal (depth 1.2 m)	6.0	119	65	4778	0.80	3.2
	Blue Heron Canal (depth 1.3 m)	27	104	4	1076	0.80	8.4
	Outlet (depth 6 m)	15	23	1	365	3.10	2.3

Boxed cell = highest average during summer; Shaded cell = lowest average during summer; Summer=June–September
Abbreviations: Total P = Total Phosphorus, SRP = Soluble Reactive Phosphorus, Total N = Total Nitrogen, Secchi = Secchi depth, µg/L = micrograms per liter, m = meters, NTU = nephelometric turbidity units

Sunset across Oswego Lake



OREGON WATER RESOURCES DEPARTMENT

by Jake Constans, Watermaster, District 18

INTRODUCTION

The District 18 Watermaster's Office is a field office of the Oregon Water Resources Department (OWRD) (www.wrd.state.or.us) in cooperation with Washington County (www.co.washington.or.us/index.htm), and is responsible for water distribution management within the Tualatin, Oswego Lake, and Lower Willamette Drainage Basins in northwestern Oregon. District 18 covers approximately 1,111 square miles and serves the majority of the population in Washington and Columbia counties, as well as parts of Clackamas, Multnomah, and Yamhill counties. There are 2,806 total surface water rights in the district which cover 58,602 acres of land. As part of the surface water rights within the Tualatin River Basin, the following streams have instream water rights: Tualatin River, Gales Creek, Scoggins Creek, Rock Creek, West Fork Dairy Creek, and Fanno Creek. To assist in monitoring surface water in the basin we currently utilize 17 total gaging stations, 10 of which are on real time data.

WATERMASTER DISTRICT 18 GAGING STATIONS FOR 2019

STATION NUMBER	STREAM	STREAM MILE	LATITUDE	LONGITUDE	TYPE
14206200	Dairy Creek at Hwy 8 near Hillsboro, OR	2.06	45°30'38"N	123°06'56"W	*Logger
14205480	E. Fk. Dairy Creek at Dairy Creek Rd near Mountaindale, OR	12.33	45°40'32"N	123°03'54"W	Staff
14205000	W. Fk. Dairy Creek @ Banks, OR	7.7	45°37'26"N	123°06'59"W	Staff
14205160	W. Fk. Dairy Creek @ Evers Rd near Roy, OR	1.96	45°34'34"N	123°05'34"W	Staff
14204530	Gales Creek @ Old Hwy 47 near Forest Grove, OR	2.36	45°30'39"N	123°06'56"W	*Logger
14204540	Gales Creek @ Clapshaw Hill Rd near Gales Creek, OR	12.36	45°35'39"N	123°12'38"W	Staff
14202920	Sain Creek above Hagg Lake near Gaston, OR	1.6	45°28'50"N	123°14'40"W	*Logger
14202850	Scoggins Creek above Hagg Lake near Gaston, OR	8.0	45°30'06"N	123°15'06"W	Logger
14202980	Scoggins Creek below Hagg Lake near Gaston, OR	4.8	45°28'10"N	123°11'56"W	*Logger
14202860	Tanner Creek above Hagg Lake near Gaston, OR	1.6	45°30'21"N	123°13'10"W	Staff
14206500	Tualatin River @ Farmington, OR	33.3	45°26'58"N	122°57'02"W	*Logger
14202510	Tualatin River @ Gaston, OR	62.3	45°26'21"N	123°07'85"W	*Logger
14204800	Tualatin River @ Golf Course Rd near Cornelius, OR	51.5	45°30'08"N	123°03'22"W	*Logger
14202450	Tualatin River below Lee Falls near Cherry Grove, OR	70.7	45°30'21"N	123°13'06"W	*Logger
14206295	Tualatin River @ Rood Bridge Rd near Hillsboro, OR	38.4	45°29'24"N	122°57'06"W	*Logger
14206956	Tualatin River @ Tualatin (stage only) (station number formerly 14206960)	8.9	45°23'14"N	122°45'46"W	*Logger
WAPO	Wapato Canal near Gaston, OR (from Tualatin River)	61.9	45°26'29"N	123°07'17"W	Staff

*Telemetry

Water Rights

All water in Oregon, by law, is publicly owned. With a few exceptions, a person or organization (such as a city, business, or other entity) must obtain an authorization from the state before they are allowed to divert water from its natural source, whether that water is from a stream, a lake or underground. This authorization is called a water right and they have been required for surface water since 1909. The Oregon Water Resources Department (OWRD) is responsible for issuing and managing water rights in Oregon.

Water right characteristics:

- Every water right establishes the following conditions:
  - —the location where the water is being diverted,
  - —how much water is being diverted,
  - —where the water will be used,
  - —and what the water will be used for.

  The use must be considered "beneficial" by the state and the water must be used in a way that is not considered wasteful. Changing any of these conditions requires legally changing the water right.
- Every water right has a "priority date" which is the date when it was issued.
- Water rights are usually associated with the land cited in the water right and when that land is sold, the water right usually goes with it. This is called "appurtenancy" which is a legal term for rights or restrictions that go with a property (an easement is a common example). It is possible, however, to sell or transfer a water right independent of the land. In such a case, a water right transfer must be applied for and granted by OWRD. Note that mere ownership of land does not confer the right to the water adjacent to or under that land; the land owner must own a water right.
- An instream water right is designed to retain a specified amount of flow in the stream for fish and wildlife, water quality or recreation. The Departments of Fish and Wildlife, Environmental Quality and Parks and Recreation may apply for instream water rights. An instream water right has a priority date and is not treated differently than other water rights.
- A water right remains in perpetuity as long as it is used at least once every 5 years. If it has not been used for 5 years, it may be forfeited or cancelled, but this is not automatic.

Prior Appropriation: In Oregon and throughout the western U.S., water is managed by a a system called "Prior Appropriation." Prior Appropriation is most simply explained as first come, first served, where "first" to "last" is in order of priority date.

A water source may not always be adequate to meet all of the water rights that have been issued for it. Because summers in the western U.S. are typically dry, surface water shortages in the summer are not uncommon. If a water source cannot meet all of the water rights associated with it, the entity with the oldest (most senior) priority date is entitled to all of the water documented in their water right. If water is still available after that water right has been fulfilled, then the entity with the next oldest priority date is entitled to water. This process continues on in order of priority date. The entities with more recent (junior) priority dates may exercise their water rights only after the more senior rights have been met.

The Oregon Water Resources Department monitors the availability of water throughout the season. Based upon flow, location and priority date, OWRD determines which, if any, water rights holders in the basin will be restricted from exercising their water rights. Note that the eventual use of the water (for example, irrigation, municipal supply, etc.) is taken into consideration only if two water rights have the same priority date or if a drought has been officially declared by the Governor.

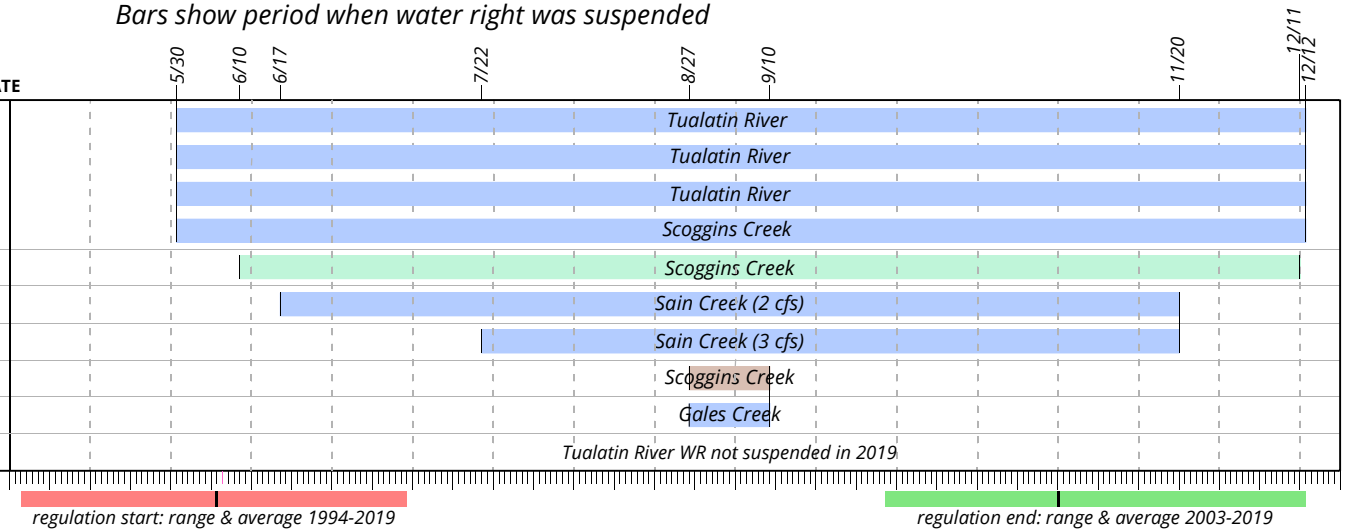
Regulatory Overview 2019

Regulation in 2019 began on May 30; the last day was December 12. Regulation was not suspended during the season. The 2019 regulation season was the longest (196 days) since records began in 1994. Previously, the longest season was 182 days in 2001. The 2019 season also had the latest date of regulation. The previous record was December 9 in 2002.

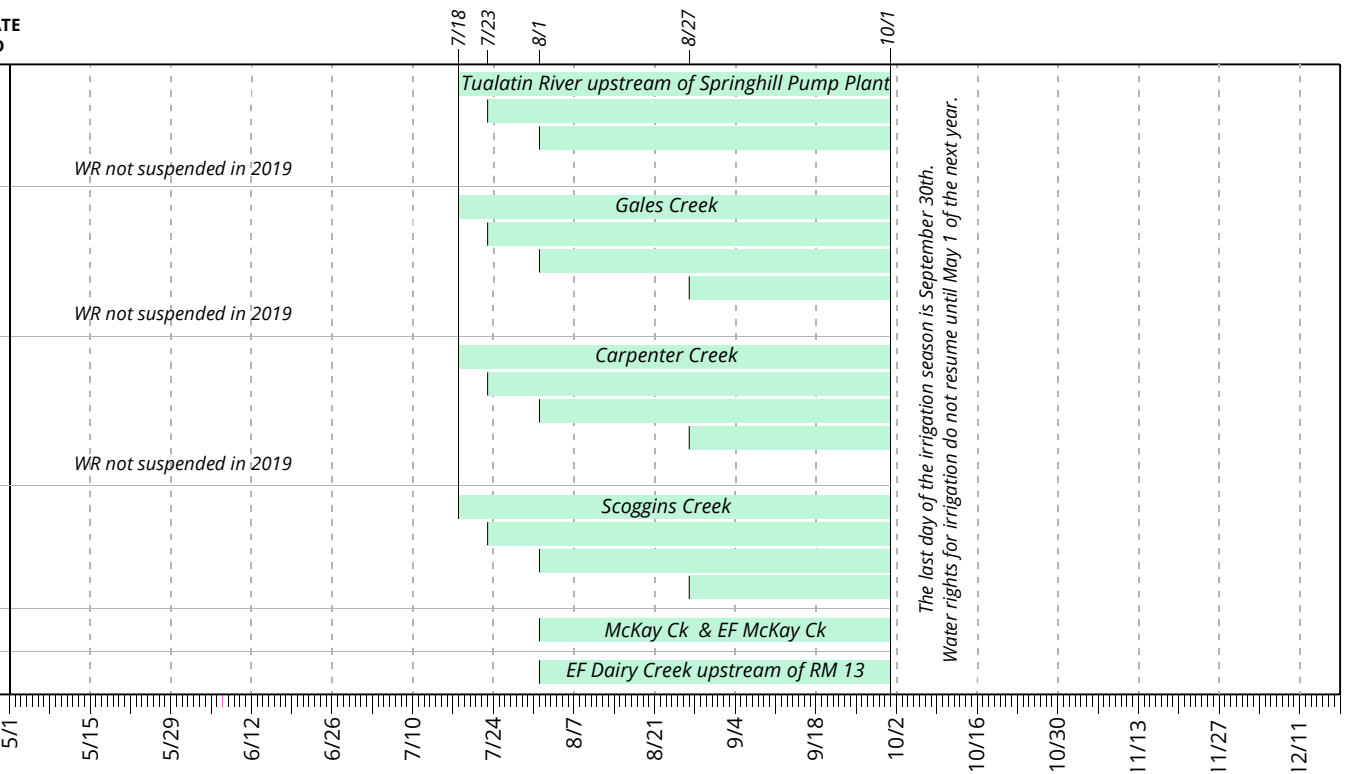
REGULATION OF WATER RIGHTS IN THE TUALATIN BASIN — 2019

Bars show period when water right was suspended

Entity	WR Permit	Priority Date
City of Beaverton	P-45455	7-15-1980
City of Forest Grove	P-40615	4-28-1976
City of Hillsboro	P-46423	2-6-1974
City of Hillsboro	P-50879	6-9-1988
TVID	P-35792	2-20-1963
City of Hillsboro	P-2443	5-1-1915
City of Hillsboro	P-1136	1-22-1912
Stimson Lumber Co	P-10633	4-1-1932
City of Forest Grove	P-12034	4-16-1935
City of Hillsboro	P-10408	1-22-1912



Location of Irrigation WRs	# of WRs Regulated Off	Earliest Priority Date Regulated
Tualatin R upstream of SHPP	11	2-20-1963
	18	4-14-1949
	23	3-18-1936
	3	8-26-1919
Gales Ck	62	9-24-1963
	38	4-18-1949
	26	6-25-1935
	5	9-6-1932
	7	1-23-1923
Carpenter Ck	4	7-10-1967
	5	8-22-1949
	6	12-14-1936
	1	3-25-1935
	1	10-21-1924
Scoggins Ck	3	7-28-1975
	5	4-15-1955
	7	4-24-1939
	1	4-1-1932
McKay Ck & tribs abv Northrup Rd	8	8-8-1966
EF Dairy Ck & tribs abv RM 13	12	3-6-1967



Water Use Municipal, Irrigation, Industrial-manufacturing

SCOGGINS DAM/HENRY HAGG LAKE

By John Goans, Reservoir Superintendent, TVID; Wally Otto, retired, TVID; Bernie Bonn

INTRODUCTION

Scoggins Dam

Scoggins Dam/Henry Hagg Lake is located on Scoggins Creek in the upper part of the Tualatin Basin. Scoggins Dam is an earthfill dam constructed during 1972–75 to store water during the winter for summer and fall use. The dam is owned by the Bureau of Reclamation (BOR) and managed by the Tualatin Valley Irrigation District (TVID). Stored water from Hagg Lake is used for irrigation, municipal and industrial use, and flow augmentation in the Tualatin Basin to support water quality and protect fish and wildlife.

Three tributaries flow into Hagg Lake—Sain, Scoggins and Tanner Creeks. Flows in Sain and Scoggins Creeks are monitored by Oregon Water Resources Department gages; flow in Tanner Creek is monitored by daily readings of a staff plate by TVID personnel. Outflow is measured by a BOR stream gage in Scoggins Creek at RM 4.8. Oregon Water Resources Department maintains the rating curves for these sites.

Scoggins Dam stores 53,323 acre-feet of water in Henry Hagg Lake as active storage—the amount of water that can be moved in or out of the reservoir between the intake structure and the top of the spillway gates. Another 7,000 acre-feet of stored water that is not engineered to be removed exists below the intake structure. It is reserved for the protection of fish if the lake were to be drafted down completely to the intake structure.

ALLOCATION OF WATER FROM HAGG LAKE

CONTRACTED TO	WATER USE	AVAILABLE VOLUME	
		ac-ft	AS PERCENT
Tualatin Valley Irrigation District	Irrigation (up to 17,000 acres)	26,705	50%
Joint Water Commission	Municipal and industrial	13,500	25%
City of Beaverton		4,000	
City of Forest Grove		4,500	
City of Hillsboro		5,000	
Clean Water Services	Instream water quality	12,618	24%
Lake Oswego Corporation	Irrigation	500	1%
Total		***53,323**	**100%**

*The active storage in Hagg Lake was revised in 2011.

Scoggins Dam is authorized by the U.S. Congress to provide flood risk management for communities located downstream, including Gaston, Cornelius and Forest Grove. The dam controls runoff from a 39 square mile watershed (about 5% of the Tualatin Basin). From November 1st to January 15th, 20,000 acre-feet are designated for storage for flood risk management. The dam does not generate electricity.

Recreation is a major activity at Hagg Lake and the surrounding area, especially during summer. Washington County maintains and operates the 2,851 acre Scoggins Valley Park/Henry Hagg Lake recreational facility. In addition to the 1,100 acre lake, the park includes picnic areas, hiking trails, two boat launching facilities, and observation decks for bird and wildlife watching. The lake is stocked for fishing. Most of the park's facilities were designed to be accessible for disabled visitors. The park is open year round and is for day-use only.

http://www.co.washington.or.us/Support_Services/Facilities/Parks/Hagglake/index.cfm

2019 Water Use

Water year 2019 marks the 45th year since Scoggins Dam began storing and releasing water for downstream beneficial use. A total of 36,873 acre-feet were delivered in 2019 (calendar year) bringing the total delivery from the Project to more than 1.3 million acre-feet.

2019 flow regulation began on May 30 for the Joint Water Commission and June 11 for TVID. With the exception of TVID's extended season irrigators, all users were permitted to return to natural flow use in the Tualatin River on December 11, 2019. As usual, TVID continued to deliver a small amount of storage water primarily to nurseries and greenhouses beginning in March and continuing until the end of November as permitted by the Oregon Water Resources Department.

2019 WATER DELIVERIES FROM HAGG LAKE

Delivered to	Volume (ac-ft)
Tualatin Valley Irrigation District	15,715
Clean Water Services	9,969
Municipal Use (Cities of Beaverton, Forest Grove and Hillsboro)	9,965
Lake Oswego Corporation	500
Other (includes two golf courses, from TVID allocation)	724
Total	**36,873**

Events in 2019

Recreation: In 2019 there were 850,000 users recorded at Scoggins Valley Park/Henry Hagg Lake. In addition to the usual recreational uses, numerous races were held including triathlons.

Coho Salmon: Eight Coho were spotted in Scoggins Creek below the dam in December.

Lake Fish Habitat: Over the previous years, the Oregon Panfish Club anchored a total of 350 fish habitat structures (8' diameter) in the upper reaches of Henry Hagg Lake. These have caused no problems in terms of operation and maintenance of Scoggins Dam. They have remained in place weighted down with concrete anchors.

Elk Mitigation: Roughly 50% of the fir trees planted in February 2012 remain standing and continue to form a visual barrier for the elk along the side of the Control House entry road. The field remains off limits to all trespassers including dogs. On numerous occasions, elk were observed grazing in the pasture.

Endangered species: As part of the consultation, BOR committed to avoid or minimize impacts to Fender's Blue Butterfly (FBB) and Kincaid's lupine. The Master Trail that traversed prairie patches containing FBB and Kincaid's lupine was relocated and trail maintenance practices modified to support these species. Reclamation has also committed to work with partner agencies to study and control invasive weeds.

Scoggins Dam Security

Department of Homeland Security Alert Levels: The Project follows the Department of Homeland Security (DHS) alert levels as required by BOR. No incidences of heightened security level occurred at Scoggins Dam in 2019 due to any specific terrorist alerts.

Scoggins Dam Safety

At Scoggins Dam, earthquake activity, weather including temperature and precipitation, river stage levels, and water surface elevation are reported and recorded electronically. In addition, key dam behavioral instruments report electronically over BOR's Hydromet system. The data are collected, stored and transmitted via satellite to BOR's Pacific Northwest Regional office in Boise, and are available on the Internet through both secure and non-secure channels. Many of these electronic reporting stations have alarms to alert operators if sudden or unusual conditions develop including earthquakes and flooding. While operators are not on site 24/7, the Project is monitored 24/7, both by BOR and TVID personnel.

Spills and Water Quality: No spills or accidents that jeopardized the water quality in Henry Hagg Lake occurred in 2019 and the BOR on-site Response Trailer was not needed for emergency response. No containment booms were deployed to contain any contaminant spills during 2019.

Drownings: No drownings were reported in 2019, thankfully!

Earthquakes: No earthquakes were recorded near the dam in 2019.

Future of the Project

Tualatin Basin Water Supply: In 2001, the water resource agencies in the Tualatin Basin (except TVID) began to explore and compare alternatives for providing the additional water needed to meet future needs. TVID was not part of this group because it is limited to serving 17,000 acres of irrigated land and the current supply is adequate. After studying many different options as well as seismic issues, the municipal and industrial water providers decided to focus on the Willamette River for future water supply.

Clean Water Services is continuing to collaborate with BOR on the Tualatin Basin Dam Safety and Water Supply Joint Project. The Project goals include developing alternatives to:

- strengthen the dam to reduce risk from a Cascadia Subduction Zone earthquake, and
- increase the storage capacity of Hagg Lake to ensure that future water supply needs are met for the maintenance and improvement of water quality in the Tualatin River.

In May 2016, Congress passed the Federal Energy and Water Appropriations Bill. The bill raised the funding cap for necessary safety upgrades to Scoggins Dam and granted BOR the statutory authority to pursue conservation storage and paved the way for the Joint Project. It earmarked $2 million for updates to Scoggins Dam. The alternatives under consideration for upgrading Scoggins Dam are:

- strengthening Scoggins Dam in its current location without increasing storage capacity
- strengthening and raising Scoggins Dam in its current location, and
- replacing the existing dam with a new dam located downstream at a narrow gap in the valley.

The Tualatin Joint Project team hosted a barbecue and area tours at Hagg Lake on September 5, 2019. More than 120 neighbors and others interested in the project enjoyed a fresh, barbecued dinner and discussed the project with Reclamation, Washington County and CWS staff at the picnic area and on bus tours. The 45-minute bus ride provided a guided tour of the project area, including the existing dam and the location for the proposed downstream dam option.

The selection of the preferred alternative was scheduled for late 2019, but the meeting was postponed until February 2020.

More information about the Tualatin Basin Water Supply Project and updates can be found at:
http://www.tualatinbasinwatersupply.org

TUALATIN VALLEY IRRIGATION DISTRICT

by Wally Otto, retired, TVID; updated by John Goans, Reservoir Superintendent, TVID

Tualatin Valley Irrigation District Overview

The Tualatin Valley Irrigation District (TVID), located in Forest Grove, Oregon, is the agricultural water service agency in the Tualatin Basin. In the early twentieth century, relatively little agricultural land was irrigated in Washington County: about 15 acres in 1915 and about 130 acres in 1933. By 1951, however, 18,455 acres had water rights registered in the county. When the TVID was formed in 1962, the total had grown to 33,885 acres. TVID was formed to assist in the delivery of irrigation water to about half of those acres (17,000) in the Tualatin Basin. The water was supplied from natural flow and return flows, and was extremely limited due to early summer withdrawals from the Tualatin River and increasing demands for water for irrigation and municipal use and for maintaining instream water quality and fish. The only storage at this time was Barney Reservoir which stored 4000 acre-feet for municipal use. Beginning in 1975, additional stored water became available behind the newly completed Bureau of Reclamation Project, Scoggins Dam. Approximately half of the water stored in Hagg Lake (Henry Hagg Lake) is allocated to TVID.

Most of the water supplied by TVID is pumped from the Tualatin River at the Spring Hill Pump Plant and delivered to TVID patrons via approximately 120 miles of pressurized pipeline. Additionally, water in both Scoggins Creek and the Tualatin River is withdrawn by irrigators for use on land abutting the river. They are known as “river users” and pay for their own pumping costs because they are not associated with the pressure pipeline or the Spring Hill Pumping Plant. When natural flow no longer meets demand, the District 18 Watermaster begins regulating water users with “junior” (or more recent) water rights off, starting with users with the most recent water right. The TVID storage right is dated 1963, so TVID patrons with water rights after that date must stop withdrawing natural and return flow water, and all water withdrawals must be supplied from storage. Storage water is discharged from Hagg Lake to either augment the river flow or supply the entire need of the TVID patrons, both the pump plant/pressure pipeline users and the river users. Water for some of the TVID members on the lower Tualatin River is supplied by water discharged from Clean Water Services’ Rock Creek Wastewater Treatment Facility. Crops irrigated with TVID water range from row crops including blueberries, blackcaps, corn, pumpkins and other vegetables to nursery stock.

TVID is allowed to use storage water early and late in the year because of an extended season for irrigation made possible by an agreement with the Oregon Water Resources Department. The early season begins March 1 and the extended season ends November 30. All water used outside the normal irrigation season (May through September) must come from TVID's annual contracted *storage* allotment of 27,022 acre-feet. TVID's total contracted amount with Reclamation is 37,000 acre-feet with the additional coming from natural and return flows in the Tualatin River and its tributaries.

The extension of the irrigation season for the Tualatin Valley Irrigation District has made growing specialty crops within the District much more appealing. During the extended spring season, the water is used primarily for berries and nurseries; during the extended fall season, water is primarily used for the nurseries. A more diverse nursery stock is now possible, including flowers which are raised well into November when protected by greenhouses. Water availability and moderate temperatures make the Tualatin Valley Irrigation District home to many small specialty nurseries along with several large operations.

2019 TVID Water Use

For the 2019 irrigation season (March through the end of November), TVID took delivery of 15,715 acre-feet of water from storage in Henry Hagg Lake—about 1,700 ac-ft less than usage in 2018. The least amount was 8,333 ac-ft in 1993; the largest seasonal delivery was 25,852 ac-ft in 2015. TVID 2019 peak use from storage was 107 cfs on August 9.

WEATHER STATISTICS AT SCOGGINS DAM 2019

Month	Description	Precipitation		Average Temperature		Other
		2019	[average]*	Low	High	
January	drier than average	5.05″	[7.82″]	35°F	48°F	16 days with no precipitation
February	wet	8.30″	[6.25″]	30°F	42°F	3.92″ & 0.73″ rain: 12th & 13th
March	dry, warm	1.73″	[5.70″]	34°F	54°F	8 days ≥60°F, 2 days ≥70°F
April	wet early, dry late	4.21″	[3.53″]	42°F	60°F	2.88″ rain 5th –8th no precipitation 21st–30th
May	dry except for a few storms	2.00″	[2.13″]	45°F	70°F	21 days with no precipitation 4 days ≥80°F
June	very dry, warm	0.24″	[1.43″]	48°F	74°F	8 days ≥80°F, 2 days ≥90°F only 4 days with any rain
July	mild	0.45″	[0.41″]	53°F	78°F	10 days ≤ 75°F; 0.37″ rain 10th
August	mild	0.54″	[0.64″]	54°F	81°F	15 days ≤ 80°F, 3 days >90°F
September	cool, wet	3.15″	[1.55″]	47°F	73°F	15 days with rain 14 days ≤ 70°F
October	somewhat dry, cool	2.72″	[3.74″]	38°F	60°F	16 days with no rain 1 days ≥70°F
November	unusually dry	1.12″	[7.74″]	37°F	54°F	22 days with ≤ 0.01" rain
December	somewhat dry	7.18″	[9.21″]	37°F	46°F	3.30″ rain 20th –21st

*average based on 1970–current year

2019 TVID Operation and Maintenance

The year was uneventful from an operations standpoint. A “moratorium” remains in place regarding new turn-out deliveries. No new deliveries were added to the delivery system during 2019.

Pipeline Maintenance: TVID delivers irrigation water by high pressure pipeline to customers from Gaston to North Plains and from west of Forest Grove to Highway 219 south of Hillsboro. The water is withdrawn from the Tualatin River at the Spring Hill Pump Plant and lifted by pumps to a water regulating tank off Winter’s Road. From there it flows under gravity pressure to all points of delivery through 120 miles of pipeline. Preventative maintenance continues to keep service delivery as dependable as possible. Several minor disruptions of service occurred during the year, but were quickly isolated and repaired. Service was restored in minutes in some cases or in up to a day if conditions did not allow quick access. There were no long term disruptions of service to District patrons.

Tributary Flow Restoration Projects: TVID and Clean Water Services continue their cooperative effort using the TVID water distribution network to supply water to West Fork Dairy Creek, Gales Creek, East Fork Dairy Creek, and McKay Creek. Each site consists of a metered pipeline with a diffuser at the outlet. All sites are located near delivery lines for the Irrigation District. Flow augmentation occurs during the summer and fall. The water not only adds to streamflow, but it cools the stream as well. The partnership between the Tualatin Valley Irrigation District and Clean Water Services is a novel way to improve the water quality of these streams at minimal cost.

WAPATO LAKE

by Kristel Griffith, Water Resources Program Coordinator, JWC
updated by John Goans, Reservoir Superintendent, TVID

The former Wapato Lake bed, located southeast of Gaston, Oregon, is a 780 acre wetland that was once the winter residence of the Atfalati indigenous people. Settlement of the area began in the 1830s and during the 1930s a levee and pump system was constructed by the Wapato Improvement District (WID) to drain the lake bed during spring so that the land could be farmed in summer. The levee protects the former lake bed from severe flooding during the winter, thereby allowing easier drainage in spring.

In 2011, the US Fish and Wildlife Service (USFWS) became the majority land-owner and the WID was dissolved. In 2013 Wapato Lake was established as a National Wildlife Refuge (NWR) as part of the Tualatin River NWR Complex.

Levee, pump and drainage issues

2007–2008: A levee failure in December 2007 resulted in flooding. By spring 2008, the lake was supporting a substantial population of algae and zooplankton. When the impounded water was discharged in June 2008, it created many water quality problems which affected drinking water treatment, agricultural irrigation, fish and wildlife, and recreational use. The State of Oregon issued a Public Health Advisory for recreational contact with the Tualatin River due to high levels of toxic algae. Detailed descriptions of these events can be found in USGS Report 2015-5178, "Upstream Factors Affecting Tualatin River Algae- Tracking the 2008 Anabaena Algae Bloom to Wapato Lake, Oregon."

2010: In 2010 when the primary pump failed, Clean Water Services led a collaborative effort to acquire temporary pumps to prevent a repeat of the 2008 problems. See the Tualatin River Flow Management Technical Committee's 2010 report for details.

2012 TMDL: Drainage from Wapato Lake was included in the 2012 Total Maximum Daily Load (TMDL) Implementation Plan. USFWS must limit pumping from the lakebed after April 30th each year to be in compliance with Department of Environmental Quality requirements (DEQ). This avoids draining the area when conditions are favorable for algal blooms (low water and high temperature), and protects water quality in the Tualatin River.

2016: As in 2010, mechanical and electrical failures caused the primary pump to be non-operational in February 2016. Pump repairs could not have been completed soon enough to drain the lake bed by April 30th as mandated by the TMDL. The possibility of a repeat of the 2008 water quality problems was a serious concern. The water and natural resource managers in the Tualatin Basin, including CWS, USGS, JWC and USFWS, worked together to obtain emergency repairs and acquire auxiliary pumps. The lake was pumped out on May 1st, only 1 day late. No water quality problems were evident.

2019: Major investments in the infrastructure at the refuge occurred in 2019. Early in the year two leaking water control structures were repaired. A new bridge was built at the pump station with capacity to carry heavy machinery. A second pedestrian bridge was constructed on the south-west to facilitate future public uses. The FWS, with assistance from CWS and JWC, commissioned the design of a new pump house, to be constructed in 2021.

Pumping operations in 2019

The lake was mostly drained by the end of April in compliance with the TMDL.

2019 PUMPING CAPACITY AND DATES OF OPERATION

Pump	Nominal Capacity (gpm)	Operation Period
USFWS Primary	~10,000	3/4 – 5/4
USFWS Secondary	~3,000	3/4 – 6/13

Similar to 2018, winter water levels in the lake bed were lower than typical and summer water levels were higher in 2019.

WATER QUALITY

by Bernie Bonn

Concern about water quality in the Tualatin River is longstanding. Until the formation of Clean Water Services (formerly the Unified Sewerage Agency of Washington County), numerous small towns and cities discharged minimally treated sewage into the river and its tributaries. Water use by agricultural activities in the basin depleted river flow in the summer and contributed nutrients and sediment. By the 1960s, the local newspaper documented the poor water quality in the Tualatin River. In 1984, the Oregon Department of Environmental Quality (ODEQ) included sections of the Tualatin River on the 303d list as being water quality limited. Water quality issues in the Tualatin Basin have included elevated pH and nuisance algae, low dissolved oxygen, high temperatures, and excess bacteria. Many groups have worked to improve water quality in the Tualatin Basin, including Clean Water Services, the Tualatin River Watershed Council, the Tualatin Riverkeepers and others. Part of the reason for the formation of the Flow Committee is to manage river flow to improve and preserve water quality.

HISTORICAL WATER QUALITY CONCERNS

Algae and high pH: In the reservoir section (about RM 3.4-30), the Tualatin River is wide and slow moving. Because the river is so broad, streamside vegetation cannot adequately shade the full width and consequently much of the water surface is in exposed to the sun. Nutrients, both naturally occurring and anthropogenic, are ample. These conditions—slow movement, sunlight, and ample nutrients— are ideal for algal growth during summer. Most of the algae in the Tualatin River are phytoplankton that float in the upper few feet of the water. During the day, photosynthesis by algae converts carbon dioxide dissolved in the water into biomass. As the concentration of dissolved carbon dioxide decreases, the pH of the water increases. High pH values can negatively affect aquatic resources.

In the 1980s the lower section of the Tualatin River was listed by the ODEQ for elevated pH (>8.5) and degraded aesthetics due to nuisance algal growth. To address these water quality problems, the ODEQ developed a TMDL for phosphorus to limit nutrient availability. Target levels for instream total phosphorus concentrations have been established for the Tualatin River at various locations.

Some Tualatin tributaries also have had problems with algal growth, usually periphyton.

Dissolved oxygen: The amount of oxygen dissolved in water is the net result of processes that contribute oxygen and processes that consume oxygen. In the lower Tualatin River the primary sources of oxygen are:

—photosynthesis by algae during the daytime, and
—inflow of oxygen rich water.

The processes that consume oxygen are:

—biochemical oxygen demand (from substances in the water that decompose),
—sediment oxygen demand (from substances at the river bottom that decompose), and
—respiration by algae.

Because the lower section of the river moves slowly and is not turbulent, oxygen exchange with the atmosphere is slow. If dissolved oxygen becomes depleted, it cannot be quickly replenished from the air. Similarly, if dissolved oxygen is in excess, the river water stays supersaturated for a prolonged period of time.

In the 1980s the lower section of the Tualatin River was listed by the ODEQ for low dissolved oxygen that could impair fish health.The water quality criteria for this section of the river, which is considered 'Cool Water Habitat,' are:

- Grab samples: dissolved oxygen > 6.5 mg/L
- Continuous Monitoring:
  —30-day average of daily mean dissolved oxygen > 6.5 mg/L (no credit for supersaturation)
  —7-day average of daily minimum dissolved oxygen > 5.0 mg/L (no credit for supersaturation)
  —Daily minimum dissolved oxygen > 4.0 mg/L

ODEQ also developed a TMDL for ammonia which consumes oxygen as it decomposes into nitrate.

Water quality monitoring

Clean Water Services obtains grab samples at numerous sites throughout the basin, including several on the Tualatin River as well as tributaries. Field parameters (dissolved oxygen, water temperature and pH) are measured in the stream at the time of sample collection. Other constituents, including chlorophyll-*a*, phosphorus, nitrate and ammonia, are analyzed in the laboratory.

Continuous water quality monitors have been deployed throughout the basin. Most are operated by the USGS as part of a cooperative agreement with Clean Water Services. The Tualatin River at Hwy 219 monitor is operated by personnel at Jackson Bottom Wetlands Preserve. Since October 2015, the Beaverton Creek at 170th monitor has been operated by Clean Water Services personnel, although the data are still reviewed by the USGS. All monitors record data at least hourly. The table below lists the currently operating continuous monitors that are not part of any special study.

LONG TERM CONTINUOUS WATER QUALITY MONITORS

Site	River Mile	Parameters*								Notes
		DO	pH	WT	SC	Tbdy	Chl	Phyc	fDOM	
Tualatin River at Oswego Dam	3.4	●	●	●	●	●	●	●		most parameters since 1991
Tualatin River at RM 24.5	24.5	●	●	●	●		●	●		most since 1997, summer only
Tualatin River at Hwy 219	44.4	●	●	●	●	●	●	●		most parameters since 2004
Tualatin River at Dilley	58.8		●	●	●	●	●	●	●	since 2016
Fanno Creek at Durham		●	●	●	●	●				since 2003
Beaverton Creek at 170th		●	●	●	●	●				most parameters since 2001
Rock Creek at Brookwood		●	●	●	●	●				since 2004
Gales Creek at Old Hwy 47		●	●	●	●	●			●	most parameters since 2001
Scoggins Creek below Hagg Lake		●	●	●	●	●				most parameters since 2002

*Parameter abbreviations: DO=dissolved oxygen, WT=water temperature, SC=specific conductance, Tbdy=turbidity, Chl=chlorophyll-*a*, Phyc=phycocyanin (indicator of cyanobacteria), fDOM=fluorescent dissolved organic matter

Tualatin River water quality since the TMDL

Since the first TMDL, advanced wastewater treatment by Clean Water Services has decreased the amount of phosphorus and ammonia discharged to the river by its WWTFs during the summer low flow period. Median total phosphorus concentrations during low flow season in the Tualatin River at Elsner/Jurgens Park (0.086 μg/L) and at Stafford (0.087 μg/L) have been below the TMDL target levels (0.11 and 0.10 μg/L, respectively) since 1998.

Streamflow in the Tualatin River during the summer has increased since the TMDLs were instituted in 1988. Much of the increase is due to Clean Water Services' releases of stored water from Scoggins and Barney Reservoirs as well as increased discharge from the wastewater treatment facilities. In addition, coordinated water management among the members of the Tualatin Flow Committee has helped eliminate the very low flows that occasionally occurred during the summer in the early 1990s and before.

Algae and high pH: Chlorophyll-*a* concentrations indicate the amount of algae in the river. They have decreased substantially since the 1990s (see the figure on page 47). Because the algal population has declined, the high pH values that were problematic in the early 1990s have become non-existent in the lower Tualatin River (see the figure on page 47). Low pH values (<6.5) are not a problem in the Tualatin River system.

Dissolved oxygen: Increased river flow affects two different processes with opposite effects on oxygen. Faster river flow decreases the amount of time water is in contact with sediment, thereby decreasing the extent to which sediment oxygen demand can be exerted and the resultant amount of oxygen depleted. Faster river flow also decreases the time available for algal populations to grow, which in turn decreases photosynthetic oxygen production. The net effect of decreased oxygen consumption plus decreased oxygen production is variable and not well predicted. In general, low dissolved oxygen is still an issue in the lower Tualatin River, especially late summer through fall when low flows and warm water temperatures increase oxygen consumption by sediment oxygen demand and short days decrease photosynthetic oxygen production (see the figure on page 47).

Tualatin River water quality in 2019

Algae and pH: Chlorophyll-*a* levels in 2019 were the lowest since USGS began chlorphyll-*a* continuous monitoring in 2001—even lower than in 2018. The maximum 3-month mean chlorophyll-*a* concentration in the Tualatin River at Oswego Dam in 2019 was 3.8 μg/L and occurred for April–June. Median total phosphorus concentrations for the 2019 summer season (May–October) were 0.097 μg/L at Jurgens Park and 0.094 μg/L at Stafford.

The maximum pH values measured by continuous monitors at the Oswego Dam and RM 24.5 sites (7.0 and 7.3, respectively) were well below ODEQ's 8.5 maximum and another sign of low algal activity in the river.

Dissolved oxygen: Dissolved oxygen conditions in the Tualatin River in 2019 at Oswego Dam continued to be problematic. The 30-day criterion (30-day mean with no credit for supersaturation) was not met from July 5 through October 12, 101 consecutive days. In addition, the 7-day criterion was not met for 2 days in July. As usual, all criteria for DO were met throughout the dry season at RM 24.5

NUMBER OF DAYS THAT DID NOT MEET DISSOLVED OXYGEN CRITERIA IN 2019

Criterion	May	June	July	Aug	Sept	Oct	May–October Percentage	Nov
Tualatin River at RM 24.5								
30 day	0	0	0	0	0	0	0%	0
7 day	0	0	0	0	0	0	0%	0
Daily	0	0	0	0	0	0	0%	0
Tualatin River at Oswego Dam (RM 3.4)								
30 day	0	0	27	31	30	13	55%	0
7 day	0	0	2	0	0	0	0%	0
Daily	0	0	0	0	0	0	0%	0

Late summer/early fall: Low dissolved oxygen at Oswego Dam in late summer and early fall have been common in recent years. Historically, algal growth is sufficient in late July and early August to offset sediment oxygen demand. In 2019, algal activity was minimal all season. See page 47.

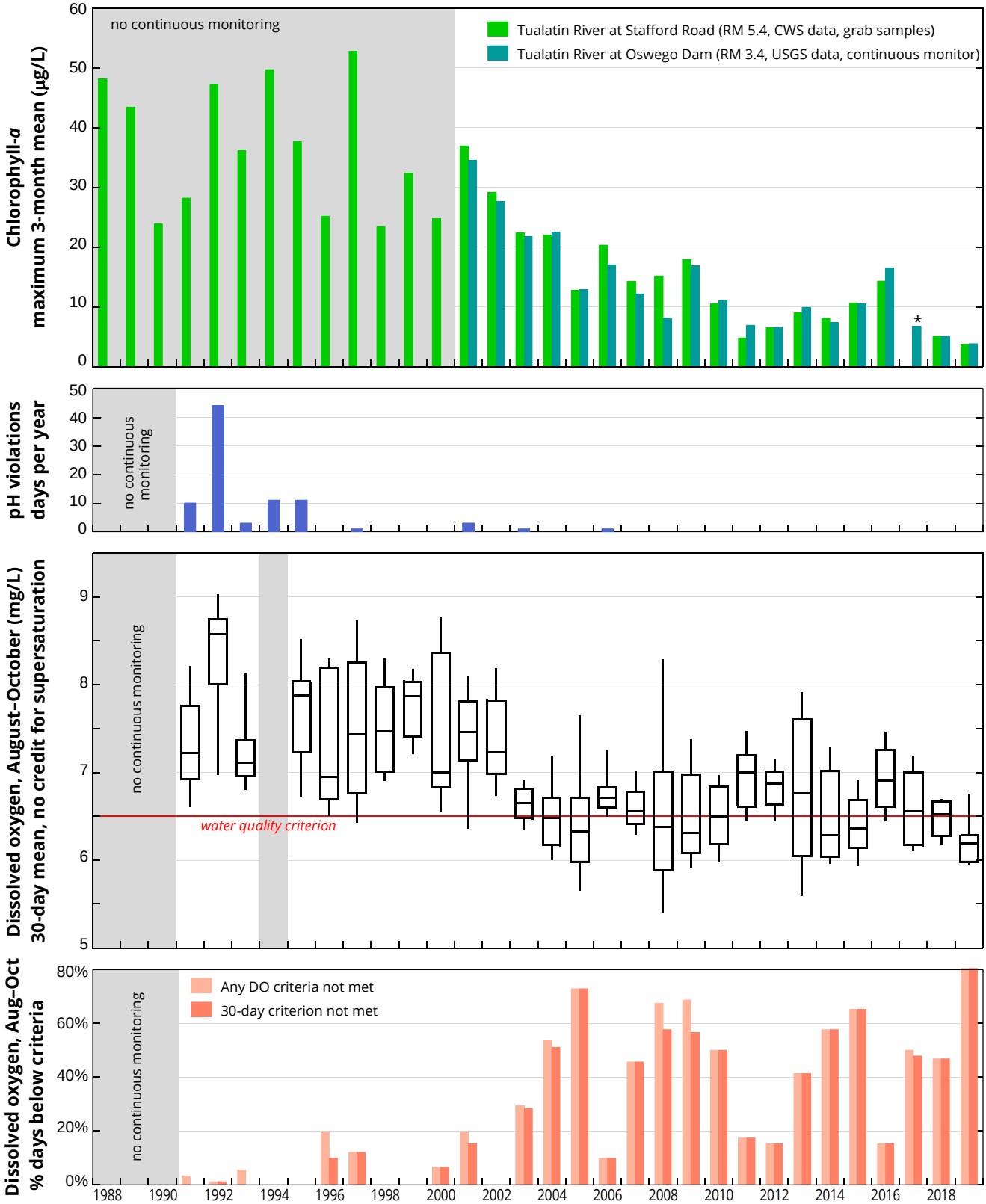
Early summer: DO levels in 2019 were unusual in that the 30-day criterion was not met beginning in early July, which is earlier than in most years. Low DO levels in early summer also occurred in 2018. Prior to 2018, only two episodes occurred in the months before August in which a dissolved oxygen criterion was unmet: July 5-7, 1992 and July 25–27, 2007 when the 7-day mean minimum criterion was not met. Until 2018, the 30-day criterion had been met every day in June and July since continuous monitoring at Oswego Dam began in 1991. The lowest DO at Oswego Dam during the entire 2019 low flow season was 4.68 mg/L on July 11. The lowest value of the 30-day statistic at that site was 5.78 mg/L on July 24–27.

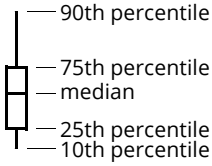
Typically during the early summer, if it is not cloudy, longer days and lower flow promote algal growth. DO levels fluctuate as the balance between photosynthetic oxygen production and oxygen depletion by SOD changes.

The graphs on page 48 show that algal activity in early summer 2018 and 2019 was much lower compared to previous years. Compared to the period of record, 2018 and 2019 had slightly higher temperatures and slight lower flows than average, but unduly different. Low flow and warm temperatures enhance the expression of SOD due to increasing contact time and decomposition rate and help explain low DO concentrations, but they do not explain the low algal activity. Similarly low flows and warm temperatures occurred in 2015 and 2016 yet algal activity was moderate and DO levels, while low at times, met the 30-day criterion throughout the early summer.

Late fall: DO concentrations met the 30-day criterion throughout November 2019 even though flows were low much of the time. Cooler temperatures likely helped slow oxygen depletion by sediment oxygen demand.

CHLOROPHYLL-*a*, pH & DISSOLVED OXYGEN — LOWER TUALATIN RIVER — AUGUST–OCTOBER 1988–2019

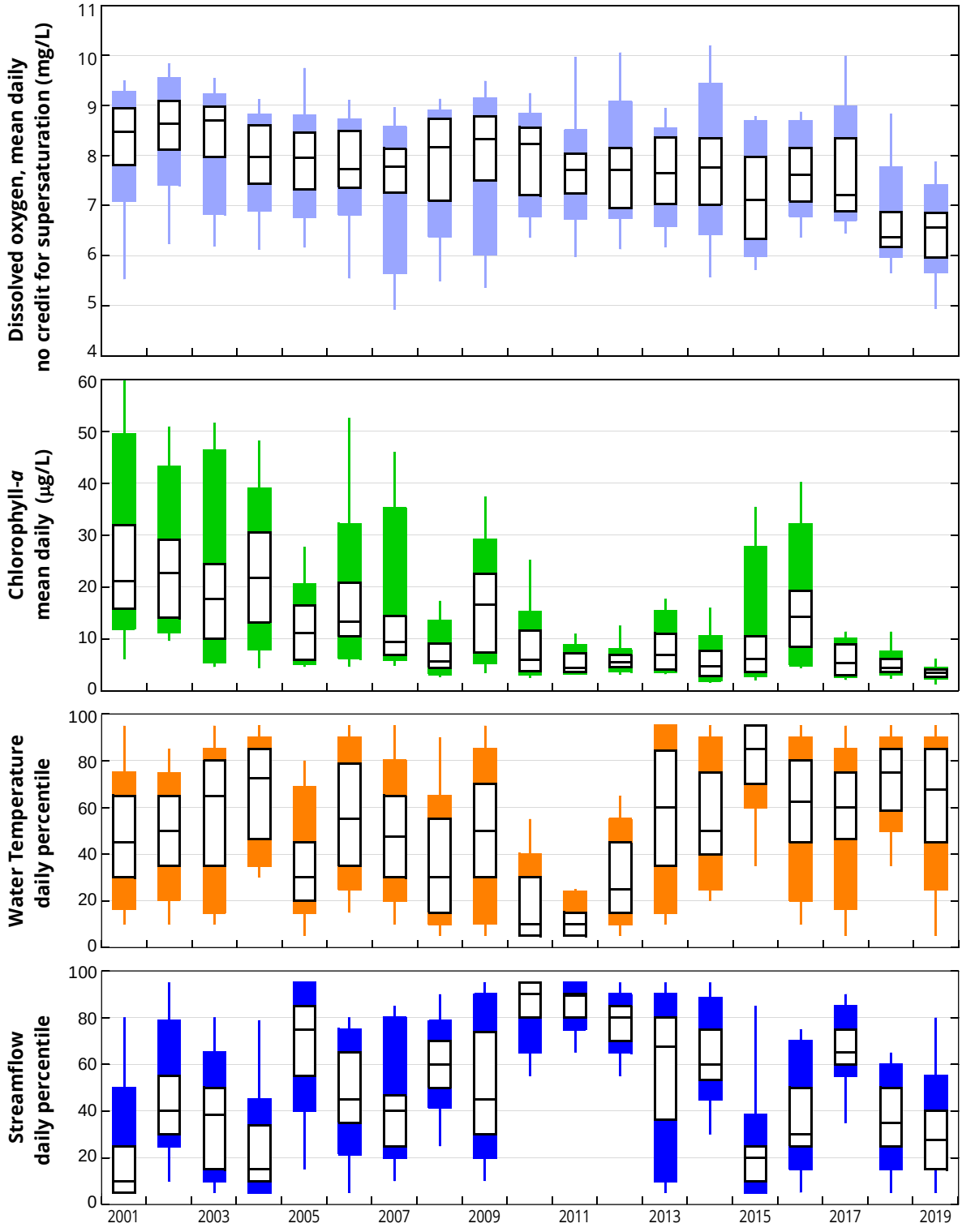




All data for Tualatin River at Oswego Dam (RM 3.4, USGS data, continuous monitor) except chlorophyll-a data from Clean Water Services which were grab samples at Stafford

*Chlorophyll-a data from Clean Water Services were not available in 2017.

DISSOLVED OXYGEN —LOWER TUALATIN RIVER — EARLY SUMMER (MAY–JULY) 2001–2019

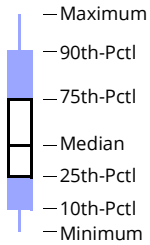


Period of Record: May–July, 2001–2019

Percentiles based on daily values
(minimum and maximum percentiles: 5 and 95)

Water quality data at Oswego Dam
(RM 3.4, USGS continuous monitor)

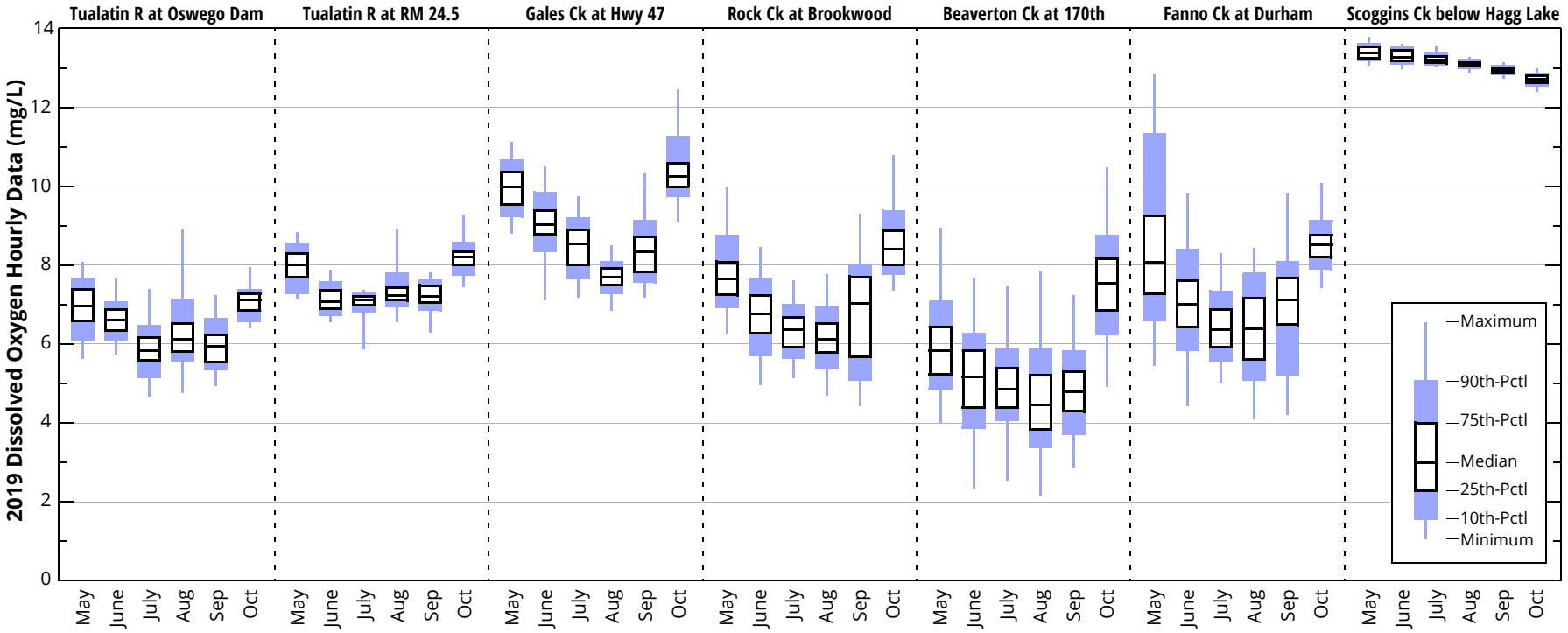
Streamflow data at West Linn (RM 3.4, USGS)



Dissolved oxygen throughout the Tualatin Basin

As previously discussed, low dissolved oxygen (DO) concentrations have been an ongoing problem in the lower Tualatin River. Some of the tributaries in the Tualatin Basin also have had low DO levels. In general, the slow moving valley bottom streams are more likely to have low DO than faster moving headwaters streams. It is thought that sediment oxygen demand is largely responsible for the low DO levels in the tributaries. Transport of material from the landscape and re-suspension of sediment are also thought to be important sources of biochemical oxygen demands to the tributaries. Continuous monitoring can provide insight into the processes that affect DO concentrations. A statistical summary of the data is shown below. More detailed descriptions for each site are provided on the following pages. Data are available at:
`https://or.water.usgs.gov/cgi-bin/grapher/table_setup.pl?basin_id=tualatin`

DISSOLVED OXYGEN LEVELS IN THE TUALATIN RIVER AND SELECTED TRIBUTARIES DURING LOW-FLOW SEASON — 2019

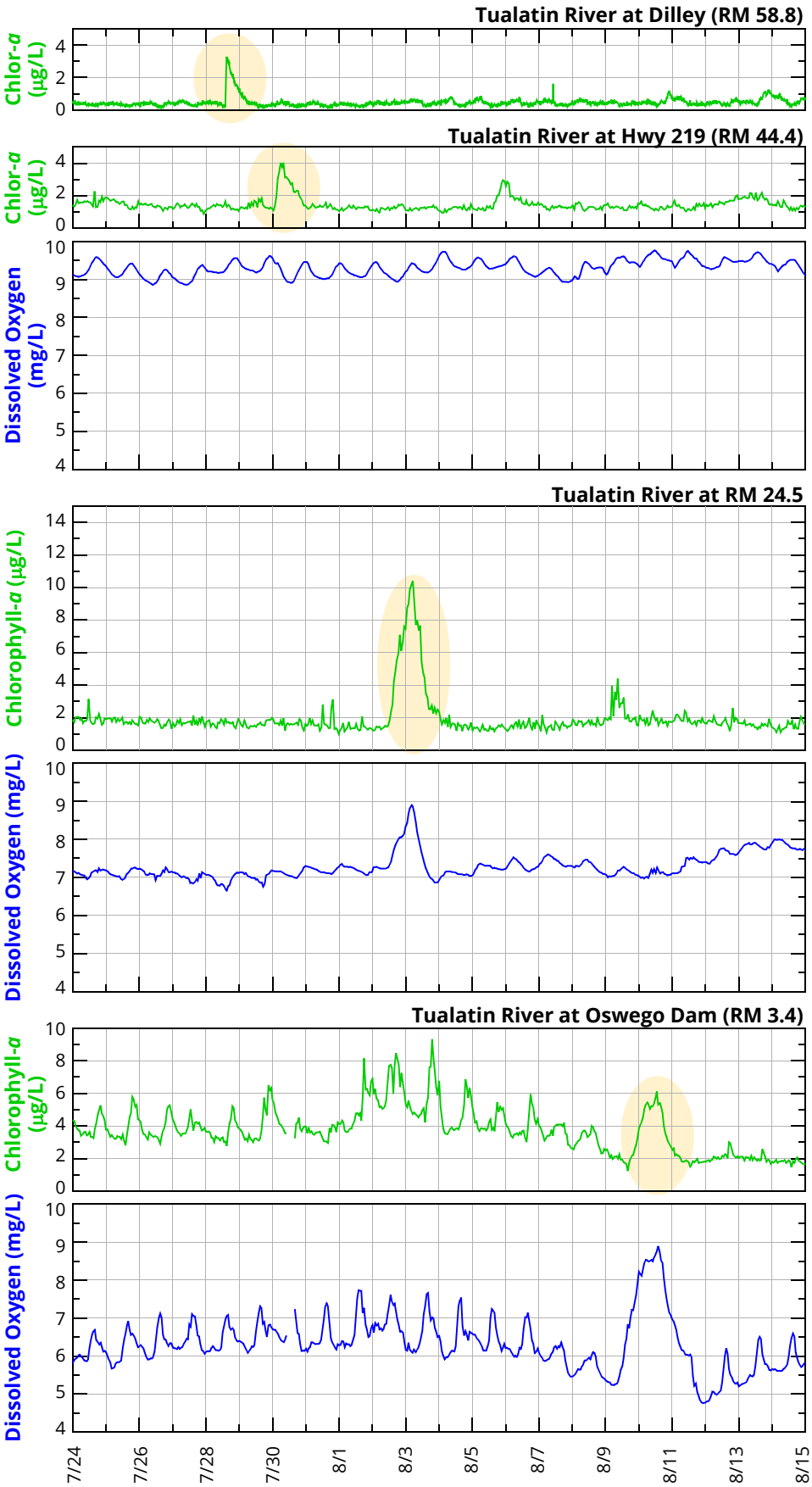


- At most tributary sites, DO concentrations are lowest in July and August when higher temperatures and lower flows increase the rate and effect of sediment oxygen demand.
- The lowest DO concentrations overall occurred in Beaverton Creek which is a slow-moving valley bottom stream that traps sediment.
- DO concentrations in many of the tributaries increased in October. This was due to very low temperatures in October 2019.
- Because of releases from Hagg Lake, DO concentrations in Scoggins Creek are greater and show a different pattern than other sites.

Tualatin River – 2019 Algal plume

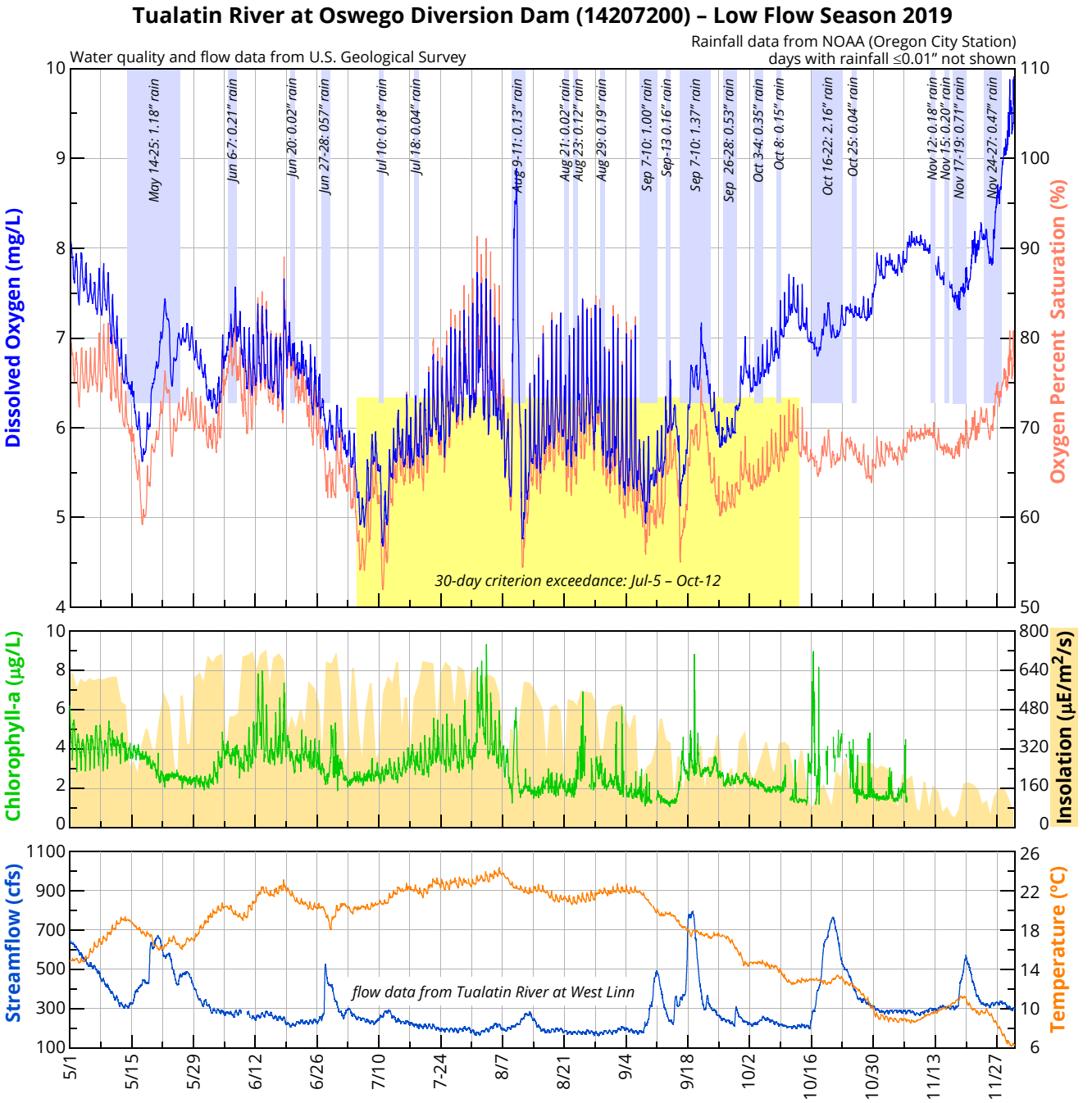
An unknown discharge to the Tualatin River upstream of Dilley occurred in July 2019. The graphs at the right track the plume as it moved downstream (see yellow highlights).

- On Sunday, July 28, an increase in chlorophyll-*a* concentration was observed at Dilley. Streamflow also increased from 223 to 247 cfs.
- A plume with elevated chlorophyll-*a* was observed at the Hwy 219 site on July 30. Chlorophyll-*a* concentrations had increased only slightly and the DO concentration was unaffected.
- On August 2, the plume reached RM 24.5. The plume took 2 days to pass. The weather had been sunny and chlorophyll-*a* concentrations had increased to more than 10 µg/L. Algal productivity was enough to increase the DO concentration by about 2 mg/L.
- The plume first reached the Oswego Dam on August 9. Chlorophyll-*a* concentrations had decreased since RM 24.5, probably due to cloudy weather beginning on August 7. Still, algal productivity was enough to increase the DO by 2-3 mg/L over baseline.
- The origin of the discharge is unknown.
  - —It was not evident at the Scoggins Ck monitor;
  - —Wapato pumps were not operating;
  - —Flow at Gaston did not show an increase;
  - —Examination of the algal species did not point to a specific source.



Tualatin River – Oswego Dam

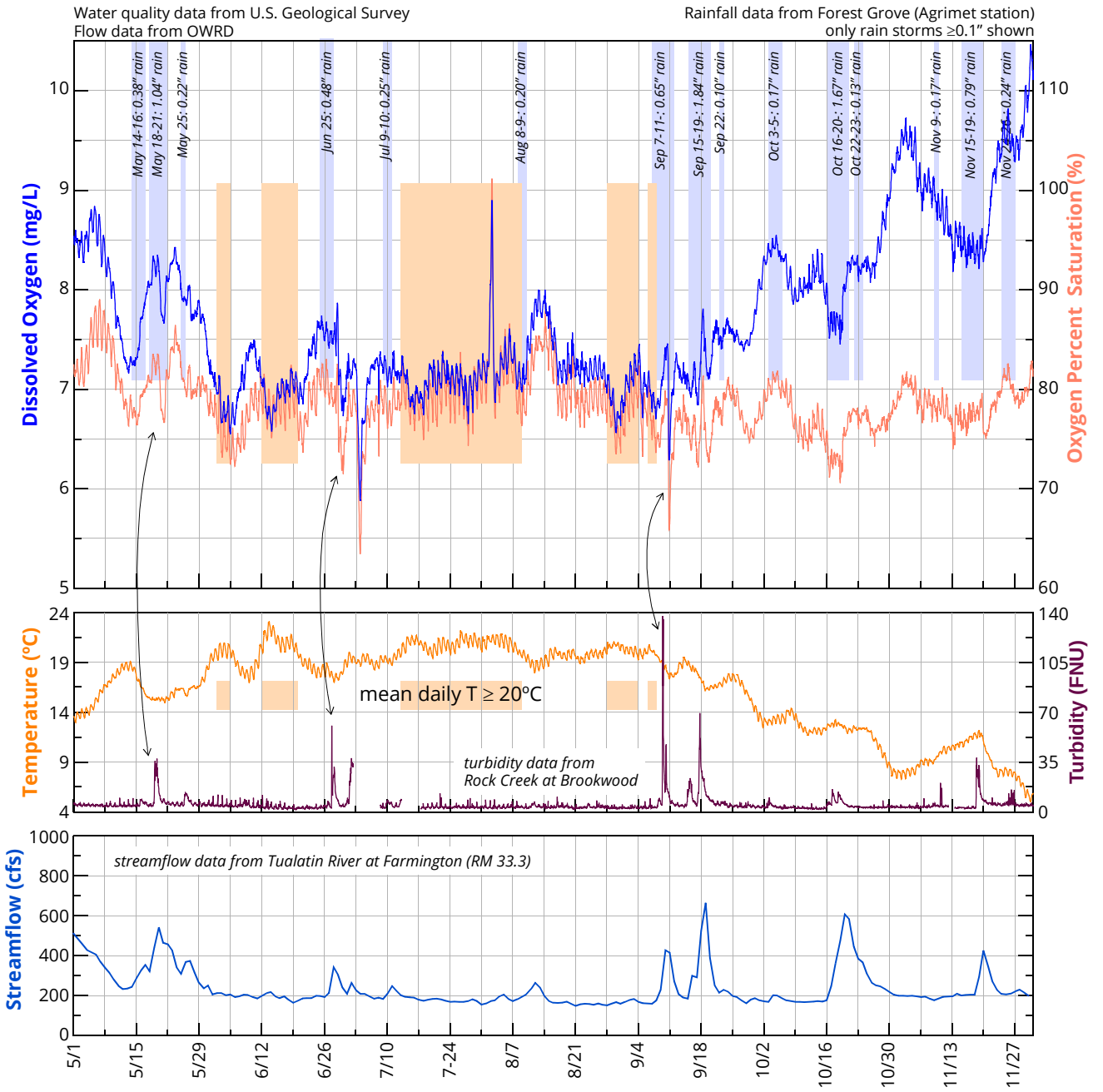
- Algal blooms at the Oswego Dam site strongly affect DO. They can be identified by high chlorophyll concentrations, large daily DO ranges and DO concentrations greater than 100% saturation. Algal activity in 2019 was minimal. DO was less than 70% saturation for most of the summer. Warm temperatures (>20ºC) increased the rate of sediment oxygen demand while cloudy weather suppressed photosynthesis. Small blooms in mid-June and late July were short-lived and never resulted in supersaturation.
- The 30-day DO criterion was not met from July 5 through October 12, 2019.
- A spike in oxygen concentration near August 10 was caused by a plume of algae likely associated with an outside source. See graph on page 50.
- The oxygen sag in mid-May coincided with a period of wet weather. The rain may have resuspended sediment in the tributaries, resulting in stormwater inflows that transported oxygen demand to the Tualatin River. They were probably not sufficient to explain the extent and duration of the sag.



Tualatin River – RM 24.5

- DO concentrations at RM 24.5 were about 75-80% saturation for most of the summer. This site usually has DO saturation of about 80%.
- The daily DO range at RM 24.5 was small (<0.5 mg/L). Significant algal blooms are rare at this site.
- DO declined sharply through mid-May as flow declined and temperature increased. It rebounded briefly in June when rainfall increased, flow increased and decreased temperatures. Greater oxygen consumption by SOD is associated with lower flow and higher temperature.
- Several sharp decreases in DO (marked by arrows) were probably caused by rain storms that increased turbidity in the tributaries, specifically Rock Creek. Turbidity is associated with an increase in oxygen demanding substances—from resuspension of sediment and from stormwater inflows. Multiple sequential sags likely indicate several tributary sources with different travel times to the RM 24.5 site.
- A spike in oxygen concentration near August 2 was caused by a plume of algae likely associated with an outside source. See graph on page 50.

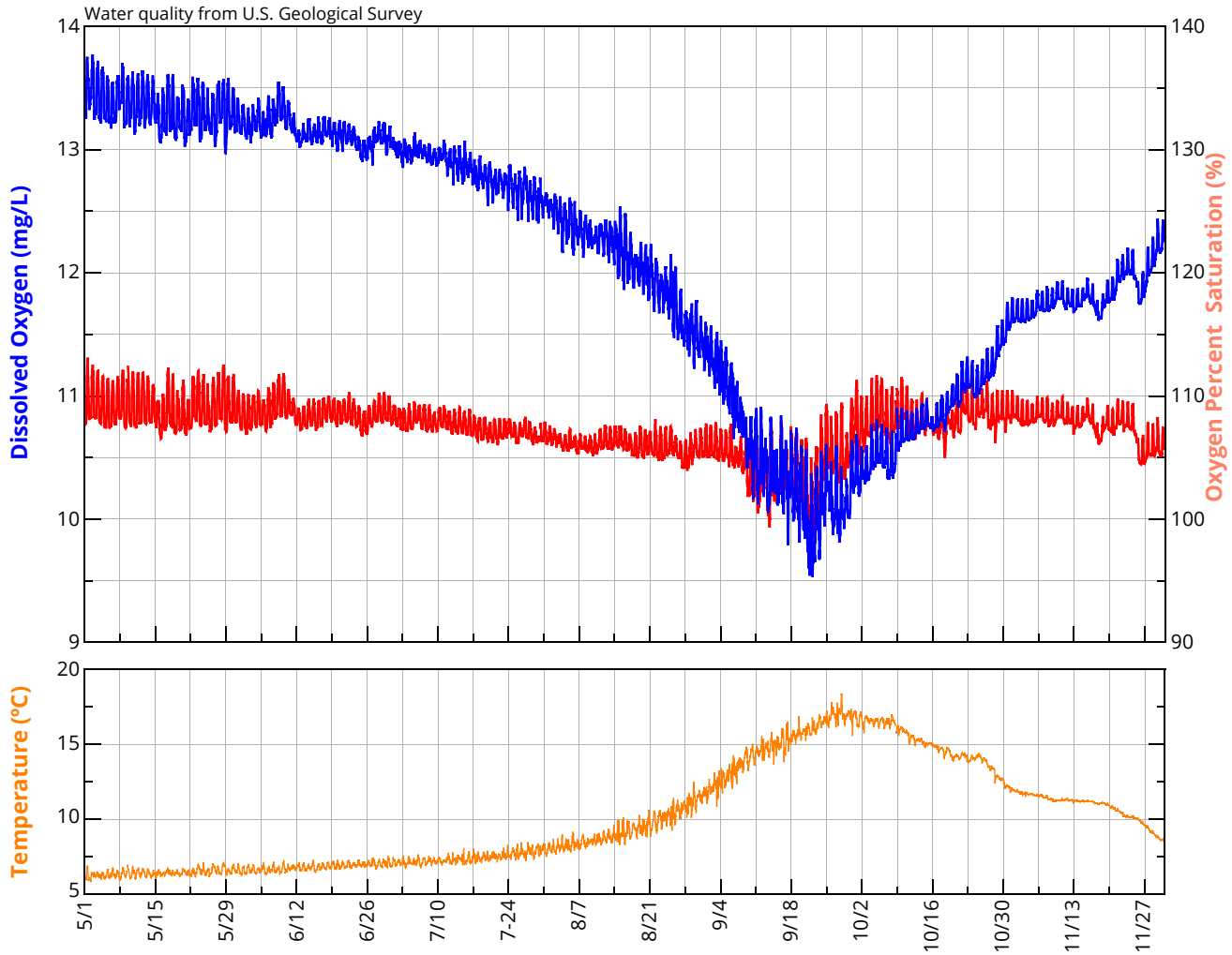
Tualatin River at River Mile 24.5 (14206694) – Low Flow Season 2019



Scoggins Creek below Hagg Lake

- The DO pattern through the low flow season at Scoggins Creek is very different from the other sites because of releases from Scoggins Dam—colder in summer and warming through fall.
- In mid-May–mid-June, photosynthetic activity by instream plants or periphyton upstream of the site was present, but less than in the past few years. The daily DO range was about 0.5 mg/L in 2019 compared to about 0.8 mg/L in 2017-2018. Photosynthetic oxygen production decreased through mid-summer and then increased slightly in September.
- As the reservoir is drawn down, more of the warmer water from the upper layers is released. Although the absolute concentration decreases, the percent saturation usually stays relatively constant.
- Short-term abrupt changes in DO can be caused by changes in dam operation. DO saturation is consistently about 100% when water is diverted through the bypass. When water is released through the regulating gate, air is entrained and DO saturation is greater than 100%. Signs of these operational changes were not evident in 2019 from May through November.

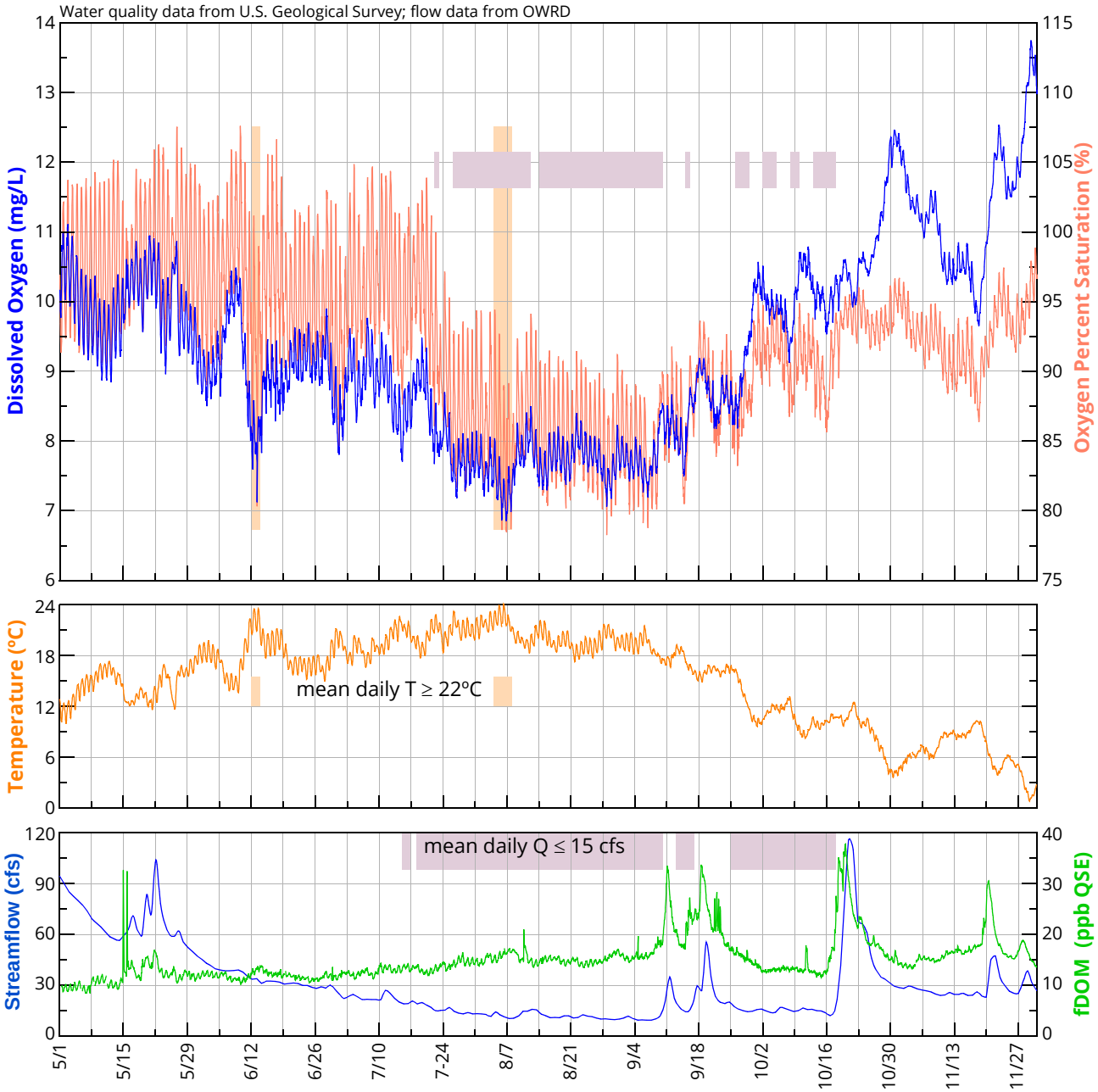
Scoggins Creek below Hagg Lake (14202980) – Low Flow Season 2019



Gales Creek at Old Hwy 47

- Algal activity at Gales Creek was evident by the daily DO range and saturation concentrations above 100%. From May through mid-July, daily average DO saturation was steady at about 95-100%, except for a few days in mid-June when high temperature caused the DO to decrease.
- DO levels fell below 90% saturation when flows dropped below 15 cfs. Low flows exacerbate oxygen loss from sediment oxygen demand because they increase the time that a smaller volume of water is in contact with the sediment. The lowest absolute DO occurred during low flow when the water temperature exceeded 22ºC.
- Measurement of fDOM (fluorescent dissolved organic matter) began in 2016. The substances that contribute to fDOM include those that make up biochemical oxygen demand (BOD). Increases in flow often show increased fDOM, indicating transport of BOD to the stream. Higher fDOM concentrations were not generally associated with decreased in DO at this site in 2019, possibly because the increased flow contained well-oxygenated rainwater.

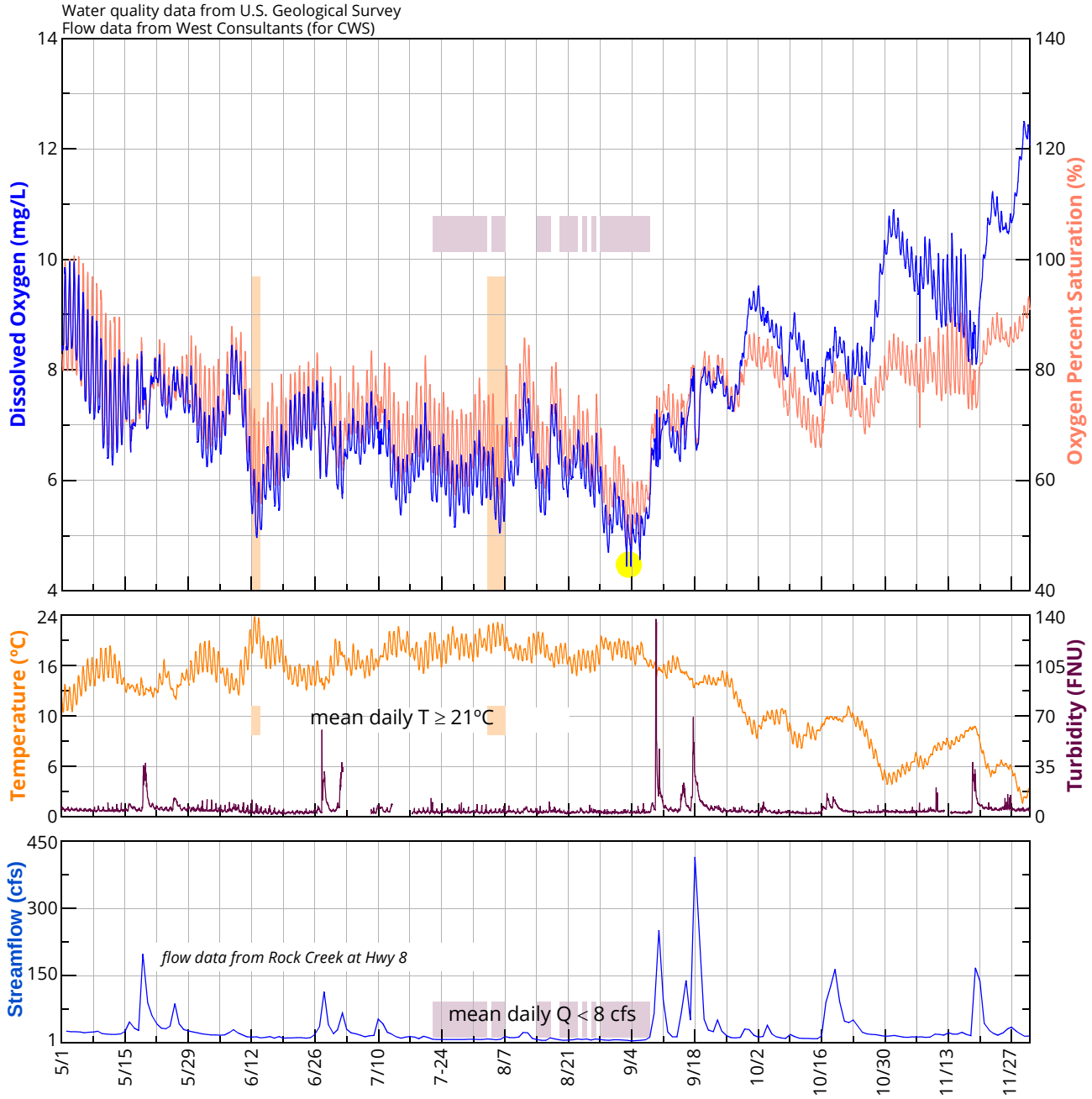
Gales Creek at Old Hwy 47 (453040123065201) – Low Flow Season 2019



Rock Creek at Brookwood

- Dissolved oxygen in Rock Creek was lower overall than all other sites except Beaverton Creek. Like Beaverton Creek, Rock Creek is a valley bottom stream with high sediment oxygen demand and little reaeration. Algal activity in Rock Creek was present (daily DO range 0.5–0.7 mg/L), but not enough to offset SOD.
- Temperature strongly affects DO in Rock Creek. Two of episodes with the lowest DO levels occurred when daily mean water temperatures exceeded 21 ºC. See orange bars. Daily maximum DO levels were about 6 mg/L, minima about 5 mg/L; these values are slightly greater than in 2018.
- DO at this site is sensitive to low flow. The lowest DO (4.44 mg/L, yellow highlight) occurred on Sep-4), also the lowest flow day of the year (4.4 cfs). DO from September through November correlated with flow.
- Intense rainfall can produce turbidity spikes from resuspended sediment and stormwater inflow. The oxygen demand associated with turbidity did not generally cause a DO sag at this site in 2019, possibly because the increased flow contained well-oxygenated rain water. Oxygen demand related to a sharp turbidity spikes at this site likely did contribute to DO sags in the Tualatin River at RM 24.5.

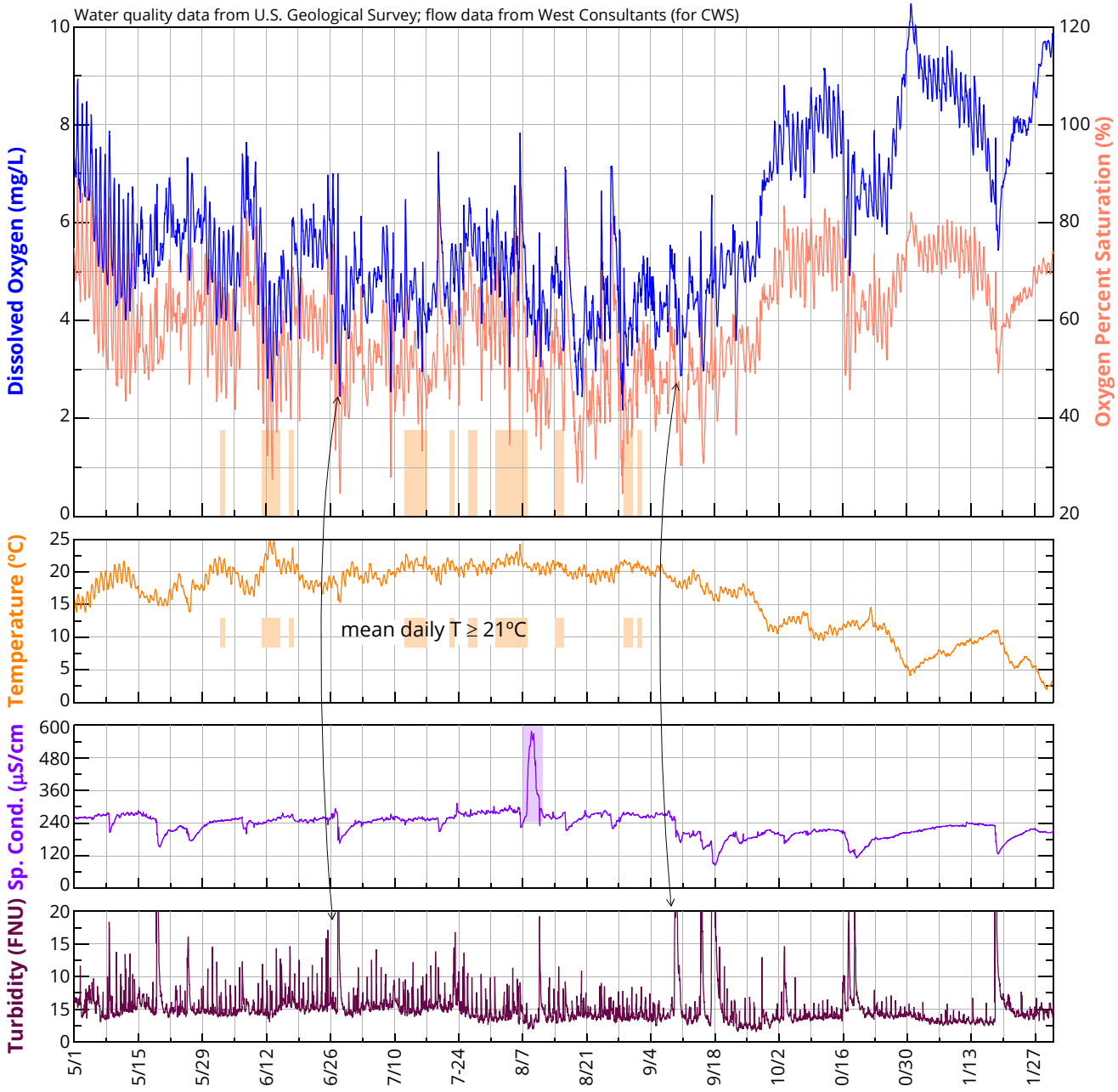
Rock Creek at Brookwood (453030122560101) – Low Flow Season 2019



Beaverton Creek at 170th

- The Beaverton Creek site has very low dissolved oxygen levels. The organic-rich, silty bottom and low flow of Beaverton Creek result in high sediment oxygen demand and little reaeration. Although algal activity is clearly present, photosynthetic oxygen production is not sufficient to offset sediment oxygen demand.
- The conditions associated with lowest absolute and percent-saturated DO varied. Some very low DO occurred when stream temperatures were high (see orange shading). Other low DO levels (June 28 and September 11) occurred in conjunction with turbidity increases associated with storms (see arrows).
- High specific conductance occurred August 8–10 (purple shading) suggesting an unknown discharge. The volume was small because flow, dissolved oxygen and temperature were not obviously affected. A similar spike in specific conductance occurred on August 8–14, 2018.
- An unusual pattern of low level turbidly spikes occurred at this site in 2019. They were generally daily, including weekends, about 9–10 FNU or greater, and usually occurred in the morning between 6-9 am. Occasionally, an additional spike occurred in the afternoon. It is unlikely these spikes are natural in origin.

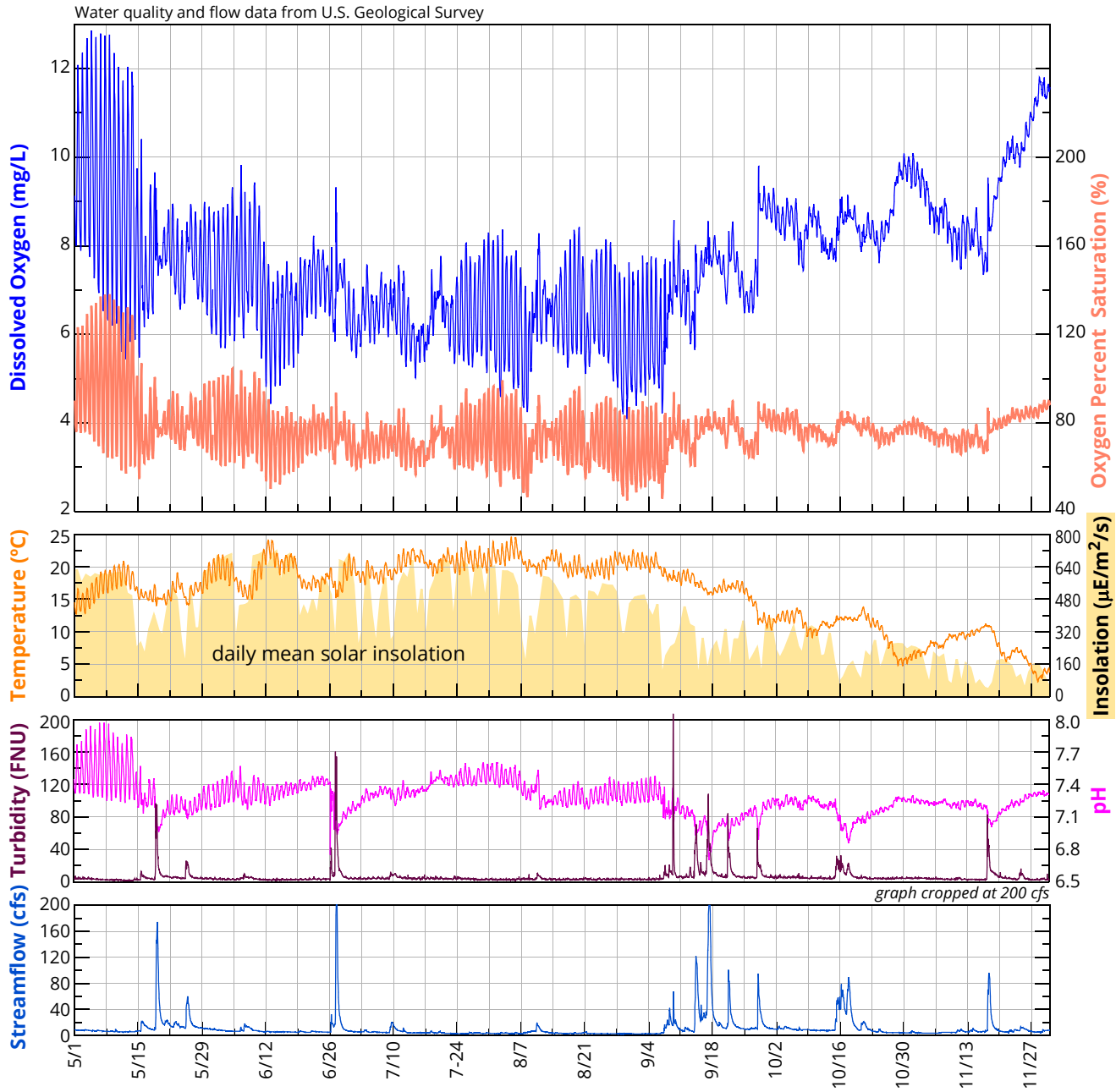
Beaverton Creek at 170th (453004122510301) – Low Flow Season 2019



Fanno Creek at Durham

- Dissolved oxygen levels in 2019 at Fanno Creek were different than in recent years. Algal activity was dominant In 2017 and 2018. Large *Cladophora sp*. blooms had been identified in Fanno Creek during mid-summer when daily DO ranges exceeded 3 mg/L). Algal activity in 2019, although present was much less. Some of the decrease in algal activity may have been related to the prevalence of cloudy days in 2019.
- Except during early May, oxygen saturation did not exceed 100%. Saturation from June through November averaged about 70%.
- In 2018, very low DO levels occurred a few times over the summer. On August 11, 2018, the DO dropped to 0 mg/L for 4 hours. DO concentrations in 2019 remained above 4 mg/L throughout the low flow season.
- Multiple rainstorms through the low flow season caused short-lived increases in flow and turbidity, indicating resuspension of sediment or erosion. This was not accompanied by an oxygen sag. Rather, concurrent decreases in pH indicate an influx of well-oxygenated rainwater which explains why DO frequently increased at the same time.

Fanno Creek at Durham (14206950) – Low Flow Season 2019



this page intentionally blank

APPENDIX A
STREAMFLOW

SCOPE

This appendix shows data for streamflow at selected sites in the Tualatin River and its tributaries. It is intended to be a comprehensive listing of sites where daily data were collected in 2019. Historical streamflow data exist for other sites. Most of the data represent daily mean flows and have been subject to quality assurance tests by the collecting entity.

The following data and analyses are included for each site. A more detailed explanation of the analyses and graphics begins on page A-4:

- Table of 2019 data with summary statistics by month.
- Graph of 2019 data superimposed on percentile statistics for the period of record for the site.
- Color-coded chart of the distribution of streamflow by month for the period of record.
- Table of monthly median streamflows by year for the period of record.
- Graphs showing low-flow trends over the period of record, including the first day of sustained low flow and the distribution of streamflow during select low flow periods.
- Graphs showing high-flow trends over the period of record, including the first day of sustained high flow and the distribution of streamflow during December–January.
- A brief discussion of the graphs and tables.

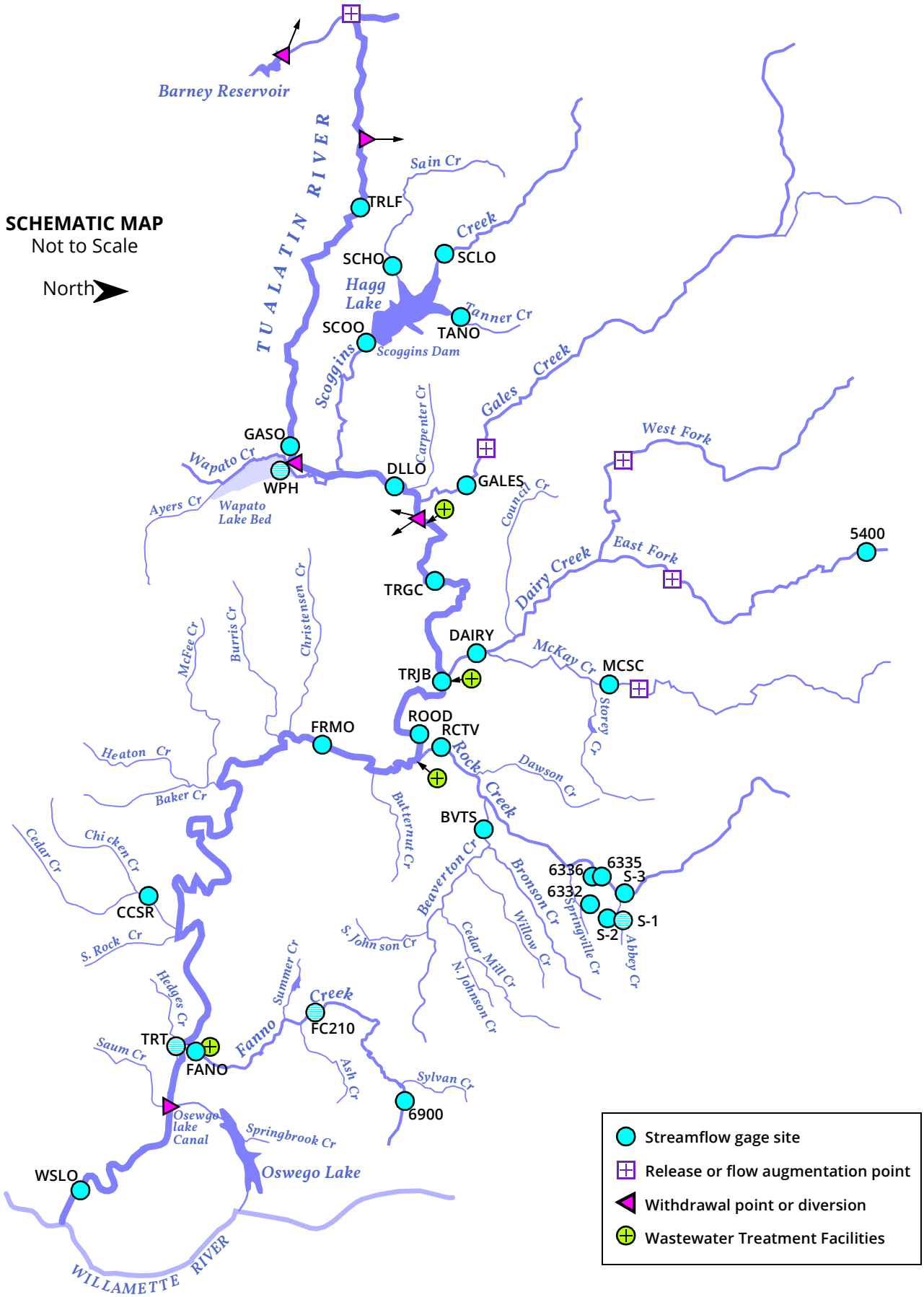
2019 HIGHLIGHTS

- Winter and spring flows in the Tualatin River in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. Storms near mid-September led to record high flows at some sites.
- A prolonged dry spell in November and early December led to record low flows at several Tualatin River sites.
- Baseflows in 2019 were well below their respective period of record medians for all of the tributaries. Record low flows were set for numerous days at many sites. Flows that exceeded median levels occurred only during periods of rainfall which were usually short-lived. Prolonged low flow in November through mid-December was due to dry weather.

TRENDS OF NOTE

- Flows in Scoggins Creek below Hagg Lake and in the Tualatin River at Dilley increased from 1975 through the early 1990s, mostly as a result of larger releases of stored Hagg Lake water by Joint Water Commission. Since the mid-1990s, any increases in flow have been small and difficult to discern from year-to-year variation.
- Flow in the Tualatin River at West Linn increased sharply around 1995 when water diversion through the Oswego Canal was decreased. Since then, trends in flow are small and difficult to isolate from year-to-year variation. The onset of low flow (defined as 7-day median streamflow < 250 cfs), is occurring later in the summer at West Linn; again the data from recent years is noisy. Reasons for the delay include earlier releases of flow augmentation water by Clean Water Services and increases in the fraction of total flow that is from wastewater treatment plants which does not decrease as quickly as natural baseflow in early summer.
- Flow in Fanno Creek, especially baseflow, is decreasing over the period of record (1991–present). The trend is clearer at the 56th Avenue site, but also evident at the Durham Road site. The reason is unknown. Onset of low flow is occurring earlier in the year at both sites.

STREAMFLOW GAGE SITES



STREAMFLOW GAGE SITES — ALPHABETICAL LISTING BY SITE CODE

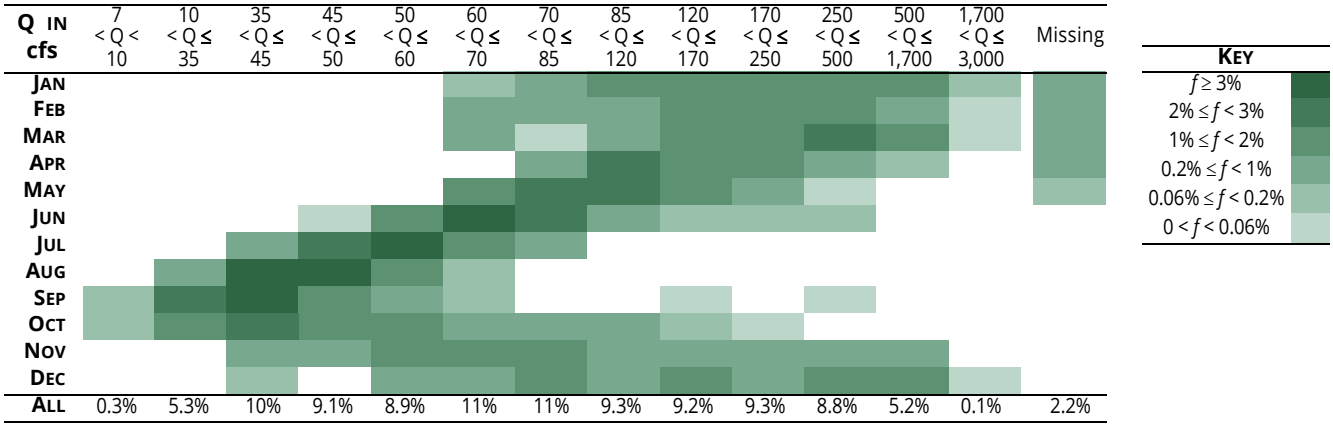
SITE CODE	SITE NAME	RIVER MILE	STATION ID	PAGE
5400	East Fork Dairy Creek near Meacham Corner, OR	12.4	14205400	A–44
6332	Bethany Creek at NW Springville Rd at Bethany, OR	—	14206332	A–57
6335	Rock Creek at NW 185th Ave near Hillsboro, OR	—	14206335	A–55
6336	Rock Creek Ditch at NW 185th Ave near Hillsboro, OR	—	14206336	A–56
6900	Fanno Creek at 56th Avenue	11.9	14206900	A–67
BVTS	Beaverton Creek at Cornelius Pass Road	1.2	14206435	A–58
CCSR	Chicken Creek at Roy Rogers Rd near Sherwood, OR	2.3	14206750	A-64
DAIRY	Dairy Creek at Hwy 8 near Hillsboro, Oregon	2.06	14206200	A–50
DLLO	Tualatin River near Dilley, Oregon	58.8	14203500	A–15
FANO	Fanno Creek at Durham Road near Tigard, Oregon	1.2	14206950	A–70
FC210	Fanno Creek at Hwy 210 at Beaverton, OR	—	—	A–77
FRMO	Tualatin River at Farmington, Oregon	33.3	14206500	A–27
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	2.36	14204530	A–41
GASO	Tualatin River at Gaston, Oregon	62.3	14202510	A–9
MCSC	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	6.3	14206070	A–47
RCTV	Rock Creek at Hwy 8 near Hillsboro, Oregon	1.2	14206451	A–61
ROOD	Tualatin River at Rood Bridge Road near Hillsboro, Oregon	38.4	14206295	A–24
S-1	Abbey Creek at NW Kaiser Rd at Bethany	—	—	A–76
S-2	South Fork Abbey Creek Downstream of NW Kaiser Rd at Bethany, OR	—	—	A–53
S-3	Rock Creek at NW Germantown Rd at Bethany, OR	—	—	A–54
SCHO	Sain Creek above Henry Hagg Lake near Gaston, Oregon	1.6	14202920	A–36
SCLO	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	9.3	14202850	A–36
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4.80	14202980	A–12
TANO	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	1.6	14202860	A–39
TRGC	Tualatin River at Golf Course Road near Cornelius, Oregon	51.5	14204800	A–18
TRJB	Tualatin River at Hwy 219 Bridge	44.4	14206241	A–21
TRLF	Tualatin River below Lee Falls near Cherry Grove, Oregon	70.7	14202450	A–6
TRT	Tualatin River at Tualatin, Oregon	8.9	14206956	A–78
WPH	Wapato Canal at Pumphouse at Gaston, Oregon	—	14202630	A–73
WSLO	Tualatin River at West Linn	1.75	14207500	A–30

EXPLANATION OF FIGURES AND TABLES IN THIS APPENDIX — PAGES 1-2

Page 1–current year data and graph: A table of mean daily streamflow for the current year is at the top of page 1. A graph at the bottom of the page shows the current year's data superimposed on shaded percentile ranges for the period of record, providing historical context. A legend, located to the right of the graph, includes the period of record for the site and definitions of lines and shading. If the period of record is too short to accurately calculate some percentiles, the appropriate shaded areas are omitted.

Page 2–Frequency Chart: A Frequency Chart for the site is at the top of page 2. This graphic can be used to determine the ranges of flow for each month, the percent of the time flow is within a particular range, and the importance of missing values. An example is shown below.

FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH FOR PERIOD OF RECORD



- *The top row* shows the ranges of streamflows (bins) corresponding to each column. The streamflow ranges do not change from year-to-year in the Flow Report. They were determined as follows:
  - —round numbers were used for simplicity,
  - —the first and last bins capture the extreme highs and lows (<0.5% of the distribution),
  - —the second and second to last bins capture the highest and lowest 5% of the distribution,
  - —the other rows each capture approximately 10% of the distribution,
  - —a column for missing data is included if needed.
- *The first column* shows the months corresponding to each row.
- *The bottom row* shows the actual fraction of the distribution in the bin. Because the bins use round numbers and do not vary from year-to-year, the distribution totals will only approximate 5% and 10% as designed. The total distribution may not add to 100% due to round-off error.
- *Each cell is color coded* based on the fraction of the overall distribution of streamflow in the corresponding bin and month. A Key to the color code is at the right of the chart. All sites use the same color code.
- *Information that can be obtained* from the example chart above includes:
  - —The all-time lowest flows at this site are 7–10 cfs, and occurred in September and October.
  - —Although extremely low flows have occurred in October, flows as high as 250 cfs have also occurred.
  - —Streamflow was less than 45 cfs about 15% of the time.
  - —Streamflow in December has been highly variable, ranging from 35 to 3,000 cfs.
  - —About 2% of the data were missing, all of which occurred in January–May. High flow occurs during several of these months, suggesting that some data may be missing because flow exceeded the rating curve. If this is the case, the highest flows may be over 3,000 cfs and the distribution fractions may be skewed with the fraction at low flow actually smaller and the fraction at high flow greater.

Page 2–color-coded table of monthly medians: A table of monthly medians of daily mean streamflow by year follows the Frequency Chart on page 2. Entries in this table are color-coded by percentiles calculated from the daily mean streamflow for the period of record. Two Keys are provided to the right of the table. The upper Key contains the values corresponding to the percentiles shown in the lower Key. Medians are not shown if more than 20% of the data are missing.

Explanation of Figures and Tables in this Appendix — page 3

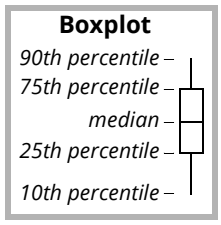
Page 3–discussion of graphs: The left side of the page contains a discussion of findings based on the graphs for each site. The narrative is divided into three sections:

- *Current year* describes the streamflow for the current year in the context of the historical record.
- *Low flow and Rainy season flow* describe the low flow and rainy season flow regimes, respectively, including when they occur and any trends over time.

Page 3–low flow season onset: The uppermost graph on the right side shows the first day of sustained low flow for the each year. The plot is arranged so that earlier dates are toward the bottom of the y-axis and later dates are toward the top. Although defining the onset of low flow is necessarily somewhat arbitrary, such a definition serves as a benchmark for comparing low flow conditions over time.

- *For mainstem sites,* low flow is defined as the first day after March 31 when the 7-day median streamflow in the Tualatin River at Farmington is less than 200 cfs. Correlations between each site and Farmington for the period of record through 2017 were used to obtain site-specific values. Flow at Farmington often has been used as a benchmark for low flow.
- *For tributary sites,* low flow is defined as a rounded number near the 25th percentile of mean daily flow.

Page 3–trends in low flow over time: Boxplots plotted versus year for selected low-flow periods show changes in flow magnitude over time. A boxplot is a graphical representation of the data distribution and is illustrated at the right.



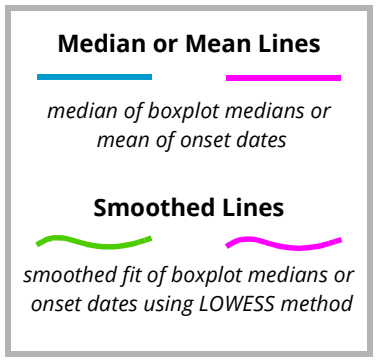
For most mainstem sites, two plots are shown: July/August and September. For a few mainstem sites, June data were shown if June had lower streamflow than July/August. For tributary sites, a plot of August/September is usually shown.

Page 3–rainy season onset: The second graph from the bottom is the high flow analog to the uppermost graph for low flow onset. The term "high flow" was not used because reservoir releases and short summer rainstorms can increase flow at mainstem and tributary sites, respectively, but do not signal the annual seasonal shift to rainy weather.

- *For mainstem sites,* rainy season flow is defined as the first day after August 31 when the 7-day median streamflow at Farmington is at least 350 cfs and remains so for the next 7 days. To help ensure that the rainy season was not a short-term increase, the difference between the daily mean maximum and daily mean minimum flows within the 7-day median period was required to be at least 50% of their average. Correlations between each site and Farmington for the period of record through 2017 were used to obtain site-specific values. A Farmington flow of 350 cfs was used by ODEQ in the TMDL as a criterion for high flow.
- *For tributary sites,* rainy season flow is defined as a rounded number near the 75th percentile.

Page 3–trends in high flow over time: The graph at the bottom right shows boxplots plotted versus year for the December/January (by water year), which is typically high flow.

Page 3–how trends are assessed: All of the graphs on page 3 show one or more lines that indicate trends and central tendencies of the data. The types of lines used vary with the graph and are shown at the right:



- *Median lines* were used for streamflow; *mean lines* for onset dates.
- *Smoothed lines* were calculated using the LOWESS method (LOcally WEighted Scatterplot Smoothing). LOWESS is a non-parametric method that fits a curve to data giving more weight to points closer to the point being fitted. LOWESS can be used to help visualize trends in data.
- *Statistically significant differences* were tested using non-parametric methods (Kendall's tau for trends, Mood medians test for 2 groups). Magenta lines are used to show statistically significant results.

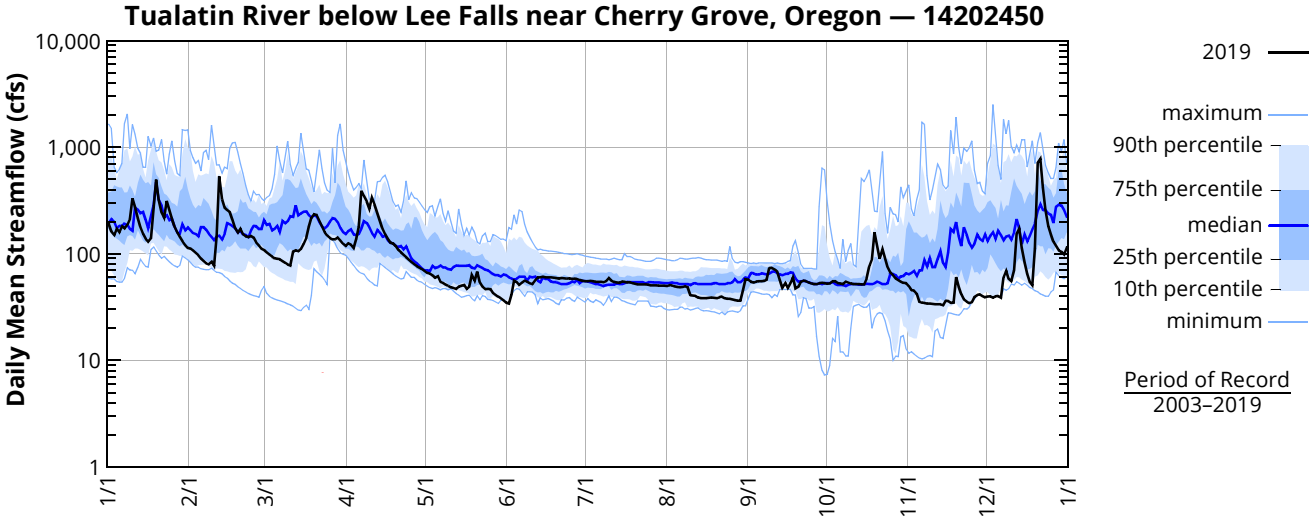
TRLF – Tualatin River below Lee Falls near Cherry Grove, Oregon – 14202450

Data source: Oregon Water Resources Department
River mile: 70.7 *Latitude:* 45 30 21 *Longitude:* 123 13 06

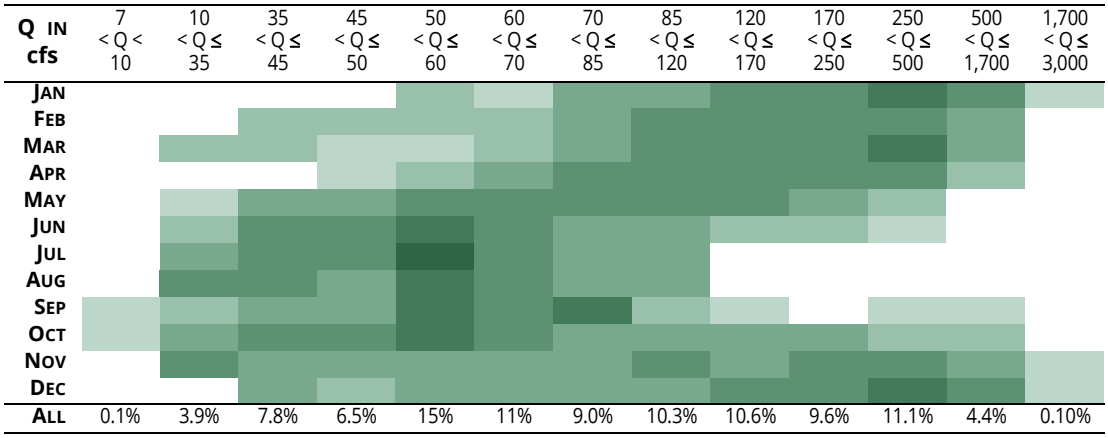
2019 — MEAN STREAMFLOW† (cfs) — TRLF

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	191	112	109	118	69.1	34.8	55.2	49.9	57.1	52.4	49.8	39.8
2	162	107	103	126	66.2	34.0	55.3	50.8	54.6	52.7	45.7	40.0
3	150	102	98.4	122	65.3	41.4	55.6	50.5	53.8	55.1	45.1	38.9
4	173	96.8	94.0	113	62.9	56.1	55.1	49.4	55.0	55.2	42.2	39.9
5	160	90.2	90.9	138	59.5	54.6	54.6	48.8	55.2	53.1	35.6	40.1
6	181	85.3	89.4	179	61.8	51.1	54.4	48.6	55.1	52.5	34.9	38.8
7	173	81.5	88.9	391	54.7	53.8	54.4	48.9	55.8	52.1	34.5	60.4
8	188	79.6	85.3	348	53.3	56.2	54.2	49.7	57.1	54.8	34.0	69.6
9	212	84.0	82.3	308	51.7	54.9	55.5	48.7	73.3	53.6	34.1	58.0
10	331	76.9	78.9	265	50.1	53.1	59.2	40.7	73.9	52.5	33.9	55.4
11	274	145	77.3	336	48.6	51.9	56.2	40.4	71.4	52.1	33.5	69.9
12	214	532	105	291	47.7	56.6	54.5	40.3	67.8	51.9	33.7	155
13	176	324	108	241	46.9	60.0	53.9	38.8	57.0	51.9	33.5	172
14	154	271	106	203	49.2	59.9	53.4	38.4	48.1	51.7	32.9	113
15	139	256	111	172	50.3	60.7	54.9	38.2	53.2	51.7	36.3	82.3
16	130	246	123	153	50.7	60.0	54.5	38.4	47.8	58.4	36.0	64.7
17	140	209	141	139	46.9	60.1	53.8	38.5	53.1	77.7	34.6	54.7
18	256	173	180	127	49.3	60.0	54.2	38.8	60.3	89.5	34.9	50.8
19	496	158	218	125	63.1	59.6	53.0	38.5	47.4	159	60.4	113
20	320	172	234	118	55.6	59.2	52.3	38.2	49.1	118	49.1	717
21	242	153	231	109	68.1	58.6	51.6	39.2	54.8	89.8	41.6	779
22	217	145	203	103	53.6	59.1	51.6	39.8	55.9	110	37.2	418
23	313	143	180	97.5	49.3	58.9	51.7	38.4	55.1	90.8	35.4	258
24	259	147	160	92.5	46.6	58.4	51.7	37.8	53.6	74.6	34.5	181
25	214	142	148	88.1	46.7	59.0	51.1	37.7	52.8	66.8	35.3	152
26	178	128	140	83.4	46.5	57.9	50.6	37.2	52.0	63.1	39.5	129
27	158	120	137	79.9	42.9	58.4	50.5	36.7	52.0	58.9	41.0	119
28	143	112	137	76.7	41.2	58.2	50.4	36.2	53.2	56.8	41.5	108
29	131	—	142	74.4	39.7	56.8	50.1	36.3	53.3	54.9	40.1	104
30	121	—	134	72.1	38.1	55.8	50.3	45.3	53.1	53.4	39.0	98.8
31	113	—	124	—	36.6	—	50.3	57.7	—	52.9	—	114
Mean	204	160	131	163	52.0	55.3	53.4	42.5	56.1	66.7	38.7	146
Max	496	532	234	391	69	61	59	58	74	159	60	779
Min	113	77	77	72	37	34	50	36	47	52	33	39
Ac-Ft	12514	8908	8052	9698	3198	3291	3281	2612	3336	4102	2300	8993

†All 2019 data are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — TRLF



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2003–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — TRLF

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2003	206	177	350	165	45.8	48.5	51.1	67.2	55.9	39.2	38.0	182
2004	247	214	118	76.0	46.1	57.7	57.9	50.2	45.3	44.6	42.4	75.1
2005	88.2	60.4	40.0	134	62.6	44.3	41.1	50.1	65.4	51.4	119	116
2006	532	148	161	120	52.2	50.0	43.3	31.8	65.9	68.5	377	292
2007	169	144	206	91.6	47.4	40.7	40.7	29.9	45.7	40.5	47.1	306
2008	270	182	216	178	97.0	47.5	36.0	40.0	48.0	46.0	82.0	76.0
2009	251	80	181	119	102	47.0	50.0	43.0	52.0	43.0	211	116
2010	389	161	139	228	98.0	83.5	63.0	58.0	64.0	54.0	125	346
2011	207	110	359	306	150	107	89.0	87.0	74.0	26.0	39.5	58.0
2012	279	206	298	169	93.0	57.5	57.0	63.0	68.5	60.0	202	397
2013	164	152	138	107	80.0	64.5	50.0	53.0	59.0	56.0	76.5	81.0
2014	100	234	287	151	105	56.5	54.0	51.0	62.0	54.0	112	244
2015	171	145	97.0	74.0	72.0	65.0	62.0	58.0	79.0	51	108	523
2016	368	265	316	83.5	59.0	65.5	53.0	50.0	64.0	156	200	289
2017	165	398	401	203	106.0	53.0	68.0	62.0	79.0	50.0	246	139
2018	255	140	175	182	62.9	58.2	51.9	64.1	67.6	52.4	34.5	169
2019	178	143	123	126	50.1	58.1	53.9	39.2	54.7	54.9	35.8	98.8
median	211	164	195	134	70.0	57.0	53.0	52.8	60.6	52.5	98.0	185

KEY

Q in cfs

Q ≤ 36.7
36.7 < Q ≤ 43.0
43.0 < Q ≤ 47.4
47.4 < Q ≤ 51.0
51.0 < Q ≤ 57.0
57.0 < Q ≤ 65.0
65.0 < Q ≤ 77.7
77.7 < Q ≤ 171
171 < Q ≤ 331
331 < Q ≤ 486
Q > 486

Q as percentile

Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

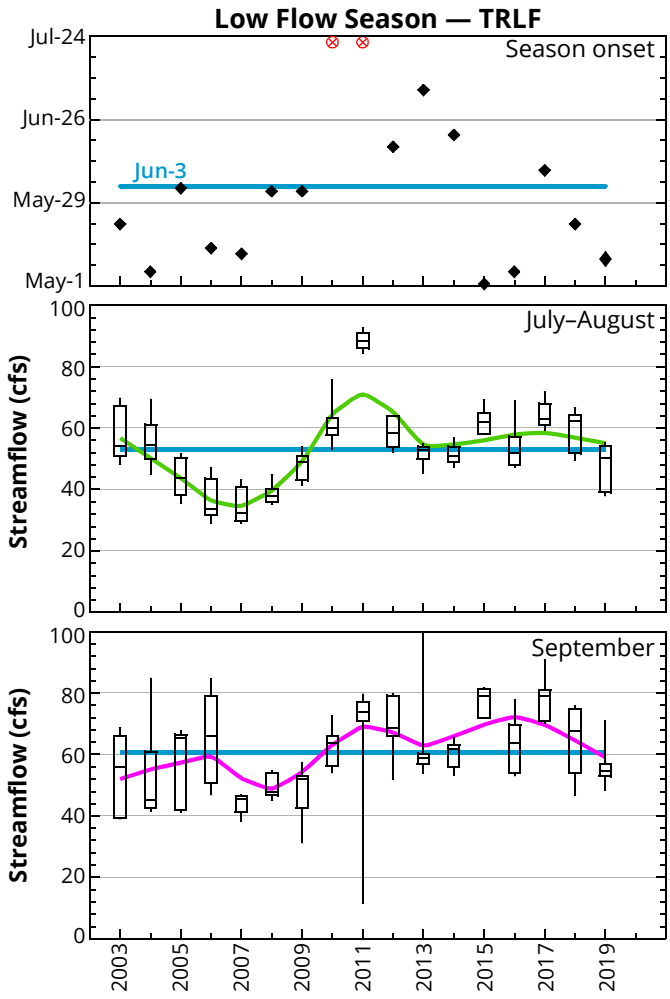
- Winter and spring flows in 2019 were somewhat typical, alternating between higher flow and lower flow as the result of intermittent storm systems. Record low flow occurred in early June, but the rest of June and July were near the long-term median. A prolonged dry spell in November and early December led to 10 days with record low flows.

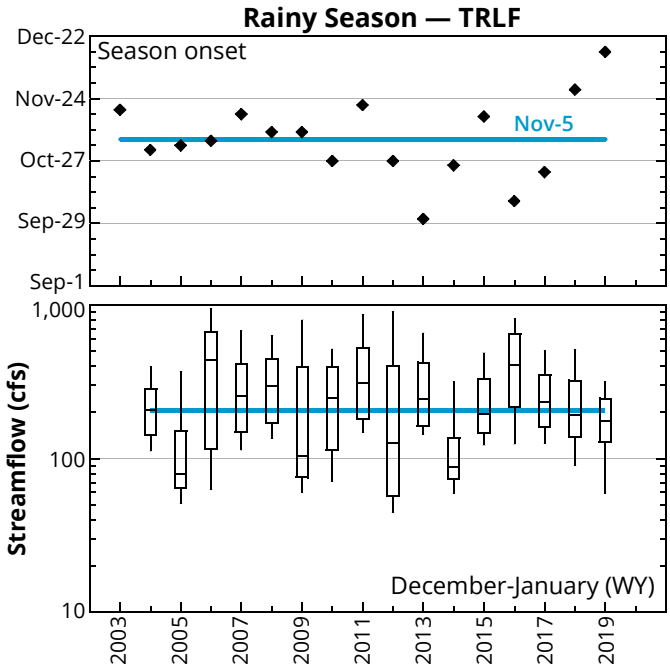
LOW FLOW SEASON

- The lowest flow months are July, August and October. Flow during this time is mostly controlled by releases from Barney Reservoir. Most of the released water is withdrawn downstream for municipal use.
- Higher flow during September (compared to July–August is mostly due to Clean Water Services' releases from Barney Reservoir.
- Low flow criterion is: 7d-Q ≤ 55 cfs (~27th pctl)
- Low flow did not occur in 2010 which had a relatively rainy and cool summer.
- Higher than normal releases from Barney Reservoir occurred from mid-April through late-September 2011 so that repairs of Eldon Mills Dam could be done. Releases were temporarily discontinued in late September. The atypical release regime in 2011 was responsible for
  - —high flows in July-August
  - —the low-flow criterion not being met until 9/30
  - —some very low flows in September
- Flow during the dry season appears to be slightly greater in recent years. The trend for September is statistically significant, but weak. For July-August, the trend is not statistically significant.

RAINY SEASON

- The highest flow months are December through March due to normal patterns in rainfall.
- Rainy season criterion: 7d-Q ≥ 80 cfs (~50th pctl)
- Onset of the rainy season has been more variable in recent years than in the early 2000s.
- No trends are evident for the magnitude of December–January rainy season flow.





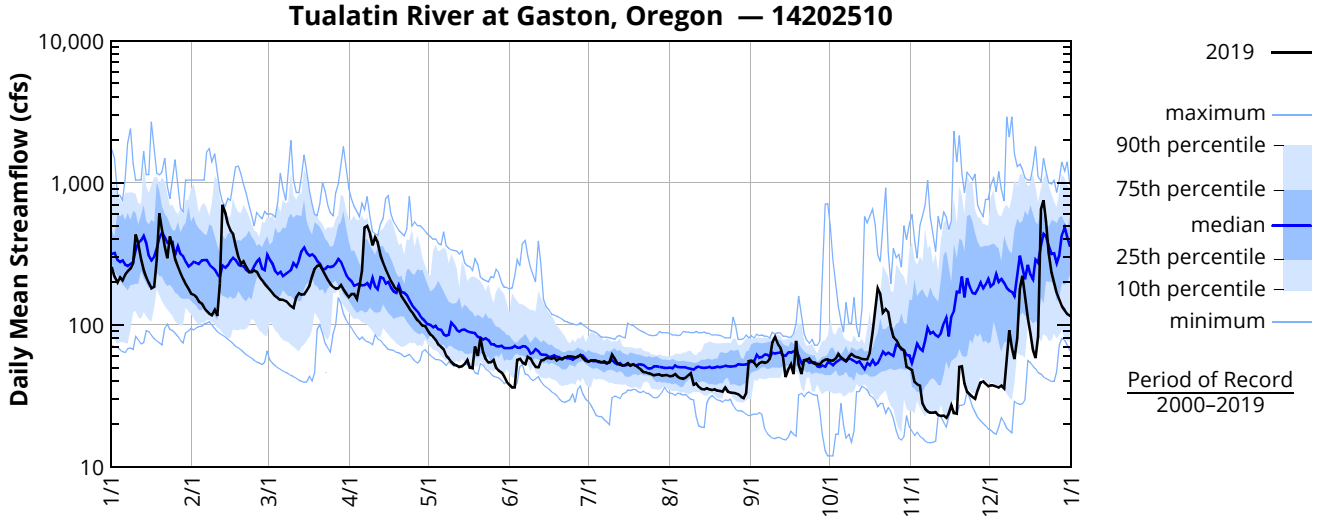
GASO — TUALATIN RIVER AT GASTON, OREGON — 14202510

Data source: Oregon Water Resources Department
River mile: 62.3 *Latitude:* 45 26 21 *Longitude:* 123 07 85

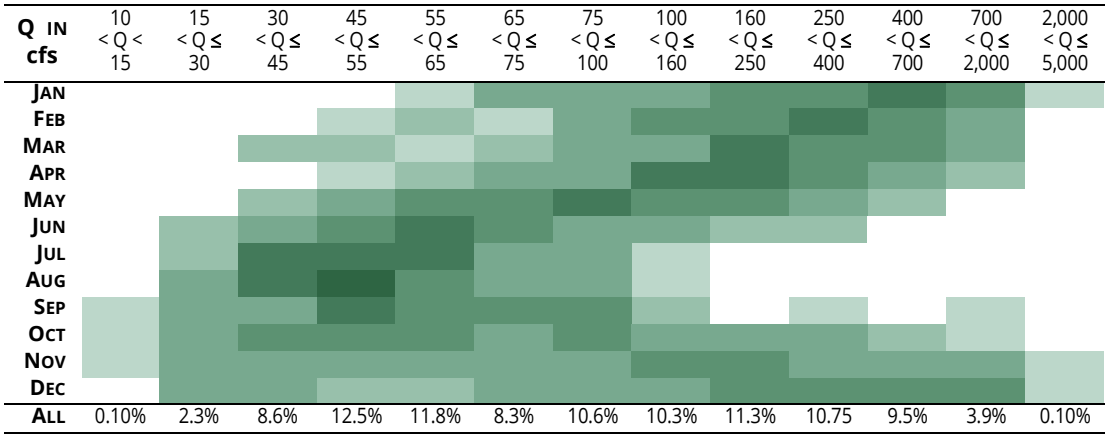
2019 — MEAN STREAMFLOW† (cfs) — GASO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	251	163	186	157	91.2	38.0	55.1	43.5	56.1	56.1	48.2	37.7
2	218	157	177	165	85.3	36.3	56.1	43.8	54.4	56.1	39.6	37.4
3	199	146	167	165	82.9	36.2	56.3	45.0	51.4	58.3	38.2	36.9
4	217	142	159	152	78.4	57.1	56.2	43.2	53.9	62.5	37.4	36.2
5	206	132	154	187	72.7	58.0	55.1	42.1	55.0	59.0	27.8	37.5
6	226	125	150	240	69.9	54.5	54.6	41.7	54.2	57.4	25.7	35.8
7	238	120	150	484	67.3	53.0	55.4	42.6	55.0	55.9	24.6	56.5
8	250	117	147	496	60.6	59.8	53.9	44.3	57.9	59.7	24.1	91.7
9	272	128	142	439	58.1	58.3	54.7	45.8	75.6	62.3	24.1	69.4
10	433	116	135	362	54.9	53.9	61.6	38.0	82.1	60.4	24.3	57.6
11	376	194	131	413	52.4	50.6	58.0	38.9	73.6	59.3	23.3	81.0
12	290	700e	157	379	51.9	50.4	53.9	36.7	69.3	58.8	22.9	179
13	244	615e	167	309	50.5	56.2	52.3	35.3	60.0	57.7	23.0	221
14	216	513	163	273	51.0	56.8	52.0	35.1	43.1	57.2	22.2	159
15	196	463	164	245	53.2	58.4	52.2	35.9	49.1	57.4	23.8	111
16	181	439	174	224	56.7	58.5	53.9	35.1	53.1	63.9	27.1	87.4
17	186	362	189	204	50.1	58.0	51.6	34.8	45.1	88.3	24.0	66.4
18	290	299	219	188	49.6	59.1	53.0	35.3	77.3	127	23.7	58.6
19	608	268	248	178	70.4	56.5	51.7	34.4	52.7	181	50.6	83.3
20	474	280	260	177	60.7	58.0	50.1	34.2	45.2	165	51.2	650e
21	355	256	262	159	81.9	57.3	48.4	34.0	56.4	122	38.7	750e
22	294	235	242	148	64.9	59.2	46.6	36.2	56.9	129	33.9	530
23	419	234	224	139	58.0	60.0	46.3	33.9	58.2	123	32.3	322
24	357	242	207	130	54.4	60.0	45.7	33.4	54.7	96.9	31.0	233
25	293	237	194	123	54.7	59.6	45.0	33.3	53.2	82.4	30.1	197
26	256	219	185	115	56.8	59.2	44.2	33.1	53.2	78.3	34.6	167
27	231	206	179	108	50.1	59.3	44.6	32.6	52.7	72.1	39.5	150
28	210	193	181	104	47.7	61.6	44.9	31.3	55.6	68.3	40.1	135
29	193	—	190	98.5	46.2	58.5	43.9	30.6	56.9	66.1	38.4	127
30	179	—	177	98.0	43.2	55.8	44.1	33.2	57.3	50.8	37.1	119
31	166	—	166	—	39.9	—	44.4	55.4	—	49.4	—	116
Mean	275	261	182	222	60.2	55.3	51.2	37.8	57.3	78.8	32.0	163
Max	608	700	262	496	91.2	61.6	61.6	55.4	82.1	181	51.2	750
Min	166	116	131	98.0	39.9	36.2	43.9	30.6	43.1	49.4	22.2	35.8
Ac-Ft	16907	14481	11199	13209	3700	3289	3145	2326	3410	4843	1907	9999

†All 2019 data are provisional—subject to revision; e=estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — GASO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2000–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — GASO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	442	310	278	86.0	69.7	75.0	62.4	50.6	67.5	65.3	57.2	72.0
2001	78.2	103	81.2	71.5	68.0	38.3	31.7	30.0	23.5	35.6	95.3	571
2002	479	391	286	172	61.4	51.3	48.2	51.6	55.7	45.2	35.3	229
2003	353	315	545	307	97.6	57.4	54.1	72.5	64.9	41.5	47.0	320
2004	372	357	179	114	70.8	69.7	64.3	54.7	51.9	63.1	67.1	113
2005	123	78.0	51.5	179	99.2	57.3	44.5	51.9	71.5	84.7	184	235
2006	855	216	240	175	69.5	57.7	39.4	31.6	62.4	69.0	452	446
2007	256	189	300	120	56.5	41.9	40.2	34.6	48.3	55.3	76.7	426
2008	366	303	276	217	111	57.5	41.0	40.0	44.5	50.0	102	86.0
2009	379	102	248	155	126	62.0	50.0	40.0	48.0	47.0	284	199
2010	587	270	238	325	119	123	66.0	58.0	62.0	65.0	167	507
2011	385	296	583	482	260	123	87.0	85.0	68.5	24.0	41.5	64.0
2012	359	271	454	242	113	68.0	61.0	65.0	68.0	64.0	294	671
2013	224	181	180	126	83.0	72.0	49.0	50.0	58.5	61.0	103	102
2014	134	382	427	231	138	68.0	52.0	48.0	59.0	52.0	123	399
2015	255	231	152	101	72.0	62.0	58.0	54.0	76.5	47.0	149	840
2016	615	499	583	117	67.0	64.5	48.0	44.0	60.0	194	262	386
2017	248	538	511	300	150	63.0	63.0	55.0	78.0	55.0	348	197
2018	376	201	253	263	70.1	61.5	51.7	62.4	72.6	53.2	36.5	204
2019	244	227	177	178	56.7	58.0	52.2	35.3	55.0	62.3	31.5	111
median	329	263	263	173	85.0	62.0	52.6	50.6	58.2	57.0	110	266

KEY

Q in cfs

$Q \leq 35.3$
$35.3 < Q \leq 43.3$
$43.3 < Q \leq 49.0$
$49.0 < Q \leq 52.2$
$52.2 < Q \leq 59.3$
$59.3 < Q \leq 69.4$
$69.4 < Q \leq 86.0$
$86.0 < Q \leq 240$
$240 < Q \leq 477$
$477 < Q \leq 640$
$Q > 640$

Q as percentile

$Q \leq$ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

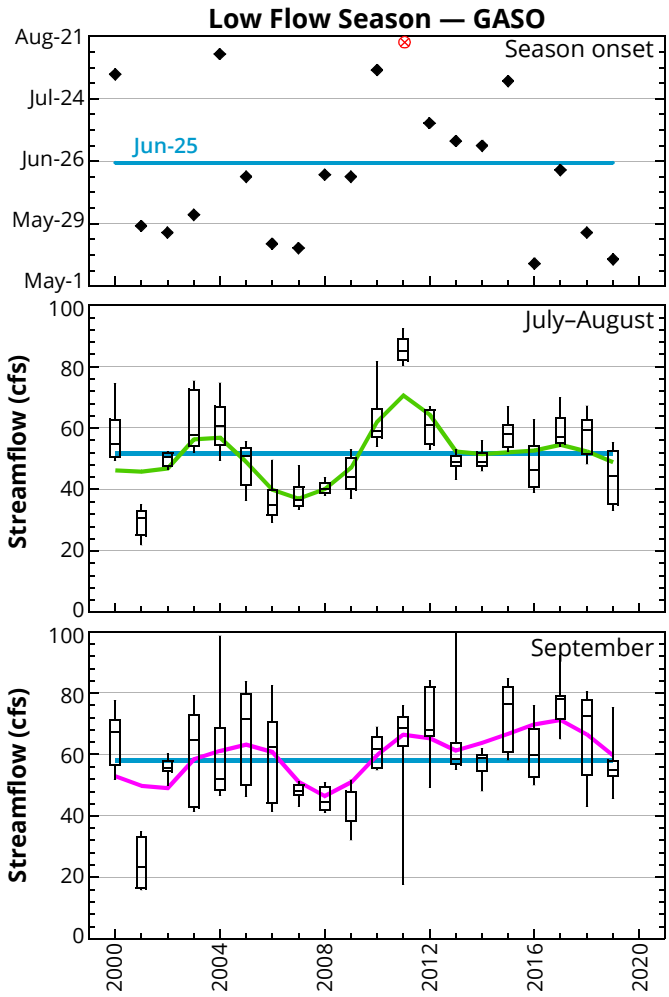
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. Prolonged dry spells led to record low flows in mid-May and early June, but the rest of June and July were near the long-term median. A prolonged dry spell in November and early December led record low flows. In all, 15 days had record low flow.

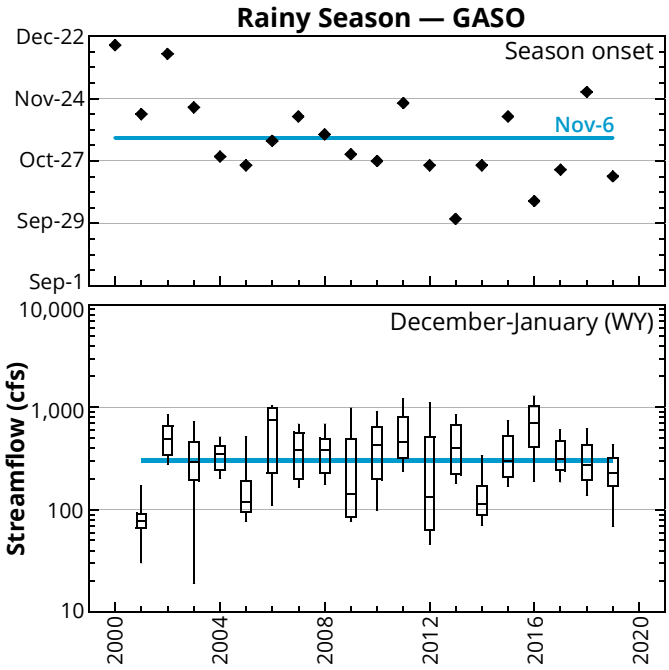
LOW FLOW SEASON

- The lowest flow months are July, August and October. Flow during this time is mostly controlled by releases from Barney Reservoir. Most of the released water is withdrawn downstream for municipal use.
- Higher flow during September (compared to July-August) is mostly due to Clean Water Services' releases from Barney Reservoir.
- Low flow criterion is: 7d-Q ≤ 55 cfs (~23th pctl)
- Higher than normal releases from Barney Reservoir occurred from mid-April through late-September 2011 so that repairs of Eldon Mills Dam could be done. Releases were temporarily discontinued in late September. The atypical release regime in 2011 was responsible for
  - —high flows in July-August
  - —the low-flow criterion not being met until 9/30
  - —some very low flows in September
- Flows during the dry season appear to be slightly greater in recent years. Although the trend is statistically significant for September, flows are highly variable and the trend may not persist.

RAINY SEASON

- The highest flow months are December and January due to normal patterns in rainfall. Although low flows are less common during these months, they do occur, especially in December, and are probably related to reservoir filling.
- Rainy season criterion: 7d-Q ≥ 85 cfs (~48th pctl)
- In 2019, rainy season onset was on October 20, but high flow only persisted for eight days and was followed by 38 days which met the criterion for low flow. Persistent high flow did not occur until December 14, 2019.
- No trends are evident for the magnitude of December–January rainy season flow.





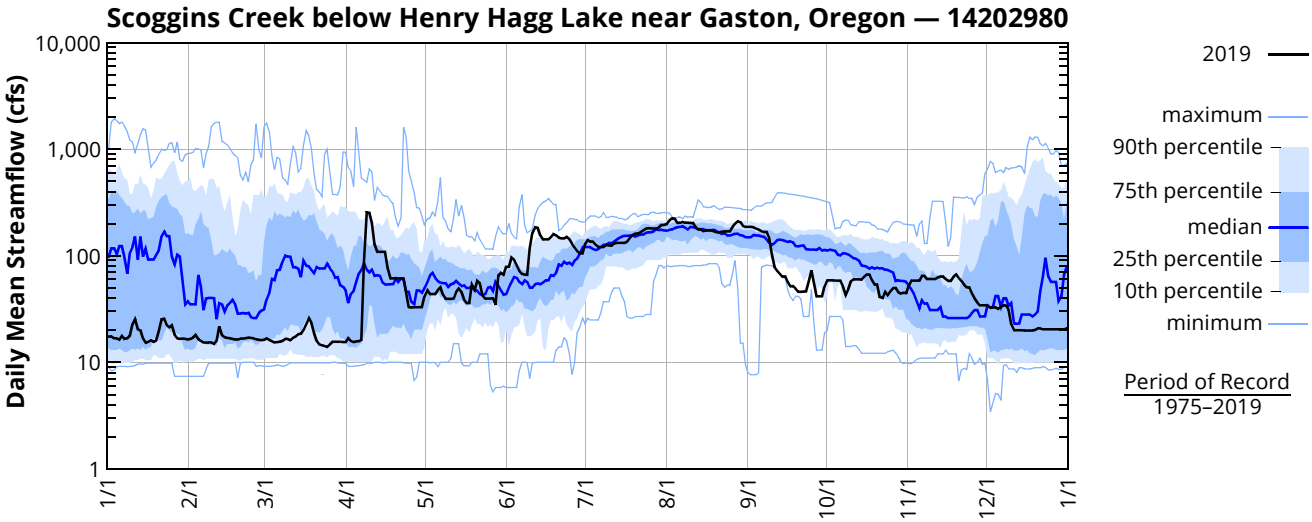
SCOO – SCOGGINS CREEK BELOW HENRY HAGG LAKE NEAR GASTON, OREGON – 14202980

Data source: Bureau of Reclamation (in cooperation with District 18 Watermaster)
River mile: 4.8 *Latitude:* 45 28 10 *Longitude:* 123 11 56

2019 — MEAN STREAMFLOW[†] (cfs) — SCOO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	17.4	16.6	16.3	15.5	41.7	78.7	129	198	186	58.9	52.6	34.1
2	17.5	17.1	16.8	17.0	47.6	78.7	140	214	186	58.8	58.3	32.5
3	16.8	18.0	16.3	15.9	43.6	96.1	136	224	185	58.7	58.3	32.6
4	16.8	16.5	15.8	15.5	43.7	91.8	136	223	180	58.5	58.3	32.9
5	16.4	15.9	15.4	15.7	43.6	81.6	127	203	177	58.3	58.3	31.8
6	17.8	15.4	15.5	15.8	47.7	72.5	121	204	171	58.3	65.0	33.2
7	16.6	15.3	15.6	16.3	50.5	67.4	121	208	167	51.8	64.9	34.3
8	16.8	15.4	15.9	85.7	43.1	66.6	121	204	167	43.1	60.6	34.1
9	17.8	15.4	16.6	254	39.4	66.3	127	204	146	48.8	60.6	30.9
10	22.9	15.0	16.6	253	39.4	118	125	203	105	57.7	60.5	22.9
11	25.5	16.0	16.2	202	39.5	164	124	202	78.3	60.1	60.5	20.0
12	20.5	21.7	17.1	129	39.6	185	130	185	72.6	59.9	62.6	20.0
13	20.0	17.9	17.6	109	45.8	182	132	177	68.1	59.9	63.9	20.0
14	16.7	17.2	18.4	109	49.5	155	132	177	63.9	59.5	63.9	20.0
15	15.3	17.0	18.5	109	45.9	142	132	171	64.1	63.5	60.4	19.9
16	15.6	16.9	20.1	109	38.9	142	132	173	56.4	66.5	58.2	19.9
17	16.2	16.6	23.2	77.1	36.0	142	136	173	51.5	66.4	58.2	19.9
18	15.6	16.4	26.0	61.2	36.0	149	147	173	52.0	58.7	64.0	19.9
19	16.1	16.4	23.4	61.1	53.4	160	157	169	49.6	53.9	66.9	20.2
20	19.5	16.7	18.9	61.1	47.5	156	161	166	45.9	53.8	62.3	20.9
21	25.3	16.7	16.1	61.1	58.2	147	161	166	45.9	41.0	58.4	20.9
22	25.7	16.9	14.8	61.1	55.2	145	166	168	46.2	40.3	53.9	20.5
23	22.3	17.1	14.5	61.2	42.7	145	173	169	46.1	46.3	50.5	20.5
24	21.3	17.0	14.3	44.4	39.7	150	179	169	58.2	42.8	50.5	20.5
25	22.3	16.8	14.0	33.0	39.8	142	181	169	73.1	46.1	44.2	20.5
26	18.2	16.5	14.8	32.8	39.8	129	180	186	55.2	49.8	40.0	20.5
27	16.9	16.3	15.6	33.0	39.9	120	180	200	41.7	49.8	36.6	20.5
28	16.6	16.2	15.6	33.0	34.8	110	179	211	41.7	45.5	34.2	20.5
29	16.7	—	15.6	32.9	65.1	105	184	207	41.7	44.2	34.3	20.5
30	16.6	—	15.6	33.0	69.1	105	194	191	51.8	44.8	34.4	20.5
31	16.4	—	15.5	—	66.0	—	194	186	—	44.7	—	20.7
Mean	18.6	16.7	17.0	71.9	45.9	123	150	189	92.5	53.2	55.2	24.1
Max	25.7	21.7	26.0	254	69.1	185	194	224	186	66.5	66.9	34.3
Min	15.3	15.0	14.0	15.5	34.8	66.3	121	166	41.7	40.3	34.2	19.9
Ac-Ft	1143	926	1044	4279	2822	7324	9197	11649	5502	3273	3283	1480

[†]All 2019 data are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — SCOO

Q IN cfs	1 < Q < 6	6 < Q ≤ 11	11 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 50	50 < Q ≤ 75	75 < Q ≤ 100	100 < Q ≤ 130	130 < Q ≤ 160	160 < Q ≤ 200	200 < Q ≤ 350	350 < Q ≤ 1,200	1,200 < Q ≤ 2,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.09%	4.5%	10.7%	8.5%	10.9%	11.0%	10.3%	10.7%	9.3%	10.1%	8.9%	5.0%	0.18%

KEY

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

Period of Record
1975–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — SCOO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	98.0	93.0	166	34.0	65.0	50.5	154	271	348	35.0	37.0	31.0
1976	86.0	24.0	124	85.0	45.0	31.0	95.0	94.0	171	140	23.0	14.0
1977	13.0	10.0	11.0	10.5	21.0	10.0	82.0	82.0	81.5	13.3	76.7	374
1978	181	41.7	28.6	60.3	76.7	33.3	84.8	122	215	173	16.0	14.0
1979	14.0	14.0	45.0	21.0	49.0	33.0	92.0	121	141	142	31.5	150
1980	205	22.0	135	74.0	35.0	29.0	80.0	117	123	84.0	78.5	123
1981	21.0	32.5	47.0	55.0	35.0	50.0	78.0	176	104	130	129	353
1982	228	217	199	142	74.0	73.0	82.0	107	103	150	131	341
1983	333	76.0	343	97.5	55.0	67.4	49.1	104	155	175	119	348
1984	65.1	66.1	59.1	60.0	76.0	68.7	108	157	107	112	212	126
1985	21.0	17.9	12.0	12.0	90.6	99.9	178	142	66.7	31.0	22.0	50.0
1986	11.0	51.0	98.1	13.0	45.9	91.8	149	158	88.4	27.0	19.0	9.0
1987	27.0	13.5	194	36.0	34.0	54.5	173	162	91.0	45.0	16.0	13.0
1988	15.0	13.0	14.0	41.0	52.0	47.5	143	166	136	90.0	27.0	27.0
1989	120	18.0	175	36.0	26.0	72.0	144	158	152	116	31.5	13.0
1990	12.0	63.5	150	15.0	33.0	54.0	188	177	114	98.0	19.0	9.9
1991	10.0	10.0	69.0	107	37.0	23.0	148	192	152	135	17.0	9.1
1992	9.9	11.0	11.0	10.5	30.0	105	164	175	102	66.0	22.0	11.0
1993	12.0	11.0	12.0	135	82.0	32.0	44.0	118	179	102	107	13.0
1994	14.0	12.0	76.0	36.0	30.0	30.0	201	188	132	83.0	22.0	17.0
1995	585	145	177	62.0	47.0	57.0	134	181	128	54.0	21.0	569
1996	334	609	32.0	202	116	38.5	181	204	93.0	75.0	24.0	57.0
1997	365	78.0	221	10.0	74.0	46.5	129	209	192	61.0	38.0	372
1998	211	172	193	35.5	59.0	50.0	133	149	199	104	39.0	121
1999	409	582	158	52.5	53.0	111	167	183	170	112	26.5	73.0
2000	191	25.0	94.0	15.5	37.0	89.0	133	173	135	113	51.0	10.0
2001	9.8	9.8	10.0	9.9	10.0	68.5	105	99.0	79.5	43.4	14.3	16.7
2002	230	54.6	92.0	80.8	46.9	122	154	160	169	134	29.5	9.7
2003	13.3	104	199	127	63.6	108	162	177	154	116	90.5	10.7
2004	10.7	117	50.5	51.0	39.7	90.6	158	204	103	95.0	20.8	10.7
2005	10.4	10.6	9.9	10.5	81.0	51.3	168	197	155	105	21.2	10.8
2006	688	75.1	33.7	66.1	45.0	60.4	176	205	156	79.2	20.8	201
2007	193	25.4	99.4	39.8	52.3	145	182	202	180	49.0	21.2	23.4
2008	289	107	33.2	96.0	73.6	50.2	186	178	174	105	22.3	19.6
2009	58.2	15.9	16.6	57.0	110	58.0	180	183	154	74.4	21.7	90.0
2010	207	99.1	68.6	169	87.4	154	139	174	98.9	79.0	27.2	318
2011	222	28.4	290	174	97.5	51.8	99.4	134	149	92.0	50.5	56.0
2012	309	82.5	249	113	100	55.0	158	187	167	63.0	113	386
2013	124	27.5	25.0	14.0	36.0	67.0	184	182	97.5	32.0	33.0	91.0
2014	47.0	48.5	299	98.0	111	89.5	178	198	164	82.0	26.0	24.0
2015	152	85.5	47.0	20.5	67.0	170	225	214	115	85.0	21.0	205
2016	288	102	284	56.5	35.0	110	155	197	118	31.4	27.0	402
2017	165	280	314	162	75.8	41.6	158	180	140	79.4	42.7	98.1
2018	232	34.9	26.9	157	59.3	111	203	177	147	79.1	42.2	13.0
2019	16.9	16.6	16.1	61.1	43.6	136	136	186	64.0	53.9	58.3	20.5
median	97.0	31.0	69.0	57.0	53.0	62.8	147	170	134	86.3	31.0	37.0

KEY

Q in cfs

- $Q \leq 11.0$
- $11.0 < Q \leq 14.0$
- $14.0 < Q \leq 19.0$
- $19.0 < Q \leq 24.0$
- $24.0 < Q \leq 40.0$
- $40.0 < Q \leq 60.6$
- $60.6 < Q \leq 84.0$
- $84.0 < Q \leq 157$
- $157 < Q \leq 224$
- $224 < Q \leq 354$
- $Q > 354$

Q as percentile

- $Q \leq 5$th
- 5th $< Q \leq$ 10th
- 10th $< Q \leq$ 15th
- 15th $< Q \leq$ 20th
- 20th $< Q \leq$ 30th
- 30th $< Q \leq$ 40th
- 40th $< Q \leq$ 50th
- 50th $< Q \leq$ 75th
- 75th $< Q \leq$ 90th
- 90th $< Q \leq$ 95th
- $Q >$ 95th

2019

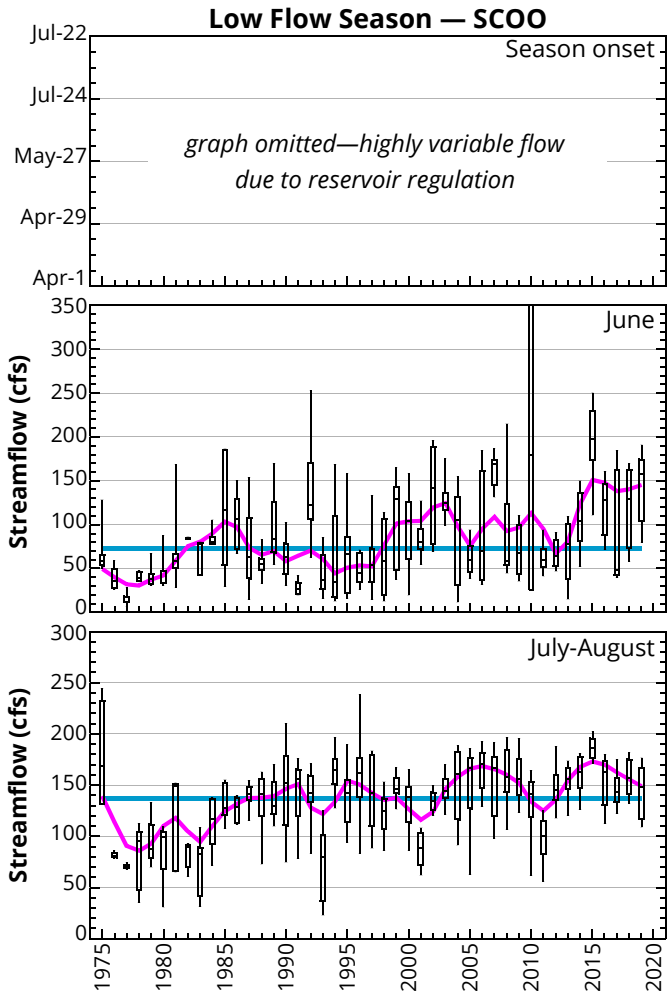
- Flow in 2019 was mostly in the typical range.
- Record low flow occurred September 11–13 when TVID, JWC and CWS all decreased releases from Hagg Lake following significant rainfall on September 9–11.
- BOR revised data for 2015-2018. Tables and graphs in this section reflect the revised data.

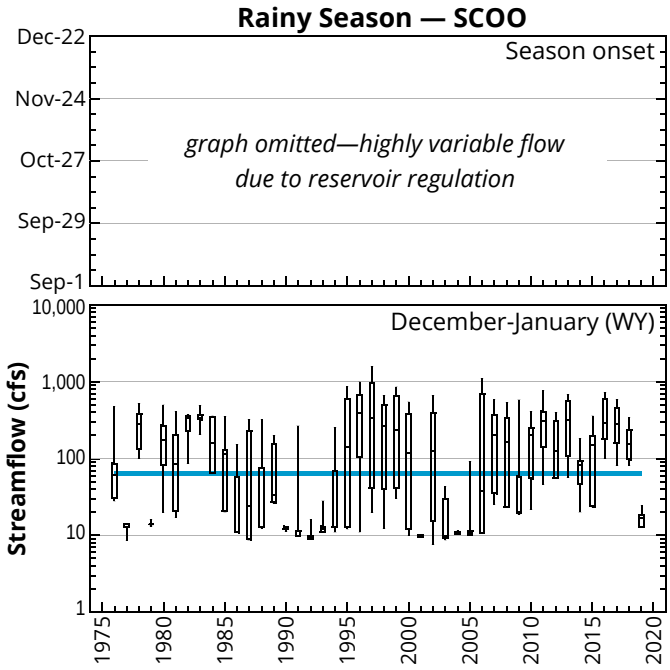
RESERVOIR EFFECTS

- Flow at this site is mostly controlled by the operation of Scoggins Dam and reservoir releases. Weather is secondary.
  - —Seasonal, sustained low or high flow regimes driven by weather generally do not occur.
  - —Both the lowest and highest flow extremes occur December through April and depend on whether on not Hagg Lake is filling.
  - —The month with the lowest average flow is November when releases for municipal use or irrigation are low and the reservoir is filling.
  - —Winter releases must be at least 10 cfs for the benefit of fish.

RELEASE SEASON

- Releases for irrigation and municipal use can begin in May and extend into November.
- The months with the highest average flow are July and August when releases are greatest due to high water demand.
- Flow during the release season varies substantially year-to-year depending on weather and other factors.
  - —1993: Spring was very wet. Flow regulation did not start until July and releases in early July were low. Flow augmentation water was also being saved for use later in the year.
  - —2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
  - —2010: June was extremely wet.
  - —2011: Joint Water Commission was releasing more water than usual from Barney Reservoir and therefore decreased their releases from Hagg Lake.
- Despite the variability, flow has increased over the period of record. The trend is statistically significant for June through August.





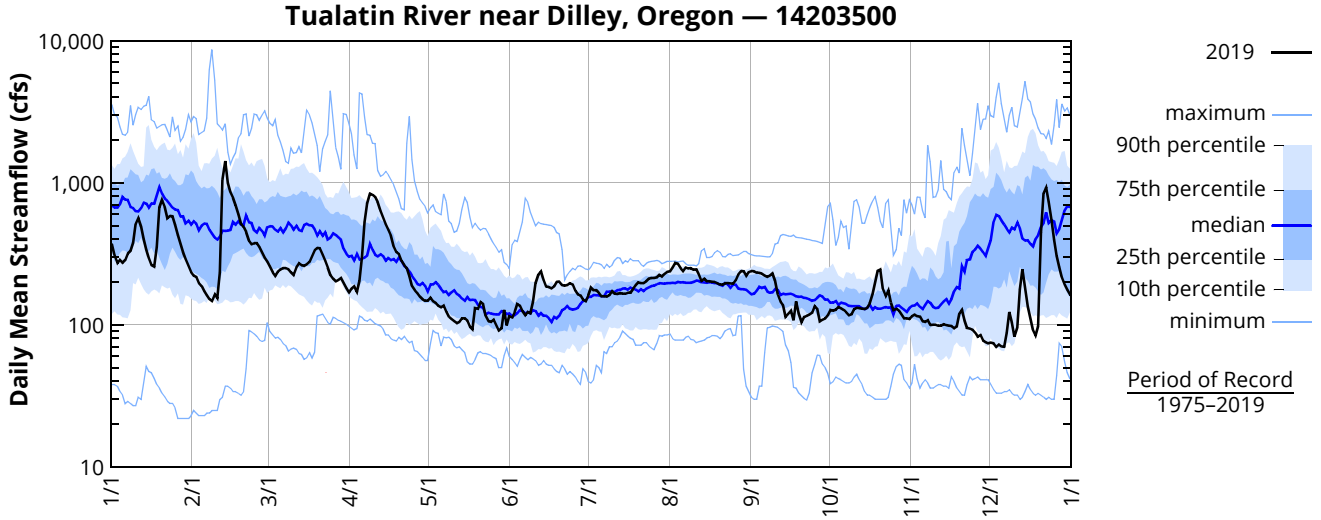
DLLO — TUALATIN RIVER NEAR DILLEY, OREG. — 14203500

Data source: U.S. Geological Survey, Oregon Water Science Center
River Mile: 58.8 *Latitude:* 45 28 30 *Longitude:* 123 07 23 *Drainage area:* 125.00 sq mile *Datum:* 147.57 ft

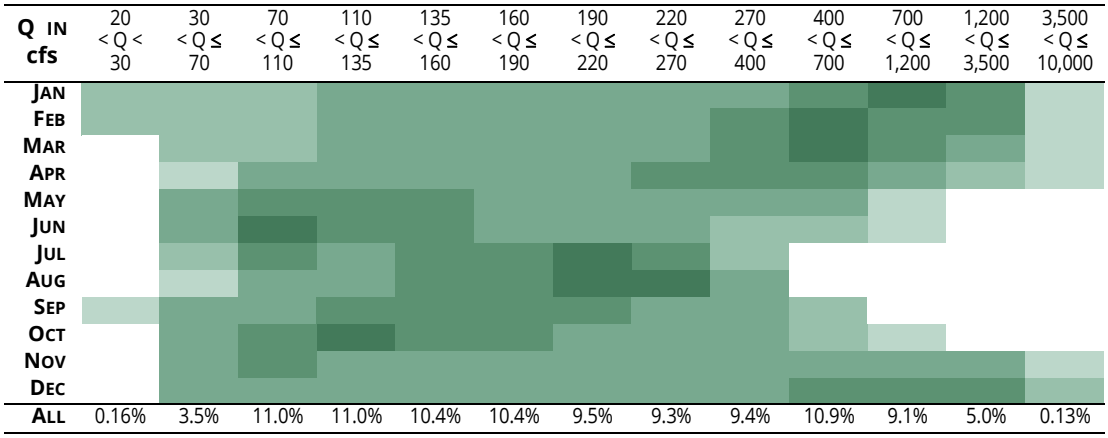
2019 — MEAN STREAMFLOW† (cfs) — DLLO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	365	223	278	169	148	115	162	238	239	127	115	74.8
2	308	218	257	180	156	113	183	253	238	126	118	74.3
3	273	198	234	187	147	123	175	272	233	128	115	69.9
4	287	188	221	170	143	140	175	269	232	134	114	72.5
5	274	173	237	204	137	137	168	251	229	131	106	70.6
6	285	161	245	300	133	125	159	239	223	128	105	70.1
7	316	152	251	529	137	117	159	253	218	123	108	88.2
8	331	147	251	715	124	123	158	249	223	117	99.7	123
9	378	164	247	839	114	121	162	251	231	119	100	104
10	516	154	234	822	110	145	173	244	206	129	100	82.7
11	566	234	225	792	106	197	166	245	163	132	98.7	95.4
12	491	1050	254	729	103	226	165	226	146	131	98.8	178
13	401	1420	271	632	105	238	167	204	138	130	101	247
14	338	996	263	569	111	207	166	211	114	129	99.9	184
15	294	855	260	509	111	186	166	203	120	132	98.4	134
16	264	784	267	467	107	185	168	203	126	142	98.2	110
17	257	694	278	425	96.9	181	168	201	108	165	94.7	91.8
18	353	598	305	355	93.3	187	180	201	146	198	97.5	84.2
19	670	516	335	324	131	201	190	196	121	240	120	97.8
20	755	488	348	315	130	202	199	192	105	245	128	446
21	670	451	345	282	145	190	197	191	114	179	108	847
22	564	391	312	263	140	189	197	196	116	160	95.2	931
23	584	369	282	251	116	190	203	196	118	175	94.2	738
24	579	375	253	220	106	196	211	195	122	144	92.7	544
25	506	376	225	188	105	192	214	194	136	127	88.4	397
26	428	352	211	176	109	174	214	206	130	130	82.7	306
27	371	322	203	167	99.6	164	216	226	106	126	85.0	254
28	325	296	207	158	91.3	161	225	239	109	118	77.6	216
29	290	—	214	152	94.5	151	219	238	111	111	75.7	191
30	260	—	198	148	128	147	228	221	117	111	74.1	176
31	236	—	181	—	99.0	—	235	236	—	110	—	164
Mean	404	441	255	375	119	167	186	224	158	142	99.7	234
Max	755	1420	348	839	156	238	235	272	239	245	128	931
Min	236	147	181	148	91.3	113	158	191	105	110	74.1	69.9
Ac-Ft	24863	24486	15654	22288	7292	9963	11441	13763	9398	8721	5930	14405

† Data after Oct 2, 2019 are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — DLLO



MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — DLLO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	833	637	688	212	189	83.5	151	302	382	65.0	316	702
1976	1010	310	546	311	111	68.5	93.0	111	199	195	42.0	35.0
1977	30.0	33.5	247	85.0	74.0	58.0	90.0	83.0	102	49.0	307	1120
1978	885	617	245	284	233	90.0	103	141	275	222	77.5	232
1979	183	745	305	146	147	62.0	99.0	134	160	170	143	632
1980	963	452	475	336	109	67.0	102	134	145	111	175	660
1981	260	431	222	297	132	138	125	198	174	191	611	1210
1982	877	1081	725	597	157	103	90.5	123	123	206	307	1070
1983	913	1415	1010	440	139	103	88.6	119	202	210	785	748
1984	516	595	460	303	280	169	143	187	126	166	761	588
1985	194	291	196	222	150	184	196	151	71.5	62.9	144	158
1986	474	568	452	117	138	105	153	162	107	66.0	117	373
1987	604	536	943	180	79.0	79.0	180	168	111	83.0	41.5	254
1988	541	264	161	193	156	92.0	148	171	153	114	190	259
1989	569	288	616	219	81.0	106	171	174	163	140	116	96.0
1990	368	1053	494	128	90.0	111	170	174	124	123	132	203
1991	327	386	354	394	149	68.0	159	192	163	136	84.0	187
1992	248	377	153	177	94.0	132	150	152	109	83.0	86.0	328
1993	278	160	310	458	207	120	89.0	120	190	135	123	150
1994	494	188	356	179	84.0	73.5	193	185	145	100	293	1050
1995	1450	1050	611	282	160	115	149	178	140	93.0	332	1970
1996	1290	1210	350	597	437	145	184	205	127	114	162	1440
1997	976	537	887	261	187	112	162	266	277	280	359	723
1998	1320	1014	673	229	171	142	184	235	241	139	150	1280
1999	1450	2285	696	344	181	156	209	224	226	173	259	902
2000	856	463	495	124	123	189	211	238	218	205	128	130
2001	112	140	116	103	108	109	131	136	98.5	95.0	153	1270
2002	1310	571	461	300	116	179	202	207	224	177	110	317
2003	536	508	1020	480	153	159	201	225	195	151	153	340
2004	572	613	293	194	120	157	205	240	154	133	66.8	139
2005	195	122	81.8	266	203	123	196	232	188	146	244	326
2006	2430	491	481	307	124	128	211	226	206	165	659	1100
2007	571	252	521	196	128	165	197	209	198	105	142	755
2008	1050	663	455	393	231	137	255	202	212	135	125	108
2009	931	151	318	271	252	105	213	200	162	117	310	411
2010	920	466	440	585	248	441	181	193	141	150	238	1110
2011	823	323	807	654	325	162	176	216	194	114	130	162
2012	719	465	809	500	237	129	193	217	217	137	389	1260
2013	416	280	267	167	161	126	198	204	151	121	154	187
2014	187	822	882	468	259	134	199	206	186	130	162	537
2015	513	408	360	159	142	202	254	238	153	124	219	1570
2016	1190	732	986	240	93.9	159	189	241	182	305	483	964
2017	644	1125	890	639	317	126	222	231	208	137	641	454
2018	774	287	429	571	132	154	245	221	191	138	87.0	290
2019	353	361	251	291	111	178	175	226	133	130	99.3	134
median	694	487	456	269	148	124	177	195	163	135	168	498

KEY

Q in cfs

- Q ≤ 77.5
- 77.5 < Q ≤ 95.5
- 95.5 < Q ≤ 110
- 110 < Q ≤ 122
- 122< Q ≤ 144
- 144< Q ≤ 169
- 169 < Q ≤ 199
- 199 < Q ≤ 402
- 402 < Q ≤ 877
- 877 < Q ≤ 1210
- Q > 1210

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

2019

- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. No records for high or low flow occurred.

RESERVOIR EFFECTS

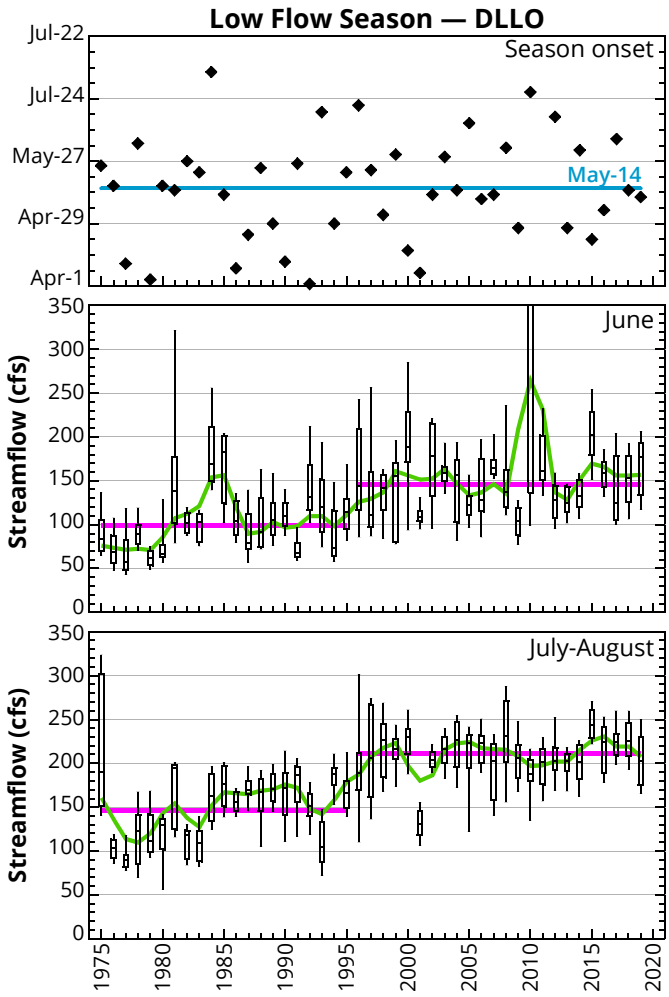
- Flow at this site is highly influenced by releases from Hagg Lake and Barney Reservoir.
  - —Releases for irrigation and municipal use can begin in May and extend into November.
  - —Onset of seasonal, sustained low or high flow regimes is highly variable.
  - —The frequency chart shows a weaker relationship between flow and season than most sites.

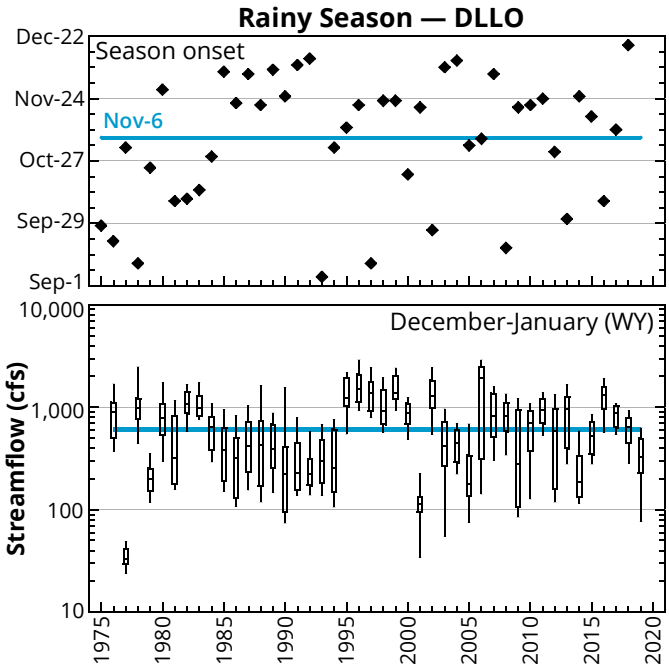
LOW FLOW

- The lowest average flows occur in May, June and October when reservoir releases are smaller than in mid-summer and rain is not prevalent.
- From 1975 through 1995, June–August flow increased markedly. The trend is statistically significant. Since 1995, no trend is evident. Several factors could contribute to the increase.
  - —Municipal water use increased due to population growth.
  - —Both the timing and amount of flow augmentation water released by Clean Water Services changed over time.
  - —Cooperation among water users and careful management of water resources increased.
- Low flow varies substantially year-to-year depending on weather and other factors.
  - —1993: Spring was very wet. Reservoir releases in early July were low.
  - —2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
  - —2010: June was extremely wet.
- Low flow criterion is: 7d-Q ≤ 130 cfs (~23th pctl)

RAINY SEASON FLOW

- December through March are the months with the highest flows.
- High flow criterion is: 7d-Q ≥ 200 cfs (~50th pctl)





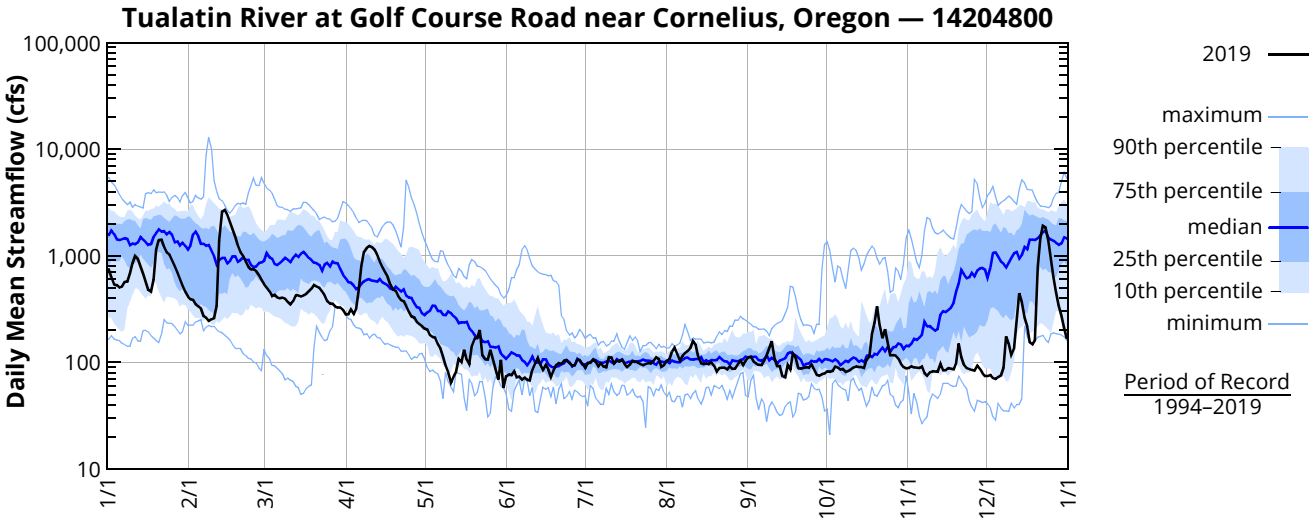
TRGC – Tualatin River at Golf Course Road near Cornelius, Oregon – 14204800

Data source: Oregon Water Resources Department
River mile: 51.5 *Latitude:* 45 30 08 *Longitude:* 123 03 22

2019 — MEAN STREAMFLOW[†] (cfs) — TRGC

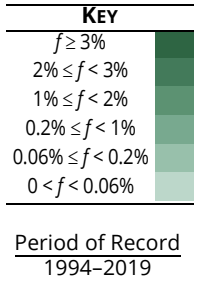
DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	744	390	541	281	207	73.9	88.6	104	111	82.8	88.6	74.7
2	631	386	505	283	203	76.9	98.7	107	113	81.5	92.1	76.4
3	535	350	465	313	181	76.3	99.0	126	102	83.2	90.1	71.7
4	529	333	418	285	173	82.6	107	138	97.3	91.5	89.1	69.9
5	504	320	430	322	171	72.3	101	119	95.1	89.8	88.3	72.8
6	516	274	409	480	148	73.6	92.0	104	94.4	85.8	92.0	75.5
7	570	264	400	802	135	69.1	98.8	115	104	86.8	79.5	89.4
8	572	247	405	1090	114	71.9	91.6	123	117	81.8	75.1	176
9	678	255	397	1190	93.6	68.7	89.9	128	136	83.3	81.2	150
10	847	261	371	1240	81.1	67.9	111	137	158	86.4	82.6	118
11	992	338	350	1210	65.1	85.6	111	159	108	90.1	82.3	137
12	934	1400	379	1140	74.1	99.2	97.9	148	92.3	91.5	81.3	259
13	803	2590	429	1010	82.1	111	104	114	92.1	90.2	96.8	446
14	684	2680	424	870	108	95.2	102	98.4	74.4	90.4	84.7	370
15	577	2420	417	778	101	85.0	106	96.2	72.4	88.5	84.7	263
16	482	2100	425	697	131	94.9	97.2	98.6	94.2	106	88.8	217
17	463	1800	440	633	106	86.1	90.6	96.2	85.5	114	87.4	154
18	598	1520	466	531	96.2	73.3	95.7	100	122	184	86.0	148
19	1140	1250	491	480	144	84.2	103	92.9	113	234	99.5	162
20	1400	1090	535	473	169	94.3	102	82.2	87.8	336	151	784
21	1410	1010	517	419	170	98.7	100	88.6	87.6	223	113	1451
22	1210	877	502	386	201	96.9	97.2	89.2	88.5	168	95.9	1914
23	1070	788	464	376	117	104	94.1	89.3	90.3	205	88.7	1851
24	1030	746	424	336	107	105	97.2	85.9	89.4	154	86.8	1383
25	916	750	376	299	106	98.5	98.7	92.5	95.4	117	84.9	916
26	797	721	354	269	131	93.8	97.8	86.9	85.3	117	83.7	631
27	697	657	355	264	107	93.8	104	87.4	76.5	116	93.4	457
28	605	594	336	240	87.1	106	112	96.4	75.3	109	87.2	342
29	527	—	328	229	69.3	105	108	104	77.9	97.5	79.1	274
30	460	—	327	219	106	96.6	91.1	94.4	78.8	90.9	74.7	211
31	415	—	309	—	57.6	—	94.1	104	—	88.2	—	170
Mean	753	943	419	572	124	88.0	99.4	107	97.2	121	89.6	436
Max	1410	2680	541	1240	207	111	112	159	158	336	151	1914
Min	415	247	309	219	57.6	67.9	88.6	82.2	72.4	81.5	74.7	69.9
Ac-Ft	46286	52385	25763	34007	7621	5237	6111	6556	5781	7464	5333	26807

[†]All 2019 data are provisional—subject to revision



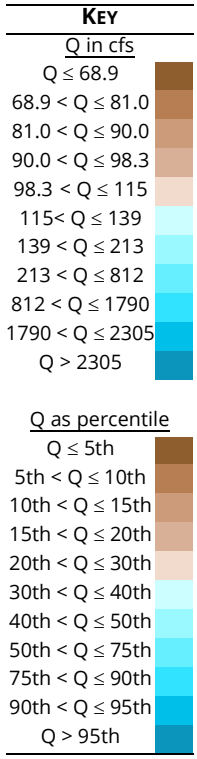
FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — TRGC

Q IN cfs	20 < Q < 30	30 < Q ≤ 65	65 < Q ≤ 90	90 < Q ≤ 110	110 < Q ≤ 125	125 < Q ≤ 160	160 < Q ≤ 250	250 < Q ≤ 450	450 < Q ≤ 750	750 < Q ≤ 1,400	1,400 < Q ≤ 2,300	2,300 < Q ≤ 5,000	5,000 < Q ≤ 15,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.06%	3.6%	11.1%	12.3%	8.0%	8.9%	8.8%	10.3%	10.3%	11.8%	9.7%	4.9%	0.13%



MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — TRGC

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994	773	461	796	405	125	76.5	120	110	91.5	75.0	623	1780
1995	2051	1766	1550	591	240	94.3	77.3	117	96.0	88.4	616	2273
1996	2036	2709	613	1005	663	152	85.6	117	82.6	125	262	2922
1997	1905	963	1843	469	251	124	87.1	134	223	452	805	1174
1998	2431	1951	1188	469	278	128	114	106	131	135	248	2198
1999	2318	3448	1290	639	303	139	120	128	146	163	526	1410
2000	1637	846	835	244	181	149	110	142	170	184	147	231
2001	183	276	199	154	123	78.6	55.3	52.7	43.4	60.8	354	2256
2002	1693	1122	854	535	125	80.9	78.8	77.3	127	124	98.6	715
2003	1073	1042	1629	806	216	78.1	69.2	117	107	130	159	755
2004	1038	1168	546	316	127	68.3	83.4	116	84.9	131	91.4	247
2005	371	176	93.7	475	298	102	99.6	89.8	76.1	126	418	620
2006	2478	1183	864	530	140	102	103	99.9	111	93.1	1603	2058
2007	1172	382	998	328	112	100	107	109	113	83.3	145	1756
2008	1800	1435	790	647	244	123	133	106	126	125	192	175
2009	1810	286	597	454	427	68.5	117	116	112	104	575	646
2010	2070	845	799	994	376	621	110	102	105	119	468	2420
2011	1840	560	1990	1210	454	186	115	112	105	82.0	138	274
2012	1480	851	1490	740	313	139	111	101	113	113	656	2510
2013	748	487	531	326	154	127	105	97.0	106	143	244	271
2014	319	1545	1560	796	381	108	102	97.0	98.0	120	264	1170
2015	862	782	603	261	96.0	94.0	98.0	100	85.5	77.0	386	2770
2016	2270	1300	1860	332	82.0	75.0	92.0	99.0	113	501	762	1470
2017	1010	1960	1600	1115	457	111	105	96.0	110	100	1057	703
2018	1450	551	765	1010	149	89.3	107	103	106	96.5	66.1	549
2019	678	734	418	446	108	90.0	98.7	100	93.3	91.5	87.3	211
median	1450	953	875	505	211	101	102	104	108	119	298	1195



2019

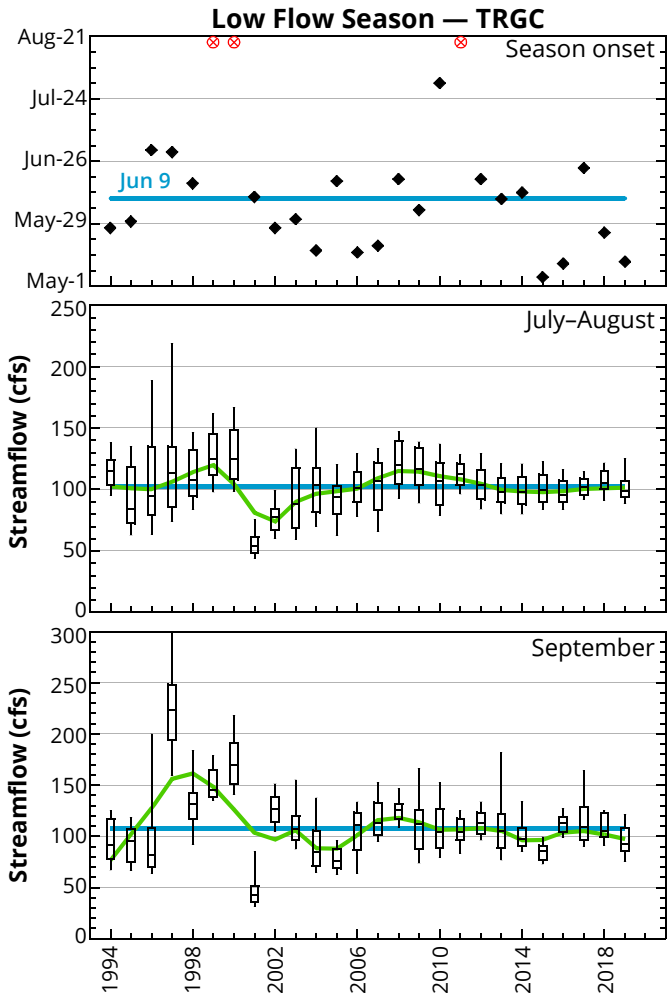
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. A long dry spell occurred in November and early December. Record low flows occurred on: March 28–30, May 13, 29–30 and December 17–19.

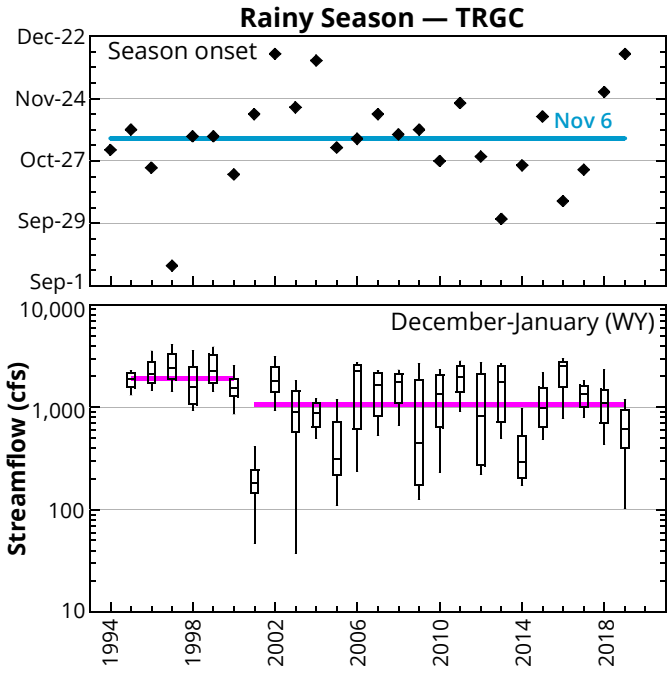
LOW FLOW

- June through September are the months with the lowest average flow.
- Because flow at this site is highly influenced by releases from Hagg Lake and Barney Reservoir and withdrawals at Springhill Pump Plant, the frequency chart shows a weaker relationship between flow and season than most sites.
- Very low daily flows can occur anytime from early summer through December depending on weather and Scoggins Dam operations.
- Low flow criterion is: 7d-Q ≤ 95 cfs (~17th pctl)
- Low flow did not occur in 1999 and 2000.
- In 2011, low flow was delayed until 9/6 because Joint Water Commission was releasing more water than usual from Barney Reservoir so that repairs could be done on Eldon Mills Dam.
- No trends are evident in flow magnitude over time for July–September.
- A few years had higher or lower flow than usual due to weather or other factors.
  - —1997: September rainfall was higher than usual.
  - —2001: Hagg Lake did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.

RAINY SEASON FLOW

- December and January are the months with the highest average flow, although very high daily flows can occur from November through April. This pattern is consistent with normal rainfall.
- High flow criterion is: 7d-Q ≥ 170 cfs (~44th pctl)
- Daily mean flows for December–January 1994–2000, were consistently greater than 1000 cfs. Since 2001, they have been more variable and generally lower than before. The difference is statistically significant. The cause is unknown.





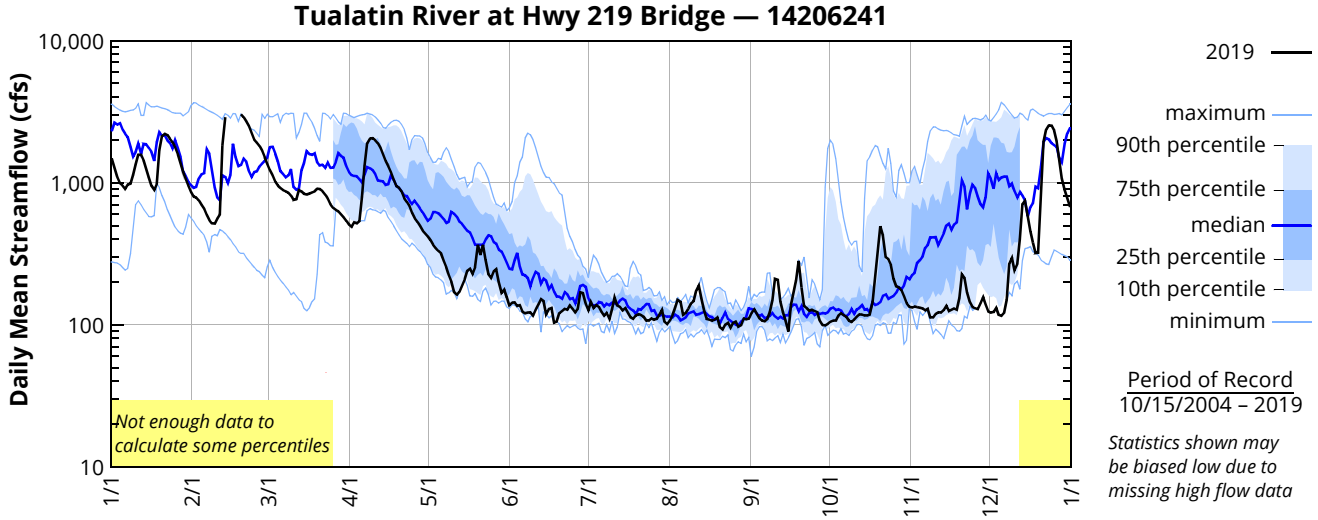
TRJB — Tualatin River at Hwy 219 Bridge — 14206241

Data source: Jackson Bottom Wetland Education Center
River mile: 44.4 *Latitude:* 45 30 01 *Longitude:* 122 59 24

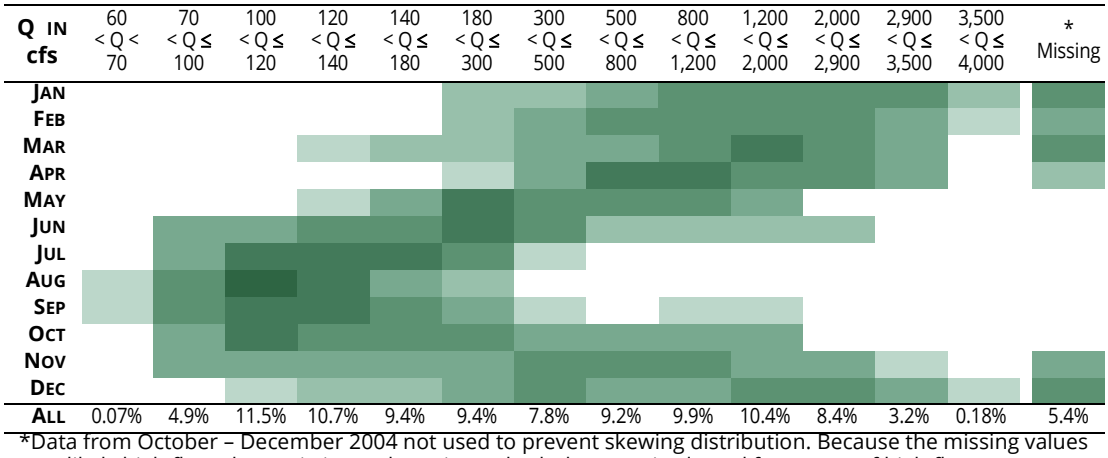
2019 — MEAN STREAMFLOW† (cfs) — TRJB

DAY	JAN	FEB*	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1460	797	1351	508	421	137	127	108	121	105	132	122
2	1266	787	1227	488	393	143	145	118	128	107	135	123
3	1089	752	1119	525	367	144	131	132	119	107	133	132
4	990	697	1014	517	347	136	137	150	111	116	132	118
5	955	655	953	536	332	137	133	146	107	121	130	116
6	905	594	916	797	317	124	123	118	106	117	126	122
7	972	547	885	1317	282	121	116	121	110	115	130	150
8	983	517	870	1891	255	122	122	130	123	107	113	271
9	1132	516	852	2049	223	123	110	141	149	105	113	298
10	1344	560	811	2051	202	116	128	147	210	109	119	244
11	1566	600	757	1994	169	128	156	175	207	114	122	269
12	1566	1831	765	1898	163	140	137	189	145	118	122	401
13	1432	2886	887	1751	171	152	134	154	122	118	127	706
14	1248		870	1565	188	147	127	125	107	116	136	748
15	1084		835	1416	210	119	131	110	90	116	125	576
16	954		825	1302	241	130	122	109	138	118	128	456
17	891		841	1188	248	132	114	107	168	145	131	377
18	987		854	1050	229	104	111	109	206	220	128	319
19	1700	3032	870	947	254	106	117	113	282	332	154	322
20	2119	2893	906	926	366	121	119	96	184	495	227	873
21	2207	2710	900	872	310	125	118	93	135	427	215	1937
22	2165	2490	868	776	366	130	115	100	131	299	169	2365
23	2036	2248	825	731	286	128	107	103	126	289	144	2523
24	1931	2016	772	687	228	137	107	96	128	264	133	2515
25	1776	1917	707	615	214	130	111	104	125	212	131	2326
26	1574	1826	663	565	238	123	109	105	124	186	129	1955
27	1369	1680	642	532	247	130	111	97	107	183	143	1424
28	1199	1515	632	496	200	169	118	100	100	176	157	1067
29	1062	—	603	461	168	168	128	111	99	159	139	886
30	947	—	575	441	177	140	105	110	102	142	124	778
31	855	—	539	—	158	—	101	111	—	134	—	685
Mean	1347		843	1030	257	132	122	120	137	177	138	813
Max	2207		1351	2051	421	169	156	189	282	495	227	2523
Min	855		539	441	158	104	101	93	90	105	113	116
Ac-Ft	82834		51838	61277	15804	7854	7473	7393	8152	10859	8230	49986

†All values should be considered estimates because the rating curve has not been updated recently; *Incomplete record



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — TRJB



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
10/15/2004 – 2019

*Data from October – December 2004 not used to prevent skewing distribution. Because the missing values are likely high flow, the statistics underestimate both the magnitude and frequency of high flow.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — TRJB

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004											176	451
2005	722	407	228	1003	802	232	127	92	88.9	154.5	780	1284
2006	3264	2395	1404	954	332	212	128	98	107	124	2264	2865
2007	2394	710	1604	638	235	152	124	118	123	118	275	2533
2008		2493	1380	1214	460	204	169	124	139	144	353	333
2009		527	1109	817	694	146	125	115	115	124	841	1088
2010		1678	1415	2081	667	995	187	120	128	127	676	
2011		1213		1901	808	316	176	135	119	117	182	415
2012		1507			597	294	157	119	121	159		
2013	1126	831	965	589	248	220	124	106	131	203	409	421
2014	563			1485	669	193	138	107	105	148	512	1721
2015	1517		1205	596	215	128	113	101	102	96	576	
2016		2254		650	193	127	117	114	132	812	1231	
2017				2019	926	247	151	117	132	139	1685	1305
2018	2307	1001	1480	1883	301	148	134	116	127	127	114	721
2019	1248	1515	852	834	241	130	119	111	124	121	131	456
median	1864	1211	1368	978	442	191	135	114	122	139	476	1227

KEY

Q in cfs

$Q \leq 100$
$100 < Q \leq 110$
$110 < Q \leq 117$
$117 < Q \leq 125$
$125 < Q \leq 145$
$145 < Q \leq 192$
$192 < Q \leq 335$
$335 < Q \leq 1105$
$1105 < Q \leq 2207$
$2207 < Q \leq 2750$
$Q > 2750$

Q as percentile

$Q \leq 5th$
$5th < Q \leq 10th$
$10th < Q \leq 15th$
$15th < Q \leq 20th$
$20th < Q \leq 30th$
$30th < Q \leq 40th$
$40th < Q \leq 50th$
$50th < Q \leq 75th$
$75th < Q \leq 90th$
$90th < Q \leq 95th$
$Q > 95th$

2019

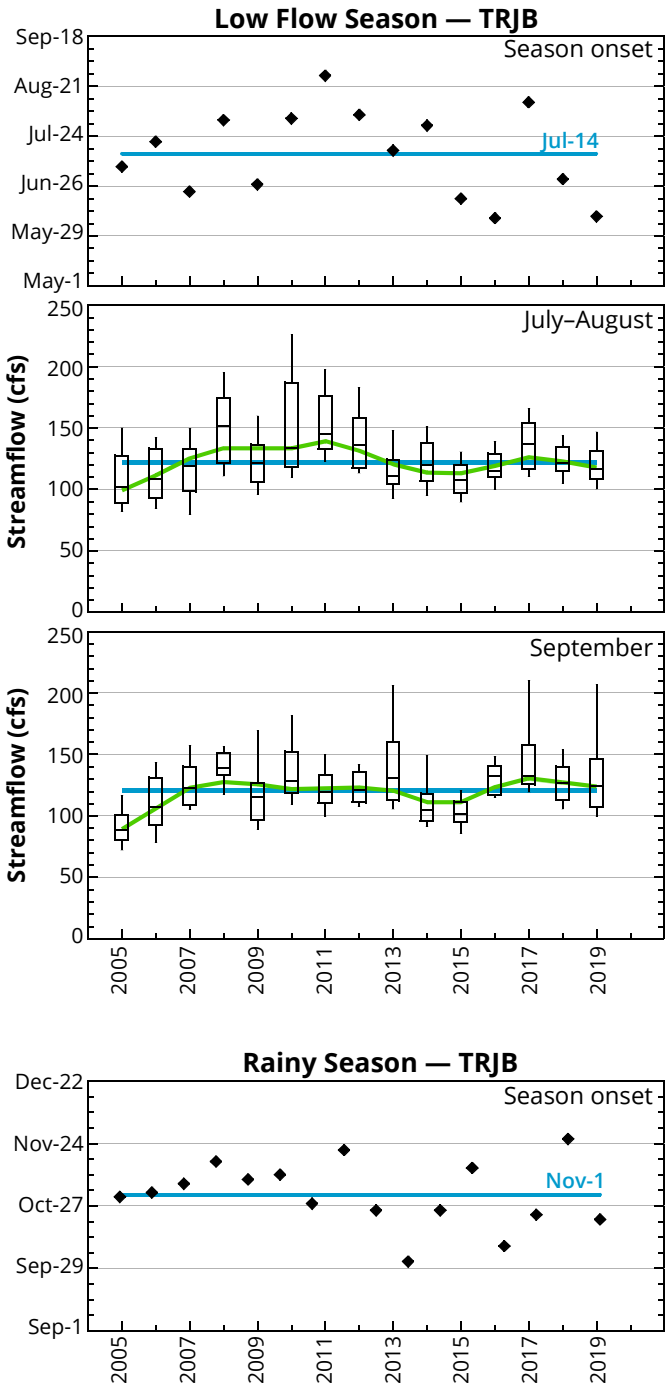
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. A long dry spell occurred in November and early December. Because the period of record for this site is relatively short (15 years), high flow records were set on 10 days and low flow records occurred on 34 days. These included:
  - —High flow records for February 19–22 and probably for February 14–18 when flow estimates were missing.
  - —Low flow records for March 27–April 5, November 25–December 7.

Low flow

- August and September are the months with the lowest average flow and the lowest daily flows.
- Low flow criterion is: 7d-Q ≤ 125 cfs (~19th pctl)
- No trends are evident in the magnitude of flow over time for July–September.

Rainy season flow

- December and January are the months with the highest average flow, although very high daily flows can occur from November through April. This pattern is consistent with normal rainfall.
- High flow criterion is: 7d-Q ≥ 200 cfs (~39th pctl)
- In 2019, rainy season onset was on October 21, but high flow only persisted for eight days and was followed a prolonged period of lower flow. Persistent high flow did not occur until December 11, 2019.
- Much of the high flow data is missing because the rating curve has an upper limit. The frequencies and percentiles in tables on the previous page are therefore skewed with low values overrepresented.
- Boxplots were not shown for the December–January rainy season because too many data are missing.



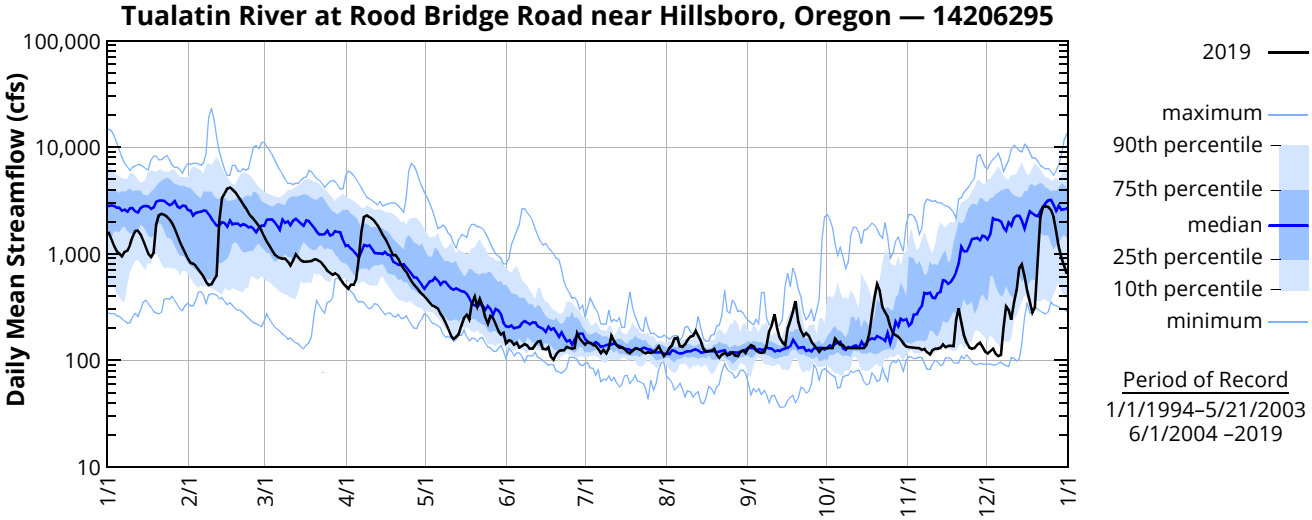
ROOD – TUALATIN RIVER AT ROOD BRIDGE ROAD NEAR HILLSBORO, OREGON – 14206295

Data source: Oregon Water Resources Department
River mile: 38.4 *Latitude:* 45 29 24 *Longitude:* 122 57 06

2019 — MEAN STREAMFLOW[†] (cfs) — ROOD

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1570	822	1450	499	399	145	141	118	130	130e	133	116
2	1370	809	1300	472	372	154	150e	130	140	130e	132	123
3	1170	778	1180	511	349	152	147	138	136	130e	131	129
4	1050	713	1070	514	328	141	139	160	124	160e	130	115e
5	999	663	980	585	320	147	138	163	119	150e	130	110e
6	950	606	942	901	308	132	128	136	118	140e	126	113
7	1040	544	916	1590	274	137	117	134	119	140e	129	203
8	1070	509	897	2210	251	143	126	142	139	130e	119	324
9	1210	521	903	2300	225	139	117	156	190	130e	114	299
10	1440	575	849	2220	199	129	130e	167	215e	130e	125	241
11	1630	624	774	2130	171	129	170e	170e	271e	130e	129	352
12	1650	2000	873	2030	159	141	152	190e	199e	130e	129	458
13	1530	3360	992	1870	166	150	138	170e	162e	130e	131	733
14	1340	3690	930	1680	175	152	131	150	148e	130e	142	798
15	1160	4100	871	1510	214	129	133	128	139e	130e	133	608
16	1010	4170	845	1390	251	127	129	121	200e	140e	137	449
17	937	4020	844	1250	268	133	121	122	236e	180	137	357
18	1020	3760	847	1090	241	109	117	123	285e	271	136	284
19	1860	3470	856	965	340e	102	124	129	359	389	239	315
20	2290	3190	882	974	400e	114	129	114	230e	518	308	919
21	2380	2930	886	903	320e	123	129	106	190e	452	229	2193
22	2320	2670	854	786	378	124	126	114	170e	314	174	2746
23	2240	2430	816	726	326	124	119	118	180e	281	146	2791
24	2110	2240	759	682	253	134	117	112	170e	257	132	2739
25	1940	2130	695	609	220e	131	120	114	150e	207	129	2583
26	1720	1990	661	555	260e	129	118	119	140e	178	131	2232
27	1490	1830	636	513	250e	130e	119	111	130e	173	140	1661
28	1290	1640	656	480	220e	180e	126	110	120e	167	147	1181
29	1140	—	636	442	190	160e	136	121	130e	157	134	914
30	1010	—	582	418	176	150e	121	124	130e	144	121	775
31	894	—	532	—	182	—	110	118	—	135	—	663
Mean	1446	2028	868	1094	264	136	130	133	172	193	146	888
Max	2380	4170	1450	2300	400	180	170	190	359	518	308	2791
Min	894	509	532	418	159	102	110	106	118	130	114	110
Ac-Ft	88919	112629	53383	65068	16235	8112	7970	8188	10253	11867	8671	54586

[†]All 2019 data are provisional—subject to revision; e=estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — ROOD

Q IN cfs	10 < Q < 45	45 < Q ≤ 100	100 < Q ≤ 120	120 < Q ≤ 140	140 < Q ≤ 180	180 < Q ≤ 280	280 < Q ≤ 500	500 < Q ≤ 900	900 < Q ≤ 1,600	1,600 < Q ≤ 2,800	2,800 < Q ≤ 4,500	4,500 < Q ≤ 12,000	12,000 < Q ≤ 25,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.12%	4.9%	8.3%	10.7%	10.4%	9.6%	9.8%	10.4%	10.9%	10.6%	9.2%	5.0%	0.09%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1/1/1994–5/21/2003
6/1/2004 –2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — ROOD

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994	1310	762	1480	656	205	123	107.0	96.0	91.5	82	1095	3590
1995	3903	4086	2810	1104	478	207	111.0	115.8	106.8	140.5	972	5587
1996	2880	4720	1123	1705	1421	317	145	147	138	257	523	4549
1997	3934	1931	3518	815	412	322	128	135	236	610	1748	2470
1998	4637	3079	2163	798	496	300	152	121	131	179	367	4046
1999	5027	6820	2665	1129	457	207		134	128	142	695	2582
2000	2626	1670	1584	412	297	200	120	124	155	196	144	375
2001	293	429	326	282	194	111	66	57	49	84	544	3823
2002	2941	2476	1516	701	239	134	111	99	123	122	121	1037
2003	2683	3123	3382	1777	424							
2004						134	105	122	114	196	212	468
2005	721	387	222	1067	905	256	124	91	85	156	899	1497
2006	5846	3111	1569	1017	332	202	139	117	122	118	2850	4187
2007	2928	815	1739	622	235	148	129	126	135	146	254	3230
2008	3560	2905	1410	1205	461	184	154	118	129	120	361	304
2009	3280	523	1140	865	768	163	126	126	130	152	1047	1110
2010	3230	1775	1530	2265	801	1100	197	136	166	169	886	3750
2011	3370	1375	3380	2090	916	342	190	146	133	133	256	418
2012	2940	1690	2900	1495	679	344	169	130	134	236	1175	4130
2013	1330	859	1020	622	264	257	138	121	175	215	434	420
2014	609	2735	2810	1680	739	201	144	114	114	181	612	2240
2015	1610	2250	1360	638	219	127	116	113	115	81	580	5570
2016	3800	2440	2860	646	188	129	114	97	115	964	1425	3240
2017	2290	5140	3570	2100	864	247	159	128	139	165	1770	1370
2018	2710	1280	1620	2140	304	143	136	129	139	135	135	798
2019	1340	1995	856	902	251	134	128	124	149	144	132	458
median	2770	1931	1740	936	406	198	133	121	129	154	548	2320

KEY

Q in cfs

$Q \leq 100$
$100 < Q \leq 113$
$113 < Q \leq 123$
$123 < Q \leq 131$
$131 < Q \leq 158$
$158 < Q \leq 226$
$226 < Q \leq 387$
$387 < Q \leq 1580$
$1580 < Q \leq 3340$
$3340 < Q \leq 4526$
$Q > 4526$

Q as percentile

$Q \leq 5$th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

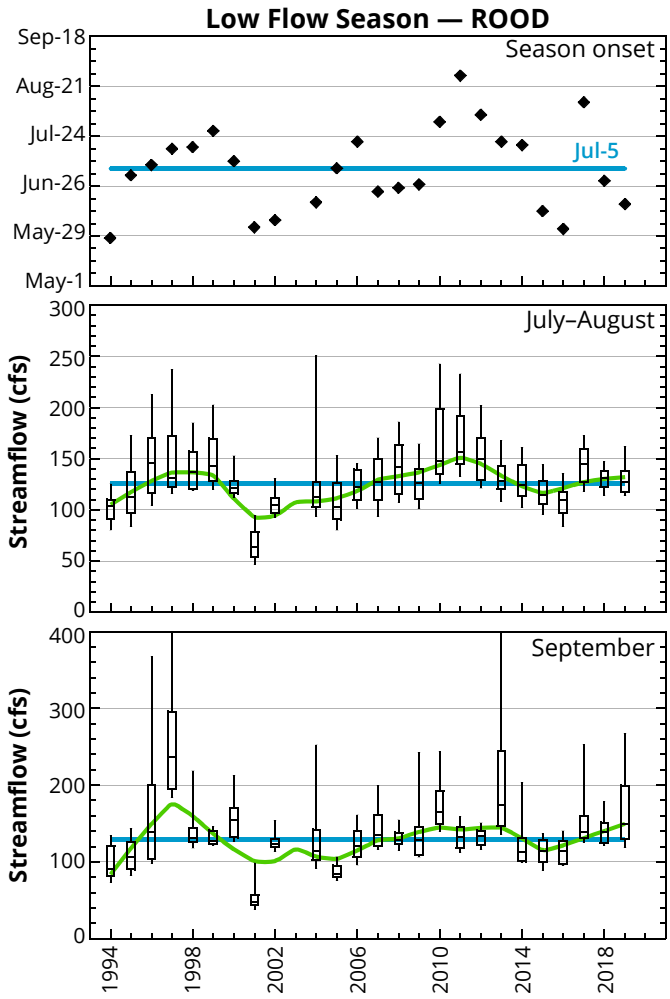
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. A few records for high or low flow were set, but never more than two consecutive days.
- Prolonged dry weather in November through mid-December led to lower than normal flows at that time.

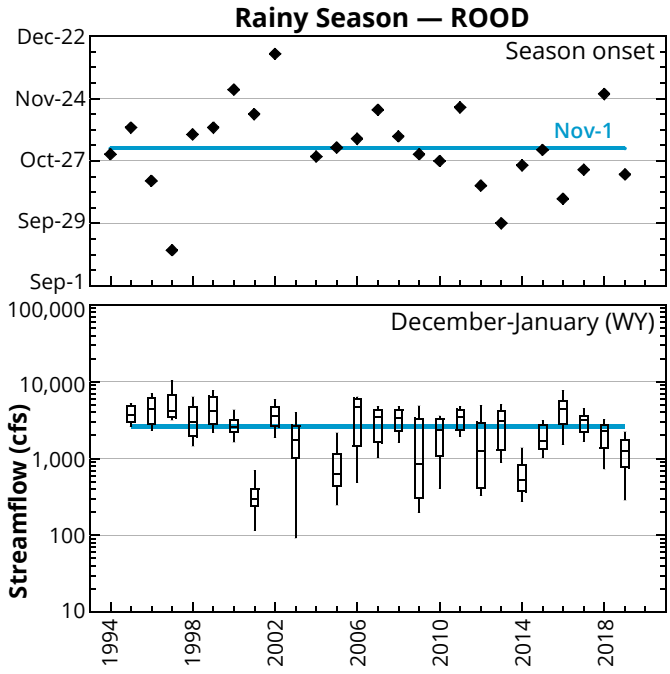
LOW FLOW

- July through September are the months with the lowest average flow and the lowest daily flows.
- Low flow criterion is: 7d-Q ≤ 123 cfs (~21st pctl)
- In 2011, low flow was delayed until 8/27 because Joint Water Commission was releasing more water than usual from Barney Reservoir so that repairs could be done on Eldon Mills Dam.
- No trends are evident in the magnitude of flow over time for July–September.
- A few years had higher or lower flow than usual due to weather or other factors.
  - —1997: September rainfall was higher than usual.
  - —2001: Hagg Lake did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
  - —2003–4: All data are missing from June-2003 through May-2004 because the bridge was being rebuilt.

RAINY SEASON FLOW

- December and January are the months with the highest average flow and the highest daily flows.
- Rainy season criterion: 7d-Q ≥ 240 cfs (~40th pctl)
- In 2019, rainy season onset was on October 21, but high flow only persisted for seven days and was followed a prolonged period of lower flow, including 26 days that met the criterion for low flow. Persistent high flow did not occur until December 11, 2019.
- No trends are evident for the magnitude of the December–January rainy season flow.





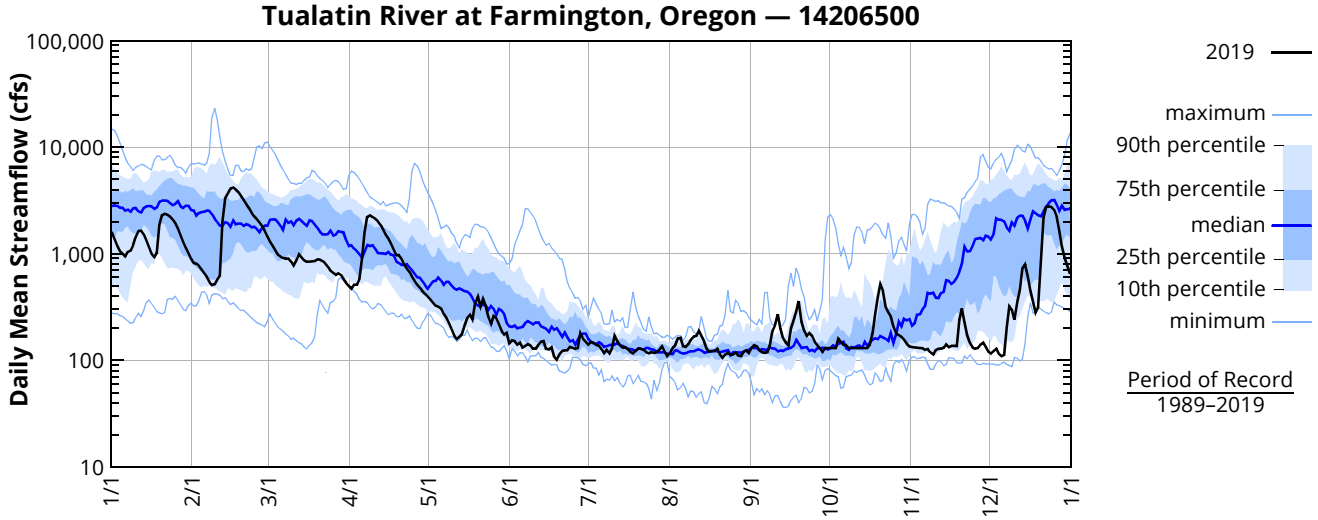
FRMO — TUALATIN RIVER AT FARMINGTON, OREGON — 14206500

Data source: Oregon Water Resources Department
River mile: 33.3 *Latitude:* 45 26 58 *Longitude:* 122 57 02

2019 — MEAN STREAMFLOW[†] (cfs) — FRMO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1750	911	1670	620	512	207	210	162	170	177	200	190
2	1540	889	1500	590	482	214	264	174	179	172	200	197
3	1320	862	1360	620	457	213	229	178	184	170	199	206
4	1160	801	1230	641	429	203	210	198	170	203	200	196
5	1100	748	1120	695	418	207	209	207	163	202	197	181
6	1040	693	1080	1010	407	193	197	184	162	188	194	182
7	1130	625	1040	1750	371	198	185	173	161	178	196	267
8	1160	583	1020	2510	342	206	190	183	178	173	185	439
9	1300	589	1030	2660	313	204	184	195	229	170	177	426
10	1540	650e	985	2570	280	194	209	208	428	169	187	359
11	1770	686	904	2450	251	187	249	234	416	168	195	456
12	1810	2090	977	2320	233	200	226	266	272	170	196	558
13	1700	3890	1130	2150	236	213	203	241	209	171	197	804
14	1500	4290	1100e	1940	244	219	195	200	191	173	211	911
15	1290	4710	1010	1750	289	198	192	175	185	171	202	759
16	1130	4880	973	1610	325	188	190	166	300	177	204	589
17	1030	4820	963	1460	355	198	181	164	292	248	205	488
18	1080	4580	965	1300	323	180	175	166	525	362	206	403
19	1910	4230	972	1150	443	166	180	171	665	476	296	411
20	2520	3850	994	1140	543	175	184	161	390	608	427	928
21	2680	3490	1010	1080	466	187	185	150	251	584	346	2267
22	2620	3120	978	952	457	189	182	157	217	445	271	3010
23	2530	2810	943	878	427	189	175	160	231	387	229	3111
24	2380	2590	888	830	342	200	169	159	221	368	209	3052
25	2180	2460	826	755	309	199	171	155	199	309	207	2897
26	1930	2280	784	694	370	193	169	162	193	265	210	2558
27	1670	2090	761	643	374	213	169	155	177	252	222	1979
28	1450	1880	778	604	317	343	174	152	163	247	231	1460
29	1270	—	764	561	265	305	183	161	180	235	218	1170
30	1120	—	713	532	237	240	173	168	188	219	200	1011
31	992	—	658	—	252	—	156	161	—	205	—	891
Mean	1600	2361	1004	1282	357	207	193	179	250	259	221	1044
Max	2680	4880	1670	2660	543	343	264	266	665	608	427	3111
Min	992	583	658	532	233	166	156	150	161	168	177	181
Ac-Ft	98384	131101	61737	76294	21955	12339	11837	11000	14854	15951	13125	64178

[†]All 2019 data are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — FRMO

Q IN cfs	10 < Q < 100	100 < Q ≤ 150	150 < Q ≤ 180	180 < Q ≤ 200	200 < Q ≤ 250	250 < Q ≤ 350	350 < Q ≤ 600	600 < Q ≤ 1,000	1,000 < Q ≤ 1800	1,800 < Q ≤ 3,000	3,000 < Q ≤ 5,000	5,000 < Q ≤ 13,000	13,000 < Q ≤ 30,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.21%	4.6%	10.7%	8.5%	11.9%	8.7%	9.9%	9.9%	11.7%	9.8%	9.2%	4.6%	0.11%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1989–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — FRMO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1989	3026	1135	3117	1154	332	157	169	186	149	185	223	390
1990	2923	5460	2514	552	406	417	203	174	164	224	419	968
1991	1349	2031	1940	2464	620	283	197	192	178	180	343	1020
1992	1184	3089	774	720	306	152	141	133	137	150	288	1763
1993	1618	723	1651	2111	938	450	200	155	202	193	217	799
1994	1797	969	1802	852	327	173	152	136	138	133	1349	3782
1995	3978	4361	2952	1296	590	264	186	180	170	215	1137	5537
1996	3520	5746	1421	2046	1794	379	200	200	196	299	600	5701
1997	4071	2127	3652	991	492	394	193	190	283	695	2069	2701
1998	5248	3584	2539	949	584	378	206	172	187	228	418	5136
1999	6113	8123	2929	1356	553	265	198	178	184	197	851	2802
2000	3002	1998	1870	503	370	252	172	172	205	255	207	375
2001	380	515	410	356	261	170	125	113	100	135	610	4827
2002	3552	2708	1803	850	299	186	148	130	166	170	172	1238
2003	2530	2870	3050	1790	535	207	148	169	170	219	219	1350
2004	2430	2555	1150	644	321	200	172	193	184	266	286	543
2005	920	505	286	1340	1180	344	180	145	144	239	1155	1910
2006	6010	3400	1800	1190	421	301	207	168	170	187	3100	4000
2007	3500	966	2120	823	339	219	190	180	190	223	397	3350
2008	4200	3360	1600	1400	587	263	223	193	204	210	430	361
2009	3830	630	1300	934	898	215	176	176	189	221	1170	1280
2010	3880	2020	1740	2590	930	1220	265	208	224	214	914	4500
2011	4110	1555	4140	2525	1060	450	257	212	193	190	299	497
2012	3560	2000	3720	1840	825	426	239	203	204	331	1455	5200
2013	1690	1105	1300	827	375	353	203	190	252	288	554	538
2014	731	3385	3550	1965	898	297	219	187	187	277	759	2670
2015	1910	2805	1660	777	307	202	178	173	183	169	793	8310
2016	4760	3020	3490	777	280	206	182	170	199	1170	1725	4060
2017	2860	7270	4550	2655	1070	334	198	167	182	222	2115	1610
2018	2960	1390	1710	2375	376	213	188	171	186	186	172	899
2019	1500	2185	978	1045	342	200	185	168	196	203	203	589
median	2892	2270	1940	1080	488	255	191	176	185	211	550	2051

KEY

Q in cfs

Q ≤ 150
150 < Q ≤ 167
167 < Q ≤ 179
179 < Q ≤ 190
190 < Q ≤ 219
219 < Q ≤ 287
287 < Q ≤ 462
462 < Q ≤ 1700
1700 < Q ≤ 3572
3572< Q ≤4880
Q > 4880

Q as percentile

Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

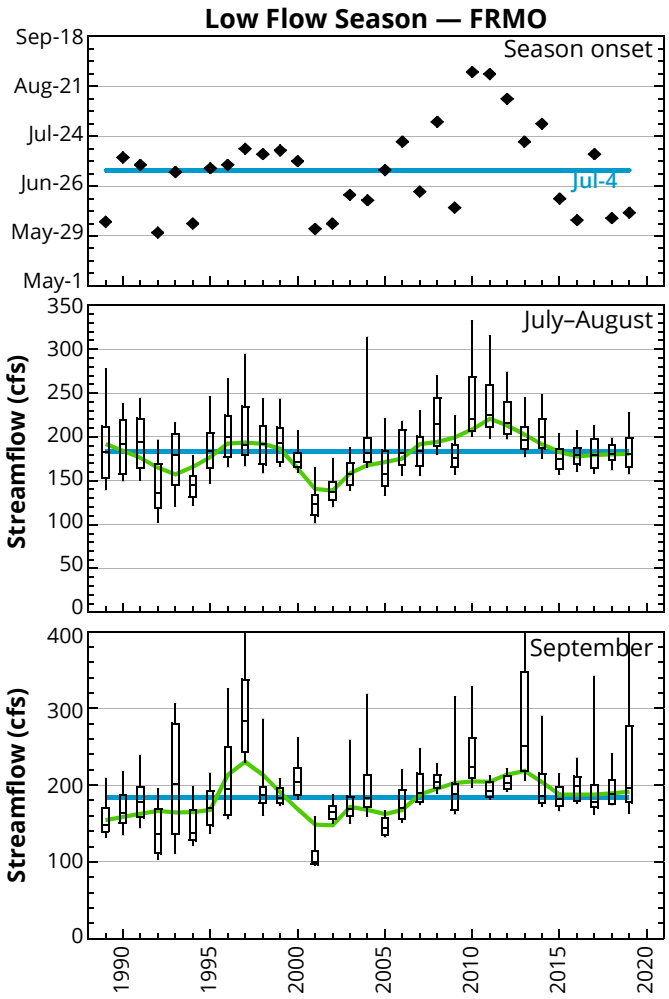
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. High flow records were set on August 12 and September 10–11, but the flows were not exceptional. They occurred on days with low high-flow records.
- Prolonged dry weather in November through mid-December led to lower than normal flows.

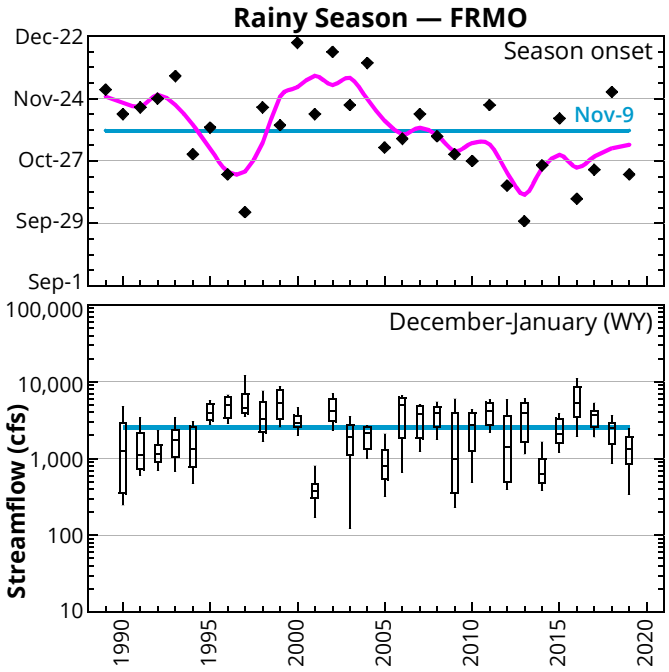
LOW FLOW

- July through September are the months with the lowest average flow. The lowest daily flow can occur June through October.
- Low flow criterion is: 7d-Q ≤ 200 cfs (~24th pctl)
- In 2011, low flow was delayed until 8/27 because Joint Water Commission was releasing more water than usual from Barney Reservoir so that repairs could be done on Eldon Mills Dam.
- No trends are evident in the magnitude over time for July–September.
- A few years had higher or lower flow than usual that can be explained by weather or other factors.
  - —1997: September rainfall was higher than usual.
  - —2001: Hagg Lake did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.

RAINY SEASON FLOW

- December through March are the months with the highest average and the highest daily flows.
- Rainy season criterion: 7d-Q ≥ 350 cfs (~44th pctl)
- The onset of rainy season appears to be occurring earlier. The trend is highly variable, yet statistically significant. Since 2005, rainy season onset occurred before November 9 (the POR mean) 11 out of 15 years (73%). For 1989–2004, rainy season onset occurred before November 9, only 3 out of 16 years (19%).
- Rainy season onset should be interpreted with caution. In 2019, rainy season onset was on October 21, but high flow only lasted seven days. Persistent high flow did not occur until December 11.
- No trends are evident for the magnitude of the December–January rainy season flow.





WSLO — TUALATIN RIVER AT WEST LINN, OREG. — 14207500

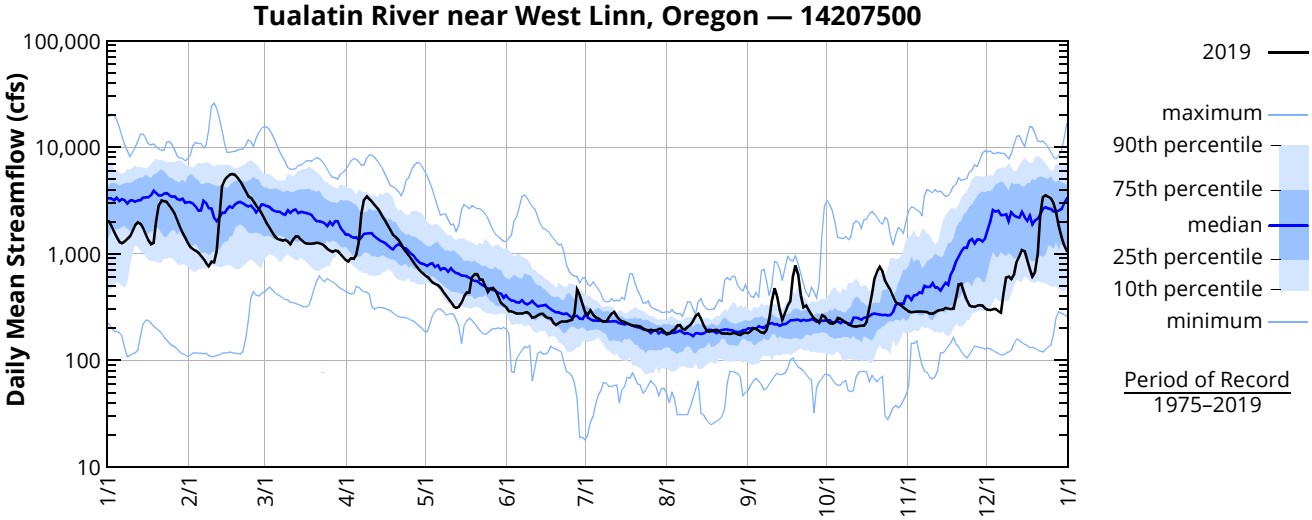
Data source: U.S. Geological Survey, Oregon Water Science Center

River Mile: 1.75 *Latitude:* 45 21 03 *Longitude:* 122 04 30 *Drainage area:* 706.00 sq mile *Datum:* 85.61 ft

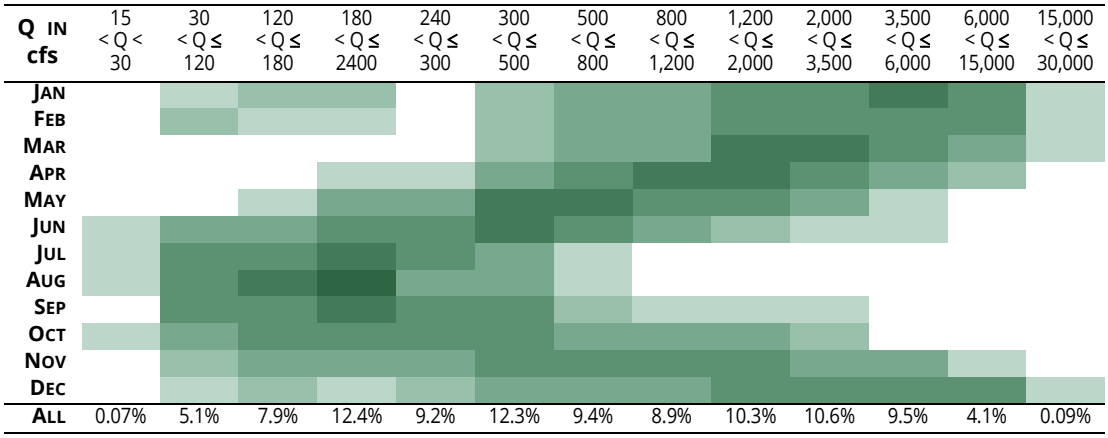
2019 — MEAN STREAMFLOW† (cfs) — WSLO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2010	1150	2150	877	634	316	283	175	180	236	286	298
2	1830	1100	1930	851	608	288	268	178	190	223	283	296
3	1590	1070	1750	906	575	289	295	190	200	220	284	302
4	1420	1030	1590	897	543	283	268	195	198	229	287	304
5	1290	963	1460	979	522	276	253	213	190	250	286	291
6	1260	898	1390	1280	510	275	248	215	183	247	286	281
7	1300	822	1360	2370	482	275	238	196	181	238	285	426
8	1380	764	1330	3200	443	280e	231	195	194	228	284	600
9	1450	840	1360	3440	413	282e	232	206	243	218	275	615
10	1640	831	1310	3260	382	272e	254	216	356	213	274	579
11	1850	1050	1230	3090	352	252e	273	234	474	208	283	644
12	1970	2180	1370	2890	322	255	284	262	396	207	293	846
13	1920	4350	1450	2690	312	266	260	273	296	210	297	953
14	1740	4930	1450	2460	317	273	241	245	241	212	298	1090
15	1530	5240	1360	2220	350	273	232	213	285	211	311	1060
16	1350	5520	1290	2040	400	256	230	193	329	228	306	875
17	1230	5610	1250	1850	433	250	223	186	361	312	304	724
18	1270	5460	1240	1660	432	248	217	188	607	416	306	615
19	2020	5150	1240	1490	599	224	211	192	778	593	391	671
20	2850	4770	1250	1430	644	215	211	194	629	683	517	998
21	3160	4300	1270	1360	645	225	210	185	406	752	523	2350
22	3100	3830	1260	1230	572	232	208	179	315	682	440	3390
23	3070	3460	1230	1110	573	231	200	178	328	558	367	3550
24	2840	3350	1180	1040	497	232	193	179	292	501	330	3430
25	2610	3090	1120	968	436	236	191	177	267	459	320	3280
26	2350	2850	1070	889	471	240	193	181	248	396	319	2990
27	2060	2630	1040	811	481	278	191	181	239	352	326	2470
28	1790	2390	1070	757	453	463	191	175	227	341	329	1850
29	1580	—	1060	709	395	411	198	173	267	327	328	1440
30	1400	—	1000	664	346	338	197	180	258	314	309	1210
31	1260	—	932	—	329	—	187	182	—	298	—	1070
Mean	1875	2844	1322	1647	467	274	229	198	312	341	324	1274
Max	3160	5610	2150	3440	645	463	295	273	778	752	523	3550
Min	1230	764	932	664	312	215	187	173	180	207	274	281
Ac-Ft	115279	157940	81306	98019	28703	16332	14104	12157	18561	20949	19293	78343

† Data after Nov 18, 2019 are provisional—subject to revision; e=estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — WSLO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1975–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — WSLO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	5390	4570	3560	946	737	235	213	298	387	232	1070	3330
1976	4920	1585	3090	1255	441	247	161	176	232	213	144	132
1977	164	118	1000	306	219	161	61	37	172	150	850	4240
1978	4470	3470	1300	1035	959	347	142	128	376	268	197	905
1979	852	4435	2040	695	600	142	89	117	191	238	622	2820
1980	4450	2740	2600	1950	483	318	125	89	220	163	588	3220
1981	1390	2035	1120	1465	557	510	153	184	195	382	1785	6660
1982	4250	4765	3400	3005	598	193	99	124	184	264	780	5260
1983	4070	6610	5470	2045	609	282	254	128	267	272	3040	3380
1984	2510	3375	2440	1620	1210	757	259	133	182	333	2710	2470
1985	964	1575	964	895	345	323	128	142	143	100	431	666
1986	2080	2980	2250	618	640	182	159	78	89	100	335	1540
1987	3630	3525	5000	840	329	183	178	111	79	72	138	1830
1988	2900	1245	866	1235	735	389	147	122	117	118	688	1150
1989	3060	1235	3540	1325	441	229	135	160	117	189	228	432
1990	3320	6530	2580	582	389	411	174	135	130	203	460	1220
1991	1620	2170	2080	3055	676	339	244	147	131	139	377	1140
1992	1350	3765	882	821	330	143	110	84	96	110	306	2230
1993	2010	917	2010	2495	1200	580	235	141	177	172	196	932
1994	2010	1015	1960	966	337	205	135	126	124	113	1560	4200
1995	5030	5410	3390	1550	769	302	177	151	155	265	1365	6620
1996	4320	6930	1750	2395	2280	443	264	233	257	474	799	6440
1997	5060	2445	4680	1305	682	549	235	226	374	867	2340	3250
1998	6170	4375	3100	1150	798	569	280	212	251	340	673	5890
1999	6790	8685	3740	1745	805	416	262	230	240	261	1085	3470
2000	3910	2525	2300	758	590	385	221	212	268	367	285	596
2001	543	709	603	564	425	250	150	130	128	201	934	5430
2002	4770	3715	2440	1150	511	296	234	158	204	225	264	1610
2003	3250	3960	4140	2385	766	311	173	188	215	285	288	1740
2004	3020	3165	1350	840	432	263	178	198	228	363	358	712
2005	1030	706	436	1520	1380	485	234	171	188	282	1330	1910
2006	8630	4175	2150	1505	578	389	235	195	219	239	3500	5410
2007	3980	1140	2440	1005	454	282	235	237	248	319	482	4380
2008	4930	3855	1880	1550	692	351	261	225	242	260	603	537
2009	4380	742	1490	1110	1050	292	216	215	222	249	1230	1470
2010	4680	2300	2050	3115	1120	1490	326	245	290	289	1028	5510
2011	4930	1915	5200	2925	1320	573	341	249	254	284	439	618
2012	3890	2210	4390	2205	1020	511	278	228	237	451	1425	5990
2013	1650	1070	1250	853	436	459	245	208	293	330	626	554
2014	798	3945	4040	2280	985	347	255	199	209	329	897	2690
2015	2000	3085	1840	930	362	218	202	188	218	213	907	8020
2016	5350	3290	3880	1065	433	280	228	208	257	1210	1820	4480
2017	2980	7800	5090	2760	1230	450	242	212	238	310	2190	1810
2018	3310	1675	2070	2985	476	282	222	195	221	247	272	1020
2019	1740	2740	1270	1320	453	273	230	190	267	250	305	875
median	3320	2755	2260	1240	603	315	213	187	221	259	659	2410

KEY

Q in cfs

$Q \leq 118$
$118 < Q \leq 157$
$157 < Q \leq 191$
$191 < Q \leq 214$
$214 < Q \leq 264$
$264 < Q \leq 361$
$361 < Q \leq 576$
$576 < Q \leq 1910$
$1910 < Q \leq 4210$
$4210 < Q \leq 5660$
$Q > 5660$

Q as percentile

$Q \leq 5$th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

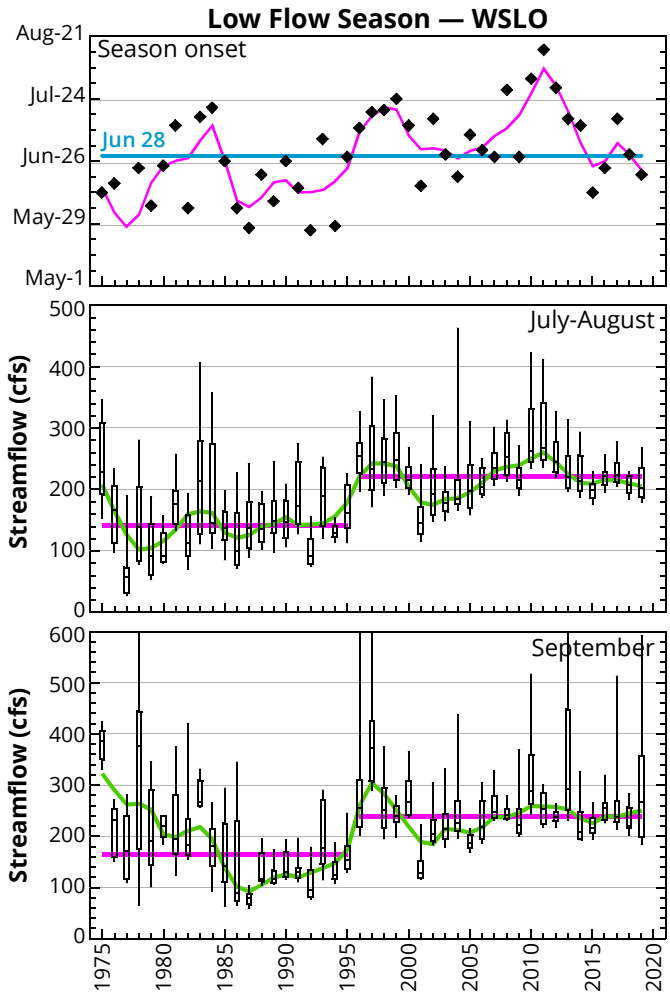
- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. No high or low flow records were set in 2019.
- Prolonged dry weather in November through mid-December led to lower than normal flows.

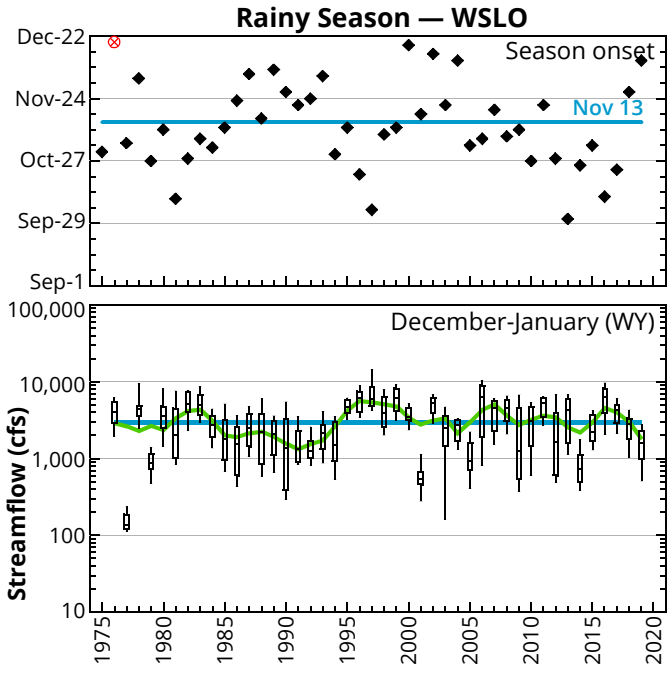
LOW FLOW

- July through September are the months with the lowest average flow. The lowest daily flows can occur June through October.
- Low flow criterion is: 7d-Q ≤ 250 cfs (~28th pctl)
- The onset of low flow has become later over the POR. The trend is statistically significant. As natural flow decreases in the spring, a greater fraction of the flow is effluent from the WWTFs. WWTF discharges have increased over time which may account for an apparent delay of low flow conditions.
- Flows in July-August and September are higher since 1995 compared to 1995 and before. The difference is statistically significant despite year-to-year variability. The difference is likely due to a reduction of about 40 cfs in the diversion of water into the Oswego Canal that occurred at that time.
- A few years had higher or lower flow than usual that can be explained by weather or other factors.
  - —1997: September rainfall was higher than usual.
  - —2001: Hagg Lake did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.

RAINY SEASON FLOW

- December through March are the months with the highest average flow and the highest daily flows.
- Rainy season criterion: 7d-Q ≥ 500 cfs (~47th pctl)
- The onset of rainy season flow for 1976 did not occur until the following March (3/3/1977).
- No trends are evident in the magnitude of the flow in the December–January rainy season.
- Water year 1977 was a drought year which accounts for the low December-January flow.





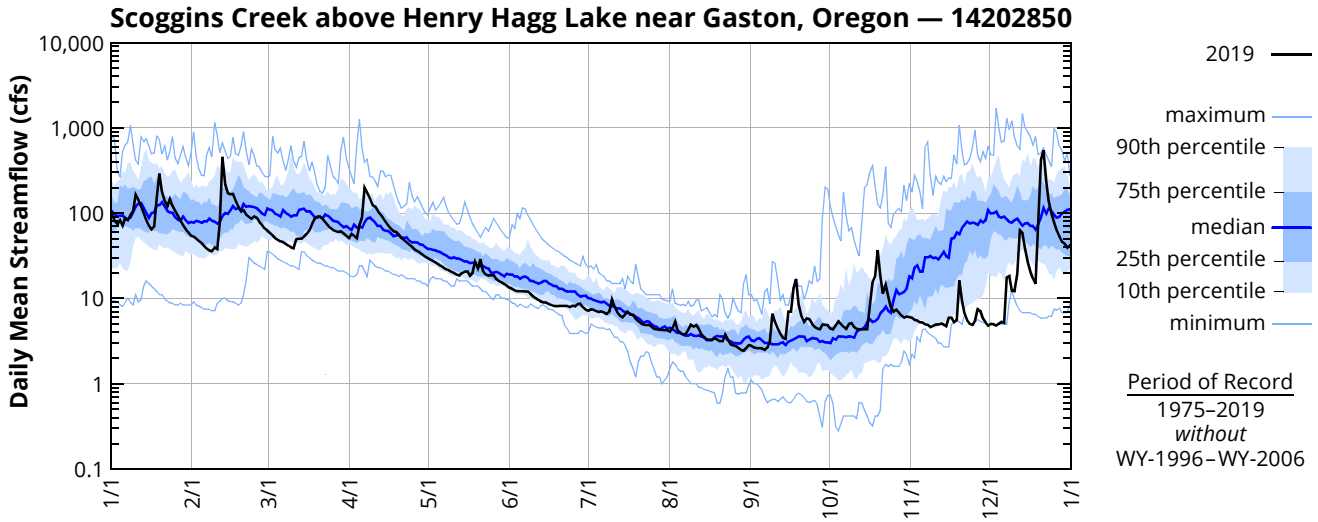
SCLO – Scoggins Creek above Henry Hagg Lake near Gaston, Oregon – 14202850

Data source: Oregon Water Resources Department
River Mile: 9.3 *Latitude:* 45 30 06 *Longitude:* 123 15 60

2019 — MEAN STREAMFLOW[†] (cfs) — SCLO

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	95.9	53.3	62.9	51.0	29.7	13.4	7.2	4.1	2.8	4.4	5.9	5.0
2	81.8	50.1	58.7	56.8	28.5	13.0	7.5	4.5	2.7	4.3	5.6	5.0
3	74.3	47.0	54.8	54.2	27.6	12.5	7.4	5.4	2.6	4.9	5.5	4.8
4	82.3	44.4	51.1	50.4	26.5	12.1	7.1	4.2	2.6	5.4	5.3	5.1
5	71.6	41.3	48.6	72.5	25.3	12.1	6.9	3.9	2.6	5.0	5.2	5.3
6	86.7	38.4	46.8	88.5	24.0	12.1	7.0	3.8	2.5	4.7	4.9	5.2
7	82.9	36.5	46.0	197	22.9	12.0	6.9	3.8	2.7	4.4	4.9	17.7
8	95.6	35.7	43.7	173	22.1	12.0	6.6	4.3	3.1	5.0	4.6	18.4
9	106	39.7	41.8	147	21.5	11.3	7.1	4.9	6.6	5.1	4.8	12.3
10	164	38.0	39.5	124	20.6	10.6	9.7	4.7	5.3	4.6	4.9	12.2
11	144	78.3	38.7	120	19.8	10.1	7.9	4.9	4.4	4.4	4.9	19.6
12	119	457	49.5	106	19.1	9.6	6.9	4.4	3.8	4.3	5.1	62.5
13	99.0	216	50.2	96.8	18.5	9.1	6.3	3.8	3.5	4.3	4.9	58.7
14	82.9	172	50.1	87.0	19.9	9.0	6.0	3.5	3.4	4.3	4.7	38.5
15	71.5	166	53.1	79.3	20.5	9.0	6.5	3.3	7.0	4.3	5.9	26.5
16	64.3	167	57.0	72.0	20.8	8.6	7.0	3.3	7.0	7.6	5.9	20.6
17	69.9	140	63.3	66.2	18.4	8.4	6.5	3.3	13.1	15.8	5.3	17.1
18	152	118	74.9	61.1	19.7	8.2	6.4	3.5	16.9	18.6	5.6	14.8
19	291	105	86.0	60.0	26.9	8.1	5.7	3.3	8.5	36.9	16.3	56.3
20	179	108	90.8	56.1	22.4	8.2	5.4	3.2	6.2	18.7	9.6	423
21	137	96.0	90.8	50.9	28.9	8.2	5.1	3.2	5.3	11.4	6.7	545
22	121	90.1	85.7	47.8	20.9	8.2	5.0	3.8	5.8	14.4	5.6	245
23	146	86.4	79.4	45.2	19.2	8.2	4.9	3.3	5.7	10.5	5.0	139
24	121	91.6	72.4	42.4	18.6	7.9	4.9	2.9	5.0	7.8	4.9	98.6
25	106	88.4	67.3	40.2	18.7	8.2	4.7	2.8	4.7	7.0	5.5	77.8
26	92.5	78.9	63.2	37.7	18.7	8.1	4.4	2.8	4.5	7.4	7.5	62.5
27	81.3	72.4	61.5	35.9	16.8	8.6	4.4	2.6	4.4	6.8	7.1	53.4
28	72.0	65.7	60.1	34.3	16.0	8.7	4.3	2.5	5.0	6.3	5.8	46.5
29	65.1	—	61.1	32.6	15.5	7.9	4.3	2.4	4.9	6.0	5.2	43.4
30	59.3	—	57.8	31.2	14.8	7.3	4.2	2.6	4.9	6.1	4.8	39.2
31	54.5	—	54.0	—	14.1	—	4.3	2.9	—	6.0	—	41.9
Mean	105	101	60.0	73.9	21.2	9.7	6.1	3.6	5.2	8.3	5.9	71.6
Max	291	457	90.8	197	29.7	13.4	9.7	5.4	16.9	36.9	16.3	545
Min	54.5	35.7	38.7	31.2	14.1	7.3	4.2	2.4	2.5	4.3	4.6	4.8
Ac-Ft	6485	5596	3691	4398	1303	576	374	222	312	510	353	4405

[†]All 2019 data are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — SCLO

Q IN cfs	0.1 < Q < 0.5	0.5 < Q ≤ 2	2 < Q ≤ 4	4 < Q ≤ 6	6 < Q ≤ 10	10 < Q ≤ 20	20 < Q ≤ 35	35 < Q ≤ 60	60 < Q ≤ 85	85 < Q ≤ 130	130 < Q ≤ 250	250 < Q ≤ 1,000	1,000 < Q ≤ 2,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.14%	3.3%	11.8%	8.6%	9.0%	11.5%	9.9%	12.7%	9.2%	10.2%	9.5%	4.2%	0.07%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1975–2019
without
WY-1996–WY-2006

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — SCLO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	179	133	123	53	33	11	5.4	3.0	1.9	4.9	79	147
1976	164	92	129	60	21	12	5.7	3.8	2.4	2.2	5.9	6.8
1977	9.1	9.1	59	21	16	12	4.5	1.5	4.5	6.2	72	144
1978	163	122	55	51	46	17	5.7	1.6	3.8	1.8	6.7	45
1979	31	190	68	37	29	11	4.0	3.0	2.8	4.0	24	127
1980	151	125	93	67	21	15	6.2	3.4	3.2	2.2	40	117
1981	59	106	51	69	26	24	8.4	3.6	2.2	20	96	215
1982	147	202	131	110	33	14	7.9	4.1	3.8	11	50	211
1983	158	304	160	74	29	12	11	3.3	5.9	5.3	154	96
1984	102	132	102	66	68	31	12	6.3	5.2	11	135	94
1985	44	79	69	67	24	19	7.4	3.7	4.4	8.4	29	47
1986	124	138	93	39	35	13	9.1	2.3	4.4	5.5	34	65
1987	117	114	154	43	19	9.7	5.8	2.3	2.1	4.7	15	75
1988	98	72	43	50	26	16	7.8	2.9	1.8	3.5	53	54
1989	121	51	136	53	19	8.4	3.7	1.8	0.7	0.6	11	17
1990	80	172	109	35	22	19	5.1	3.0	3.0	4.6	21	41
1991	68	102	82	78	30	15	9.1	4.3	2.2	1.2	11	46
1992	70	91	32	40	16	8.1	2.4	1.1	1.7	3.1	16	80
1993	67	45	71	94	44	25	9.8	5.1	2.8	3.5	5.0	37
1994	71	63	74	44	20	12	5.5	2.4	1.5	2.3	77	183
1995	153	121	120	57	26	13	7.4	3.5	3.9			
1996–2005												
2006										2.5	187	150
2007	86	64	104	44	21	10	5.1	3.2	2.9	10	29	178
2008	139	112	107	85	39	19	7.2	4.6	3.4	6.2	40	39
2009	129	40	92	54	52	17	6.6	4.4	3.7	9.8	104	90
2010	202	90	81	99	41	41	12	6.1	7.5	9.7	81	189
2011	105	69	175	118	45	24	13	6.6	4.1	8.3	24	39
2012	125	90	150	78	44	22	9.6	4.9	3.3	7.0	94	200
2013	75	69	64	44	21	18	6.9	4.8	4.7	19	33	27
2014	35	111	136	75	50	16	7.5	3.9	2.9	8.2	60	126
2015	84	73	50	32	16	7.8	4.2	2.6	3.0	3.8	52	331
2016	177	137	165	44	17	11	5.4	2.9	3.0	80	110	130
2017	76	225	210	104	44	19	6.9	3.7	3.2	4.4	129	64
2018	147	64	87	90	22	12	4.6	2.7	2.8	3.2	7.0	74
2019	93	83	58	58	21	8.8	6.4	3.5	4.8	6.0	5.3	38
median	97	97	93	58	28	14	6.7	3.5	3.1	5.3	42	90

KEY

Q in cfs

Q ≤ 2.3
2.3 < Q ≤ 3.1
3.1 < Q ≤ 3.9
3.9 < Q ≤ 5.0
5.0 Q ≤ 8.5
8.5< Q ≤ 16
16 < Q ≤ 28
28 < Q ≤ 81
81 < Q ≤ 161
161 < Q ≤ 233
Q > 233

Q as percentile

Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. Storms led to record high flow on September 17–18. Ten days with record low flow in November and early December occurred due to dry weather.

DATA GAP

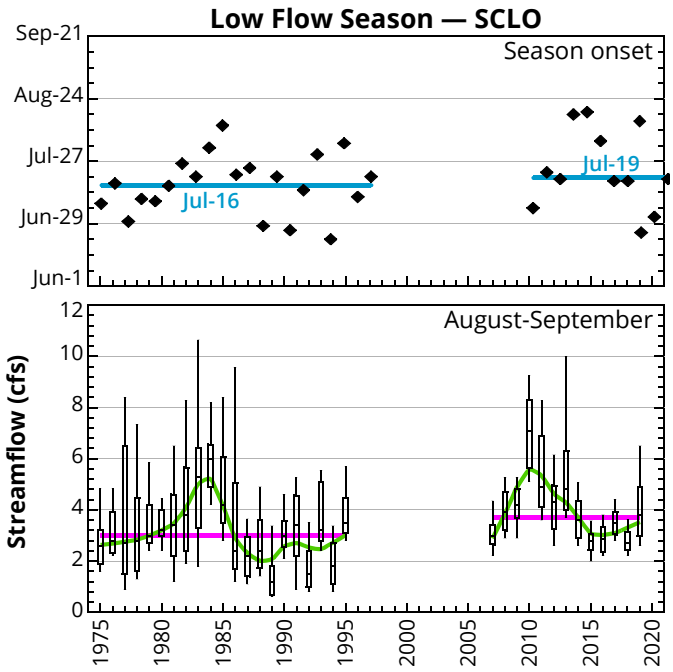
- Data from October-1995 through September-2006 are missing due to issues with OWRD data processing.
- Flows before and after the data gap have a statistically significant difference. Flows from the later period are about 1.25 times those in the earlier period. The factor is the same for both the August–September period and the December–January period.
- The difference may or may not indicate true changes in the flow regime. In particular, the later period may not have adequate representation of dry periods that were better captured by the longer early record.

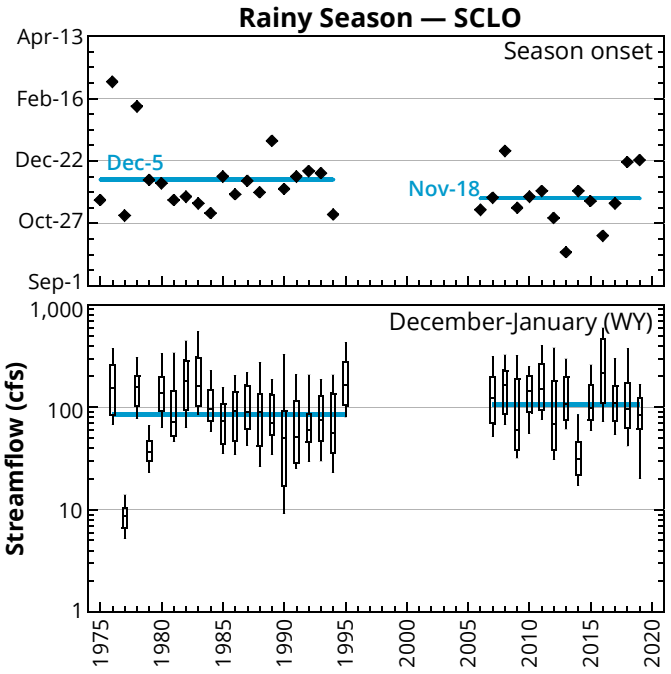
LOW FLOW

- August and September are the months with the lowest average flows. The lowest daily flows occur in September and October.
- Low flow criterion: 7d-Q ≤ 7 cfs (~26th pctl)
- The difference between low flow onset before and after the data gap (1996-2006) is not statistically significant.
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December through February are the months with the highest average flow.
- Rainy season criterion: 7d-Q ≥ 80 cfs (~70th pctl)
- The difference between high flow onset before and after the data gap (1996-2006) is not statistically significant.
- Water year 1977 was a drought year which accounts for the low December-1976 to January-1977 flow.





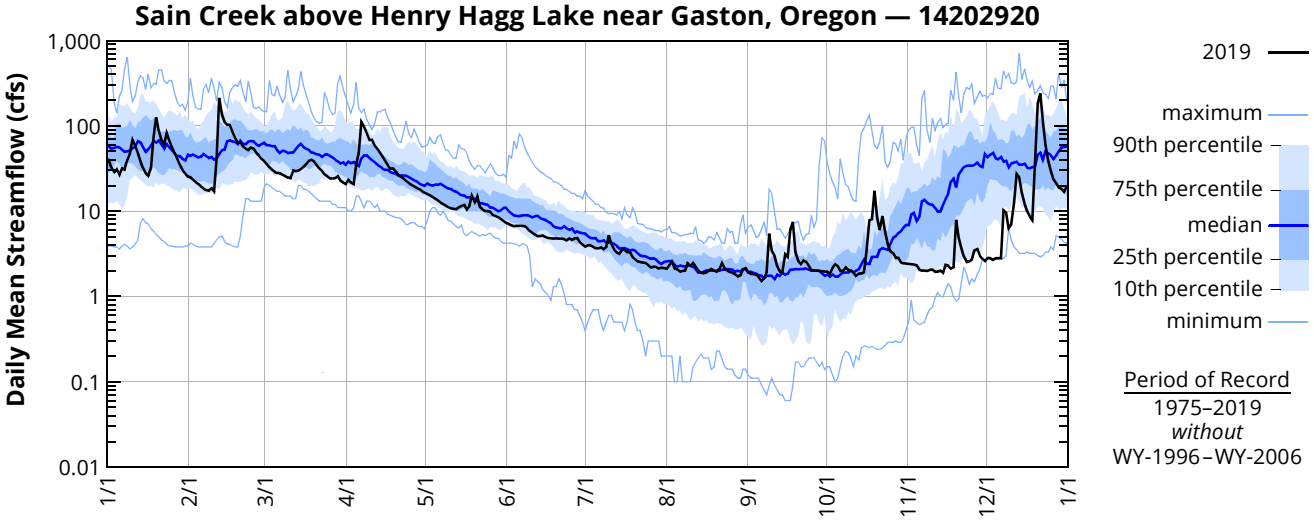
SCHO – Sain Creek above Henry Hagg Lake near Gaston, Oregon – 14202920

Data source: Oregon Water Resources Department
River Mile: 1.6 *Latitude:* 45 28 50 *Longitude:* 123 14 40

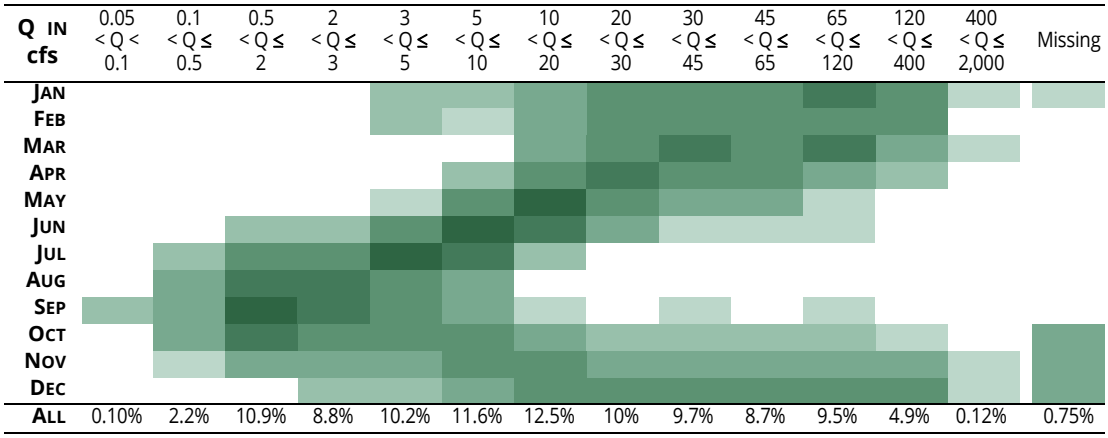
2019 — MEAN STREAMFLOW† (cfs) — SCHO

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	39.6	24.9	38.6	20.8	16.5	7.3	3.8	2.1	1.9	2.0	2.4	2.8
2	32.3	23.2	35.7	23.3	15.9	7.1	4.0	2.4	1.8	1.8	2.4	2.8
3	28.6	22.0	32.7	21.8	15.4	6.8	4.0	2.6	1.8	2.2	2.4	2.7
4	30.9	20.8	30.3	20.8	14.7	6.7	3.8	2.1	1.8	2.4	2.3	2.8
5	26.7	19.4	28.8	35.2	14.1	6.7	3.7	2.1	1.7	2.3	2.1	2.8
6	31.8	18.3	28.0	48.0	13.3	6.7	3.7	2.0e	1.5	2.0	2.0	2.8
7	30.8	17.6	27.8	110	12.6	6.7	3.8	2.0e	1.7	2.0	2.0	10.2
8	40.0	17.4	26.8	97.8	12.2	6.6	3.6	2.0e	1.9	2.2	2.0	9.5
9	47.5	18.6	25.9	81.7	11.7	6.3	3.8	2.4	5.5	2.0	2.1	6.3
10	68.3	17.1	24.7	67.9	11.2	5.8	5.2	2.3	3.4	2.0	2.1	7.0
11	58.8	41.9	24.3	68.5	10.8	5.6	4.1	2.5	3.0	1.9	1.9	12.6
12	47.6	213	29.8	59.4	10.6	5.3	3.6	2.2	2.2	1.7	2.0	27.4
13	38.4	134	29.5	54.0	10.5	5.1	3.3	2.0	2.0	1.9	2.0	25.0
14	31.7	111	29.7	48.1	11.1	5.1	3.2	1.9	1.9	1.9	1.9	16.5
15	28.0	103	31.2	43.3	11.6	5.2	3.5	1.9	3.1	1.9	2.4	12.2
16	26.1	102	33.0	38.7	11.9	5.0	3.6	1.9	2.9	3.4	2.3	9.9
17	32.4	84.9	35.5	34.5	10.4	4.8	3.3	2.0	6.1	7.8	2.1	8.6
18	74.1	70.8	39.2	31.3	11.4	4.8	3.3	2.1	7.4	8.1	2.2	7.8
19	126	63.1	40.1	31.9	15.1	4.7	2.9	2.0	3.3	17.4	7.9	29.0
20	88.2	64.2	38.3	29.5	12.7	4.8	2.7	2.0	2.6	8.5	4.9	183
21	67.3	57.2	34.8	26.5	15.0	4.7	2.6	2.1	2.4	6.0	3.7	239
22	60.2	53.8	31.5	25.1	11.3	4.7	2.5	2.5	2.7	8.8	2.9	113
23	82.4	52.0	29.6	23.9	10.5e	4.7	2.5	2.1	2.6	5.8	2.5	60.4
24	67.0	55.9	27.0	22.5	10.0e	4.6	2.5	2.0	2.3	4.2	2.6	38.4
25	56.3	54.3	25.6	21.4	10.0	4.8	2.3	1.9	2.0	3.4	2.7	29.4
26	47.3	48.6	24.1	20.4	9.8	4.6	2.2	1.9	2.0	3.2	3.5	23.5
27	40.7	44.9	24.2	19.6	9.0	4.8	2.2	1.8	2.0	2.8	3.6	21.2
28	34.6	40.7	24.4	18.8	8.7	4.8	2.2	1.7	2.0	2.8	3.0	18.9
29	30.4	—	25.6	18.1	8.4	4.3	2.1	1.8	2.0	2.5	2.8	18.2
30	27.6	—	22.9	17.2	8.1	4.0	2.2	2.1	2.0	2.4	2.6	16.9
31	25.4	—	21.7	—	7.7	—	2.1	2.1	—	2.4	—	19.4
Mean	47.3	57.0	29.7	39.3	11.7	5.4	3.2	2.1	2.6	3.9	2.7	31.6
Max	126	213	40.1	110	16.5	7.3	5.2	2.6	7.4	17.4	7.9	239
Min	25.4	17.1	21.7	17.2	7.7	4.0	2.1	1.7	1.5	1.7	1.9	2.7
Ac-Ft	2910	3163	1827	2340	718	324	195	128	157	237	161	1944

†All 2019 data are provisional—subject to revision; e=estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — SCHO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1975–2019
without
WY-1996–WY-2006

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — SCHO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	115	86	78	27	16	5.1	1.9	0.80	0.19	2.3	26	70
1976	81	39	65	31	11	6.0	2.8	2.2	1.4	1.6	3.0	3.2
1977	3.9	4.2	30	10	6.9	1.4	0.50	0.60	2.0	2.7	20	70
1978	92	67	38	27	25	13	4.1	1.1	4.1	2.7	2.6	19
1979	17	87	35	19	15	6.4	3.6	2.7	2.4	2.6	10	62
1980	75	57	46	25	8.9	3.9	2.2	1.8	1.7	1.8	14	39
1981	27	55	26	34	12	9.5	2.2	0.19	0.11	10	43	89
1982	83	107	71	66	16	6.5	3.0	1.1	1.2	3.1	17	93
1983	77	157	89	45	17	11	6.5	3.0	4.1	3.0	73	53
1984	52	67	57	36	32	16	6.4	3.7	3.0	5.4	56	51
1985	26	43	29	29	11	7.7	2.4	1.7	1.9	1.9	9.3	20
1986	57	69	44	19	17	6.5	3.0	0.45	0.72	2.2	7.4	28
1987	59	60	81	19	7.4	5.1	3.3	0.51	0.25	0.25	1.3	30
1988	51	38	25	30	16	12	4.7	1.5	0.88	1.7	23	23
1989	68	27	68	34	11	5.7	2.5	1.1	0.61	1.1	3.7	7.1
1990	53	91	57	19	11	9.5	2.0	1.2	1.1	2.1	9.0	24
1991	35	49	43	35	15	7.1	3.5	2.1	1.1	1.1	7.2	23
1992	28	44	18	24	8.9	4.3	1.2	0.76	0.78	1.2	7.5	45
1993	35	21	33	44	21	11	5.2	3.0	1.6	1.2	1.4	16
1994	32	27	35	22	10	5.8	1.7	0.63	0.43	0.29	33	90
1995	82	68	63	31	15	7.8	4.7	4.2	4.1			
1996–2005												
2006										2.1	72	67
2007	51	39	57	29	14	6.7	4.1	2.6	1.9			
2008	72	63	53	50	17	9.7	3.6	2.3	2.0	3.6	21	22
2009	68	21	41	26	30	11	4.8	3.0	2.4	3.5	52	36
2010	119	54	52	62	30	26	8.1	4.3	4.5	4.2	33	125
2011	64	35	117	61	27	13	7.4	3.9	2.6	3.8	7.2	14
2012	85	52	88	40	24	12	5.6	3.2	2.1	2.9	52	118
2013	36	30	31	22	11	8.2	3.9	2.8	2.4	6.6	15	16
2014	20	83	90	51	28	9.5	4.3	2.4	1.8	3.0	18	67
2015	45	49	30	22	8.8	4.5	2.5	1.6	2.0	1.8	23	206
2016	109	83	91	24	10	6.3	3.8	2.1	2.2	39	55	81
2017	51	129	115	68	26	12	5.3	3.0	2.4	3.4	68	37
2018	79	39	51	54	15	7.8	3.4	2.2	2.0	2.2	3.4	30
2019	40	50	30	30	11	5.0	3.3	2.0	2.0	2.4	2.4	17
median	53	54	48	31	15	7.6	3.7	2.2	1.9	2.6	16	41

KEY

Q in cfs

$Q \leq 0.90$
$0.90 < Q \leq 1.6$
$1.6 < Q \leq 2.1$
$2.1 < Q \leq 2.7$
$2.7 < Q \leq 4.3$
$4.4 < Q \leq 7.7$
$7.8 < Q \leq 14$
$14 < Q \leq 41$
$41 < Q \leq 83$
$83 < Q \leq 120$
$Q > 120$

Q as percentile

$Q \leq$ 5th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

- Winter and spring flows in 2019 were somewhat typical, alternating between higher and lower flows due to intermittent storms. Storms led to record high flow on September 17–18. Four days with record low flow in November and early December occurred due to dry weather.

DATA GAP

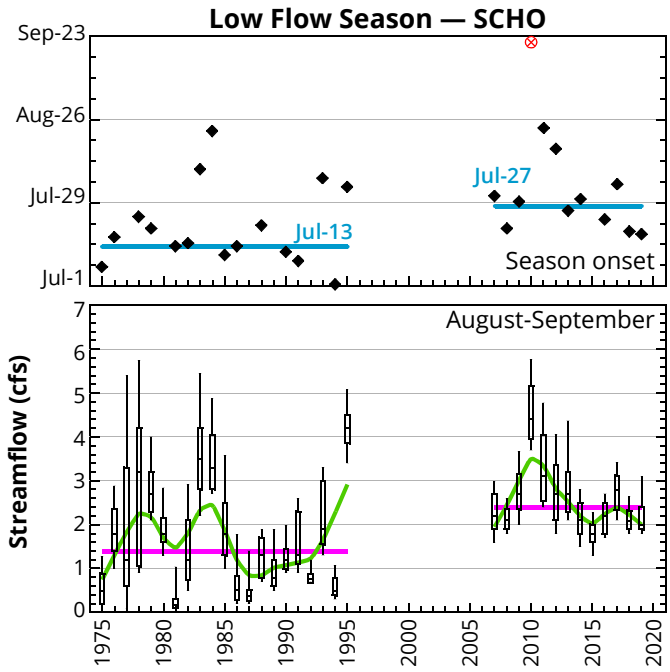
- Data from October-1995 through September-2006 are missing due to issues with OWRD data processing.
- Flows before and after the data gap have a statistically significant difference. Flows from the later period are about 1.7 (August-September) and 1.3 (December January) times those in the earlier period.
- The difference may or may not indicate true changes in the flow regime. In particular, the later period may not have adequate representation of dry periods that were better captured by the longer early record.

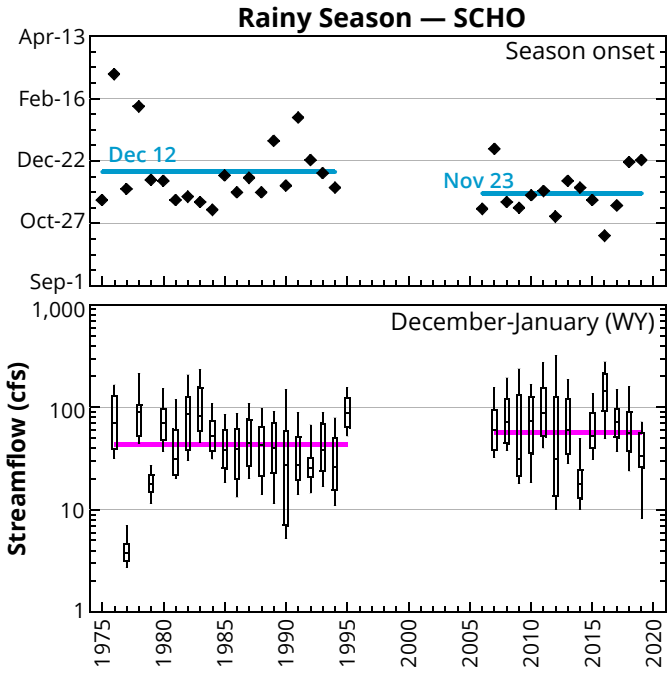
LOW FLOW

- August and September are the months with the lowest average flows.
- Low flow criterion: 7d-Q ≤ 3.5 cfs (~25th pctl)
- Low flow onset after the data gap is later than before, which is consistent with higher flows in the more recent period. The difference is not statistically significant.
- Low flow did not occur in 2010.
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December through February are the months with the highest average flow.
- Rainy season criterion: 7d-Q ≥ 40 cfs (~73th pctl)
- Onset of the rainy season after the data gap is earlier, which is consistent with higher flows in the more recent period. The difference is not statistically significant.
- Water year 1977 was a drought year which accounts for the low December–January flow.





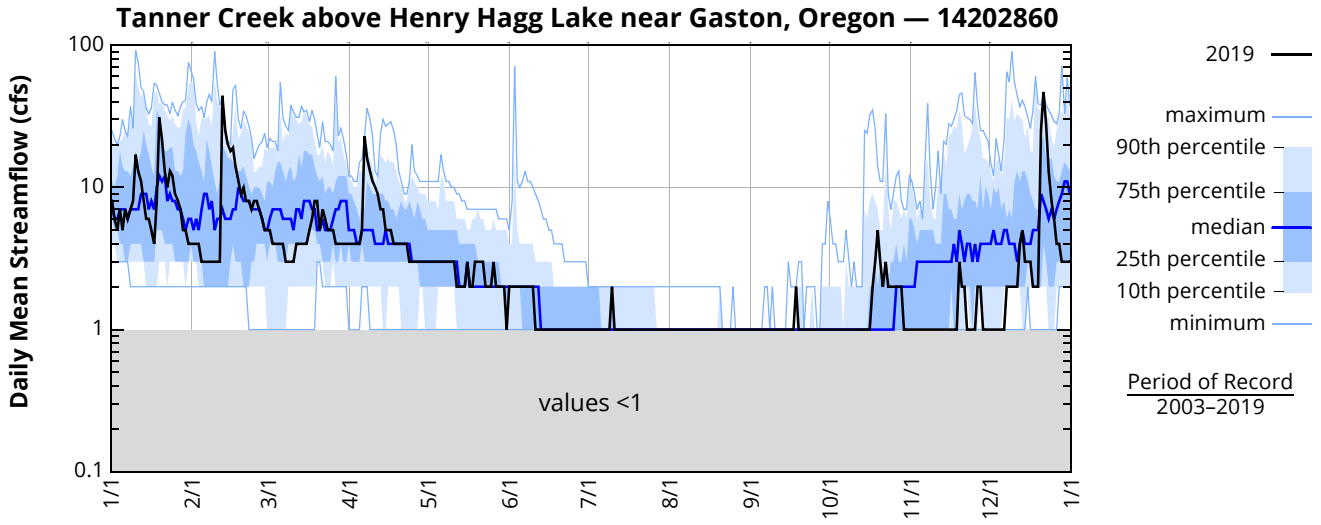
TANO – TANNER CREEK ABOVE HENRY HAGG LAKE NEAR GASTON, OREGON – 14202860

Data source: Oregon Water Resources Department
River mile: 1.6 *Latitude:* 45 30 21 *Longitude:* 123 13 10

2019 — MEAN STREAMFLOW* (cfs) — TANO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	8	4	5	4	3	2	1	1	1	1	1	1
2	6	4	5	4	3	2	1	1	1	1	1	1
3	5	4	4	4	3	2	1	1	1	1	1	1
4	7	3	4	4	3	2	1	1	1	1	1	1
5	5	3	4	4	3	2	1	1	1	1	1	1
6	7	3	4	5	3	2	1	1	1	1	1	1
7	6	3	4	23	3	2	1	1	1	1	1	2
8	7	3	3	16	3	2	1	1	1	1	1	2
9	8	3	3	13	3	2	1	1	1	1	1	2
10	17	3	3	11	3	2	2	1	1	1	1	2
11	13	3	3	10	3	1	1	1	1	1	1	2
12	11	44	4	9	2	1	1	1	1	1	1	4
13	8	25	4	7	2	1	1	1	1	1	1	5
14	6	20	4	7	2	1	1	1	1	1	1	3
15	6	18	4	5	2	1	1	1	1	1	1	3
16	5	19	4	5	3	1	1	1	1	1	1	3
17	4	14	5	5	2	1	1	1	1	2	1	2
18	8	11	6	4	2	1	1	1	2	3	1	2
19	31	9	8	4	3	1	1	1	1	5	3	2
20	22	10	8	4	3	1	1	1	1	3	2	25
21	13	8	5	4	3	1	1	1	1	2	2	47
22	10	8	7	4	3	1	1	1	1	3	1	28
23	13	7	6	4	2	1	1	1	1	2	1	13
24	12	8	5	3	2	1	1	1	1	2	1	8
25	9	8	5	3	2	1	1	1	1	2	1	6
26	8	7	5	3	3	1	1	1	1	2	2	4
27	7	6	4	3	2	1	1	1	1	2	2	4
28	5	5	4	3	2	1	1	1	1	2	1	3
29	5	—	4	3	2	1	1	1	1	1	1	3
30	4	—	4	3	2	1	1	1	1	1	1	3
31	4	—	4	—	1	—	1	1	—	1	—	3
Mean	9	9	5	6	3	1	1	1	1	2	1	6
Max	31	44	8	23	3	2	2	1	2	5	3	47
Min	4	3	3	3	1	1	1	1	1	1	1	1
Ac-Ft	555	522	282	359	155	79	63	61	61	97	71	371

*Values are read from a staff plate. Values may be daily readings taken at about 8:00 a.m. or averages over several days.



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — TANO

Q IN cfs	Q=1	Q=2	Q=3	Q=4	Q=5	6 ≤Q≤ 8	9 ≤Q≤ 14	15 ≤Q≤ 29	30 ≤Q≤ 49	50 ≤Q≤ 79	80 <Q≤ 100	Missing
JAN												
FEB												
MAR												
APR												
MAY												
JUN												
JUL												
AUG												
SEP												
OCT												
NOV												
DEC												
ALL	2.5%	36.2%	15.5%	8.9%	10.7%	8.3%	7.7%	4.7%	1.9%	0.4%	0.05%	3.2%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2003–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — TANO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2003	9	8	11	6	2	1	1	1	1	1	2	7
2004	10	8	4	3	2	1	1	0	1	1	2	2
2005	4	2	1	4	3	1	1	1	1	1	3	6
2006	25	5	3	2	1	1	1	1	0	1	10	9
2007	6	4	5	2	1	1	1	1	1	1	1	
2008	10	12	8	7	4	2	1	1	1	1	2	2
2009		2	5	1	1	0	1	1	1	1	3	2
2010				10	5	5	2	2	1	1		
2011		11	17	11	7	2	1	1	1	1	1	1
2012	5	4		4	2	2	2	1	1	1	6	5
2013	2	2	2	3	2	2	1	1	1	2	4	3
2014	4	6	6	5	4	1	1	1	1	1	4	9
2015	5	7	4	3	2	1	1	1	1	1	5	32
2016	27	19	19	4	2	1	1	1	1	7	9	12
2017	5	23	22	8	3	2	1	1	1	1	12	5
2018	13	5	7	9	3	2	1	1	1	1	1	5
2019	7	7	4	4	3	1	1	1	1	1	1	3
median	7	7	6	4	2	1	1	1	1	1	3	5

KEY

Q in cfs

Q = 0
Q = 1
$1 < Q \leq 2$
$2 < Q \leq 5$
$5 < Q \leq 12$
$12 < Q \leq 19$
Q > 19

Q as percentile

Q ≤ 3rd
3rd < Q ≤ 40th
40th < Q ≤ 56th
56th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

- Winter and spring flows in 2019 were typical, alternating between higher and lower flows due to intermittent storms. Like all sites in the basin, flows in November–mid-December were low due to lack of rainfall.

LOW FLOW

- June through October are the months with the lowest average flows; however, low flow can occur almost any time of year.
- Tanner Creek drains a small watershed and therefore flows tend to be very low overall.
- Low flow measurements have only one significant digit and cannot be distinguished from one another.

RAINY SEASON FLOW

- December through March are the months with the highest average flows. Because some data from these months are missing, the distribution likely under-represents the frequency and range of high flows.

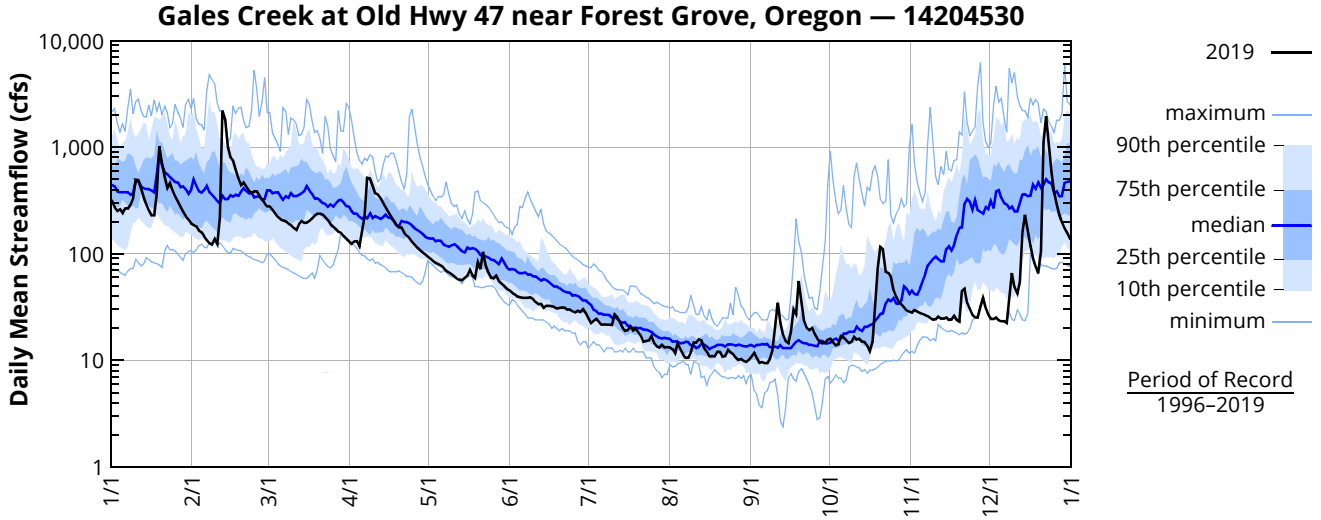
GALES – GALES CREEK AT OLD HWY 47 NEAR FOREST GROVE, OREGON – 14204530

Data source: Oregon Water Resources Department
River Mile: 2.36 *Latitude:* 45 30 39 *Longitude:* 123 06 56

2019 — MEAN STREAMFLOW† (cfs) — GALES

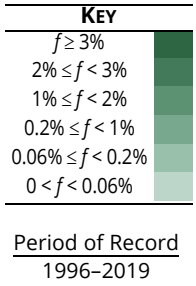
DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	313	186	279	124	89.7	43.1	22.3	12.8	11.8	14.9	29.6	24.4
2	274	181	258	130	85.2	41.6	23.5	11.7	10.5	13.9	28.9	25.4
3	252	166	239	131	82.6	39.7	24.6	14.5	9.5	14.1	27.8	23.8
4	261	159	222	117	80.0	39.1	23.2	12.6	9.7	17.0	27.3	23.3
5	240	145	211	163	77.4	38.6	21.6	11.4	9.4	16.5	26.8	23.3
6	267	135	206	223	73.9	38.6	21.8	10.5	9.4	15.6	26.1	22.3
7	265	127	201	513	69.4	38.7	21.6	10.6	10.3	14.6	24.9	39.4
8	290	122	192	509	66.9	39.0	21.6	11.9	12.4	15.0	24.1	66.1
9	332	138	187	437	64.4	37.7	21.4	14.7	20.3	16.6	24.3	48.7
10	495	123	175	370	61.4	35.2	27.0	14.7	34.9	15.7	25.7	42.3
11	491	216	167	362	58.5	33.6	25.5	15.8	22.5	15.9	24.6	54.3
12	410	2200e	191	333	57.3	33.9	22.5	15.5	17.4	15.0	24.7	158
13	340	1800	202	299	56.5	31.2	20.2	13.0	15.2	14.9	25.3	233
14	291	1010	195	271	59.6	32.5	19.0	12.1	14.5	13.8	24.0	165
15	254	805	196	245	62.8	32.5	19.2	10.9	18.7	12.2	24.2	120
16	229	755	204	224	71.0	32.3	20.9	11.0	29.8	15.0	26.3	91.1
17	230	621	214	203	62.4	31.8	19.1	10.9	26.9	33.4	23.9	75.9
18	367	509	228	185	59.4	30.7	19.9	12.1	55.5	72.8	23.1	65.8
19	1020	440	237	177	83.5	31.0	18.4	12.0	35.4	116	45.0	105
20	709	464	238	177	72.0	31.4	17.0	10.8	23.3	110	47.3	1113
21	522	428	232	157	104	31.1	15.0	11.0	20.1	67.9	34.7	1950
22	415	387	222	147	78.4	29.9	15.2	12.6	19.2	66.3	30.0	1057
23	460	373	208	140	66.1	30.0	15.4	11.9	20.2	61.0	26.6	579
24	394	384	191	130	59.7	28.8	17.0	11.5	17.7	45.9	25.3	379
25	346	385	179	122	58.9	28.2	14.7	10.7	16.1	39.0	25.2	293
26	306	352	170	114	62.1	29.2	13.6	10.1	15.0	35.0	32.0	234
27	274	324	161	108	55.6	28.4	13.2	10.3	14.5	33.6	38.6	199
28	248	297	158	103	52.3	30.2	14.0	9.9	14.8	31.5	31.2	172
29	227	—	147	98.5	49.9	27.7	13.2	9.7	15.7	29.4	26.9	156
30	209	—	139	94.3	47.3	24.8	13.3	10.1	16.1	28.6	24.5	139
31	193	—	131	—	45.5	—	13.2	10.8	—	28.1	—	129
Mean	352	473	199	214	66.89	33.35	18.97	11.88	18.89	33.52	28.30	252
Max	1020	2200	279	513	104	043	027	016	056	116	047	1950
Min	193	122	131	94.3	45.5	24.8	13.2	9.7	9.4	12.2	23.1	22.3
Ac-Ft	21667	26245	12258	12708	4113	1984	1166	730	1124	2061	1684	15485

†All 2019 data are provisional—subject to revision; e=estimated



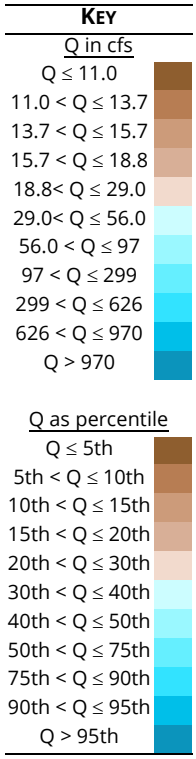
FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — GALES

MONTH	2 < Q < 6	6 < Q ≤ 10	10 < Q ≤ 15	15 < Q ≤ 20	20 < Q ≤ 35	35 < Q ≤ 70	70 < Q ≤ 120	120 < Q ≤ 200	200 < Q ≤ 300	300 < Q ≤ 500	500 < Q ≤ 1,000	1,000 < Q ≤ 4,000	4,000 < Q ≤ 10,000
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.22%	2.9%	9.7%	8.8%	11.7%	10.1%	10.2%	11.1%	10.1%	11.0%	9.2%	4.7%	0.10%



MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — GALES

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1996	634	751	256	336	231	70.1	26.2	12.6	18.1	32.9	87.7	1034
1997	645	356	725	195	97.1	71.5	28.9	15.5	26.3	146	342	314
1998	805	599	403	203	104	55.2	30.4	13.8	15.2	26.0	85.7	742
1999	628	1255	438	246	119	48.3	23.7	18.7	14.4	18.8	175	581
2000	527	337	310		88.3	61.9	26.0	14.2	11.1	15.2	30.7	101
2001	86.1	136	88.9	71.7	75.6	30.5	17.3	15.0	12.9	22.5	140	743
2002	648	474	298	185	78.2	40.3	15.0	7.7	7.6	9.5	67.9	239
2003	385	330	545	282	122	38.2	19.7	11.7	12.1	23.8	43.2	294
2004	431	429	255	168	87.0	45.0	20.6	13.5	20.4	28.5	88.0	141
2005	211	117	80.6	235	133	72.7	26.1	16.7	13.5	28.3	169	281
2006	986	279	279	215	99.1	60.1	21.5	10.0	8.7	10.7	538	512
2007	307	169	344	143	71.4	29.0	17.5	12.7	7.2	22.4	65.9	722
2008	581	465	333	274	119	38.0	15.0	13.0	11.0	15.0	76.5	82.0
2009	403	140	272	182	143	59.5	22.0	13.0	18.0	30.0	243	243
2010	745	321	285	349	146	145	41.0	25.0	28.5	29.0	190	758
2011	459	315	753	401	172	79.0	40.0	21.0	17.0	19.0	49.5	107
2012	461	376	566	275	141	65.5	27.0	16.0	12.0	21.0	271	1040
2013	291	226	233	142	86.0	54.5	20.0	15.0	15.0	65.0	113	116
2014	155	447	430	277	182	57.5	23.0	16.0	13.0	20.0	123	392
2015	283	283	207	150	62.0	22.5	13.0	13.0	14.0	16.0	167	1290
2016	732	518	656	132	60.0	28.0	19.0	10.0	10.0	194	309	578
2017	367	975	750	376	167	61.4	30.0	15.3	13.0	20.7	429	250
2018	485	228	304	328	82.5	39.9	17.4	13.1	15.2	14.2	27.8	211
2019	291	350	202	170	64.4	32.4	19.9	11.7	15.9	16.6	26.5	105
median	441	350	331	208	109	50.1	22.0	14.0	14.0	22.5	118	370

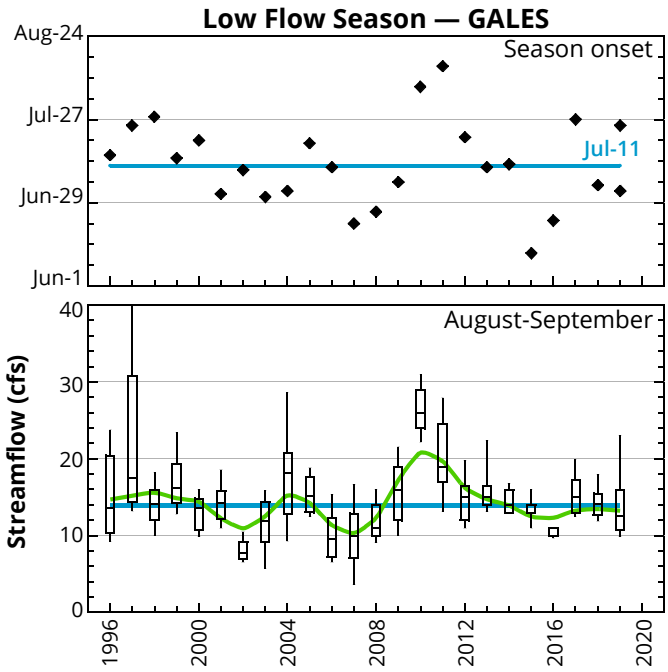


2019

- Except during periods of rainfall, flow in 2019 was below the median for most of the year. Record low flows were set on 23 days, including two long stretches: March 29–April 2 and November 25–December 7.

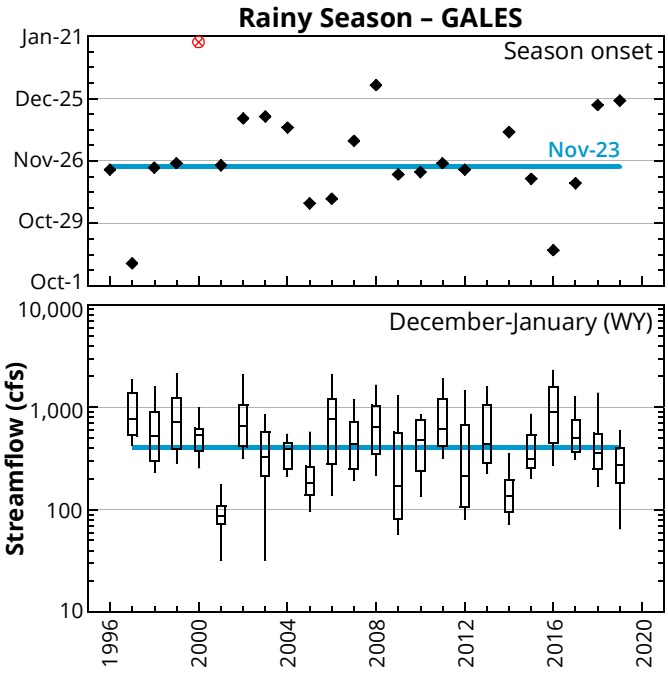
LOW FLOW

- August and September are the months with the lowest average flow and the lowest daily flows.
- Low flow criterion: 7d-Q ≤ 25 cfs (~26th pctl)
- No trends are evident in the magnitude of the flow for August–September.
- Various rates of flow augmentation have supplemented streamflow in Gales Creek during July–October since 2009. The augmentation point is about 2.6 miles upstream of this site. Flow augmentation rates ranged from 0.5–2.0 cfs depending on the year.
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.
- Spring rainfall in both 2010 and 2011 was high, resulting in higher flows that persisted into summer.



RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 300 cfs (~74th pctl)
- No trend is evident in the magnitude of the flow for December–January.
- The fall/winter of 2000-2001 was very dry.
  - —The rainy season criterion was not met in 2000.
  - — Winter flows were low for WY 2001.



5400 – East Fork Dairy Creek near Meacham Corner, Oregon – 14205400

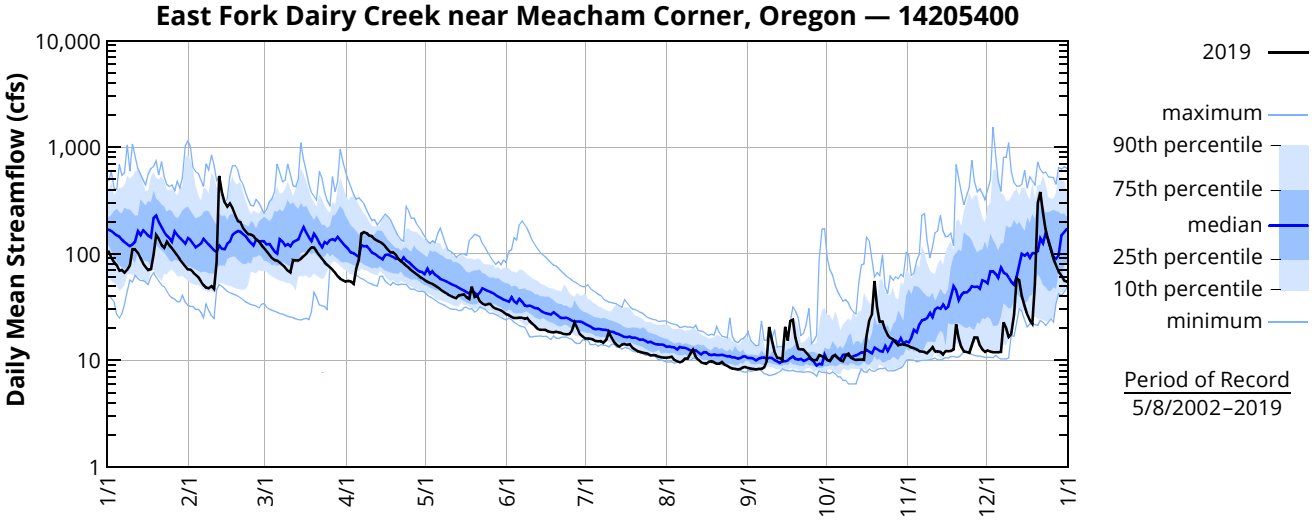
Data source: U.S. Geological Survey, Oregon Water Science Center

River Mile: 12.4 *Latitude:* 45 40 51 *Longitude:* 123 04 12 *Drainage area:* 32.92 sq mile *Datum:* 29.0 ft

2019 — MEAN STREAMFLOW† (cfs) — 5400

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	104	71.1	113	54.8	56.7	27.2	16.0	10.6	8.46	10.1	13.7	12.4
2	91.7	67.6	106	55.6	54.8	26.6	16.1	10.7	8.28	9.89	13.2	12.1
3	82.5	63.3	97.8	54.9	53.4	25.7	15.9	10.8	8.26	10.8	13.0	11.9
4	78.3	60.1	91.2	51.9	52.2	25.0	15.7	10.1	8.23	11.3	12.7	11.9
5	69.3	54.9	87.3	72.4	50.4	25.0	15.2	9.76	8.28	10.5	12.2	11.9
6	70.8	50.7	86.3	87.0	48.5	25.2	15.1	9.61	8.28	10.0	12.1	12.0
7	66.7	48.2	82.3	155	46.2	25.1	15.2	9.84	8.56	9.82	12.0	22.8
8	71.3	47.6	78.1	160	44.5	24.6	14.7	10.4	9.88	11.2	11.7	20.1
9	78.3	49.9	74.3	156	43.2	25.2	15.6	10.4	20.6	11.6	12.4	16.6
10	110	46.7	69.5	147	41.4	23.3	18.4	11.7	15.7	10.7	13.3	17.7
11	110	83.6	66.8	146	40.3	22.0	16.4	12.7	11.9	10.3	12.1	26.9
12	102	535	87.3	138	39.0	20.9e	14.9	10.9	10.5	10.1	12.2	58.7
13	90.6	370	86.8	133	38.2	19.8	14.0	10.2	10.5	10.2	12.0	56.5
14	81.5	302	86.8	129	40.8	19.3	13.5	9.64	9.97	10.2	11.4	40.3
15	75.3	277	89.6	124	41.2	19.4	14.1	9.44	20.7	10.1	12.3	32.2
16	70.2	296	94.6	118	41.6	19.3	14.3	9.31	15.4	17.0	12.2	27.0
17	72.0	268	100	110	39.0	18.7	14.0	9.65	23.5	24.2	12.3	23.8
18	98.3	229	108	103	37.8	18.4	14.2	9.77	24.1	27.3	12.7	22.1
19	149	203	115	103	49.2	18.3	13.1	9.60	16.3	55.5	21.9	51.9
20	138	198	114	98.4	39.3	18.6	12.7	9.27	12.8	31.8	16.2	299
21	121	175	105	89.4	40.1	18.3	12.2	9.29	12.7	23.1	13.3	380
22	114	162	96.9	84.6	35.8	18.0	12.0	9.73	12.7	23.2	12.1	248
23	130	153	90.4	81.3	34.0	17.7	11.8	9.10	11.9	19.5	12.0	172
24	120	152	83.0	76.9	33.1	17.5	11.7	8.87	11.1	17.3	11.8	132
25	113	147	78.8	73.8	33.9	17.7	11.5	8.60	10.3	16.3	13.9	110
26	104	137	74.2	69.7	33.9	19.1	11.1	8.39	9.99	15.8	16.4	90.0
27	96.5	130	71.0	66.8	31.9	22.7	11.2	8.27	10.1	14.8	16.4	77.5
28	88.6	120	66.7	63.8	30.8	20.1	11.1	8.20	11.2	13.9	13.8	68.0
29	82.4	—	61.6	61.3	30.1	17.7	10.8	8.27	11.0	14.1	12.6	62.4
30	76.3	—	58.3	59.1	29.4	16.7	10.7	8.61	10.7	14.2	12.0	56.2
31	71.4	—	56.4	—	28.2	—	10.6	8.72	—	13.9	—	54.9
Mean	94.4	161	86.4	97.5	40.6	21.1	13.7	9.69	12.4	16.1	13.2	72.2
Max	149	535	115	160	56.7	27.2	18.4	12.7	24.1	55.5	21.9	380
Min	66.7	46.7	56.4	51.9	28.2	16.7	10.6	8.20	8.23	9.82	11.4	11.9
Ac-Ft	5806	8921	5310	5799	2497	1256	841	596	738	989	785	4441

† Data after Nov 14, 2019 are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — 5400

Q IN cfs	5 < Q < 7.5	7.5 < Q ≤ 9.5	9.5 < Q ≤ 12	12 < Q ≤ 15.5	15.5 < Q ≤ 22	22 < Q ≤ 35	35 < Q ≤ 55	55 < Q ≤ 80	80 < Q ≤ 110	110 < Q ≤ 170	170 < Q ≤ 300	300 < Q ≤ 1,000	1,000 < Q ≤ 2,000	* Missing
JAN														
FEB														
MAR														
APR														
MAY														
JUN														
JUL														
AUG														
SEP														
OCT														
NOV														
DEC														
ALL	0.23%	5.7%	10.9%	9.3%	9.0%	11.1%	10.5%	9.2%	9.2%	9.6%	8.4%	4.8%	0.12%	1.9%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
5/8/2002–2019

*All the missing values date from January–May, 2002 before the gage was installed. Because higher flows are more common than low flows during those months, the statistics above likely under-represent high flow.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — 5400

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002					39.0	25.6	16.3	11.6	9.7	8.5	12.8	43.6
2003	98.7	142	201	126	59.5	28.4	17.8	12.8	9.9	11.1	15.2	69.3
2004	166	155	90.5	61.2	36.1	25.4	14.0	11.1	11.4	16.7	22.4	52.1
2005	65.6	45.7	29.4	93.5	93.3	39.9	22.1	10.8	10.5	12.5	38.2	82.0
2006	418	131	111	84.2	45.8	35.5	18.4	11.9	9.3	9.8	152	181
2007	148	85.6	126	69.0	38.3	22.5	15.5	10.6	7.9	12.0	19.5	239
2008	228	176	129	102	45.6	27.8	14.3	11.7	8.7	9.0	22.5	22.4
2009	161	56.1	86.7	75.8	64.4	27.6	17.0	11.8	9.0	9.3	45.6	50.6
2010	203	125	123	154	78.5	90.3	31.0	16.8	14.4	13.0	49.1	272
2011	181	109	303	156	85.8	45.8	28.9	17.8	12.9	14.3	26.4	33.0
2012	98.6	160	280	135	67.6	44.2	23.2	13.6	10.3	15.0	61.3	395
2013	120	77.9	89.1	68.1	35.2	31.2	14.8	11.4	10.6	21.7	37.3	44.5
2014	44.5	152	226	131	79.2	33.1	19.5	12.5	9.2	13.6	42.3	142
2015	108	121	93.4	66.4	35.5	16.7	13.0	10.0	10.3	8.7	29.9	260
2016	255	212	218	66.5	32.2	21.1	15.3	10.2	9.8	50.2	86.3	206
2017	146	302	238	150	80.9	40.4	21.0	13.6	10.6	12.6	83.1	82.5
2018	164	101	135	127	44.9	26.1	15.2	9.9	9.2	9.7	12.2	43.6
2019	90.6	142	86.8	88.2	40.1	19.6	14.0	9.6	10.9	13.9	12.4	40.3
median	148	128	132	94.2	50.0	29.4	17.0	11.7	10.2	12.0	32.0	93.2

KEY

Q in cfs

Q ≤ 9.3
9.3 < Q ≤ 10.3
10.3 < Q ≤ 11.4
11.4 < Q ≤ 12.9
12.9< Q ≤ 17.3
17.3< Q ≤ 25.9
25.9 < Q ≤ 39.1
39.1 < Q ≤ 103
103 < Q ≤ 212
212 < Q ≤ 300
Q > 300

Q as percentile

Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

2019

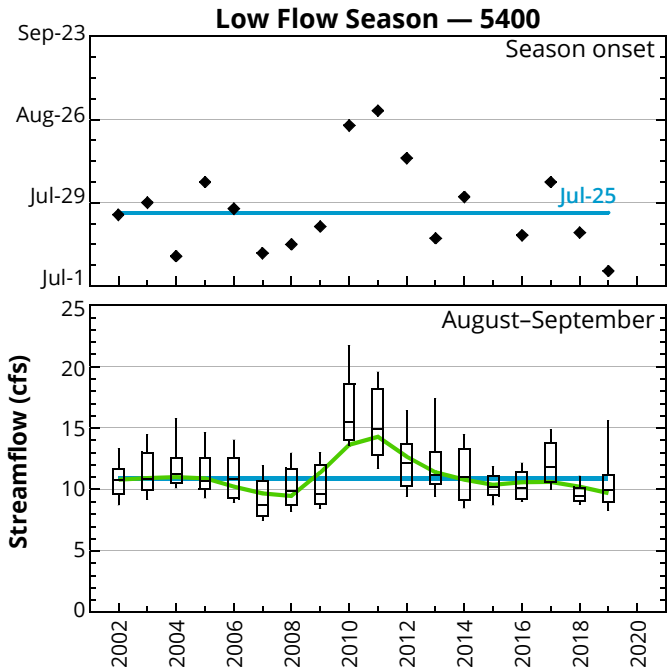
- Except during periods of rainfall, flow in 2019 was below the median for most of the year. Record low flows were set on 27 days, including 10 consecutive days from March 26 to April 4 and 12 days throughout August.
- Mid–late September was an exception with higher than average flows due to rainfall.

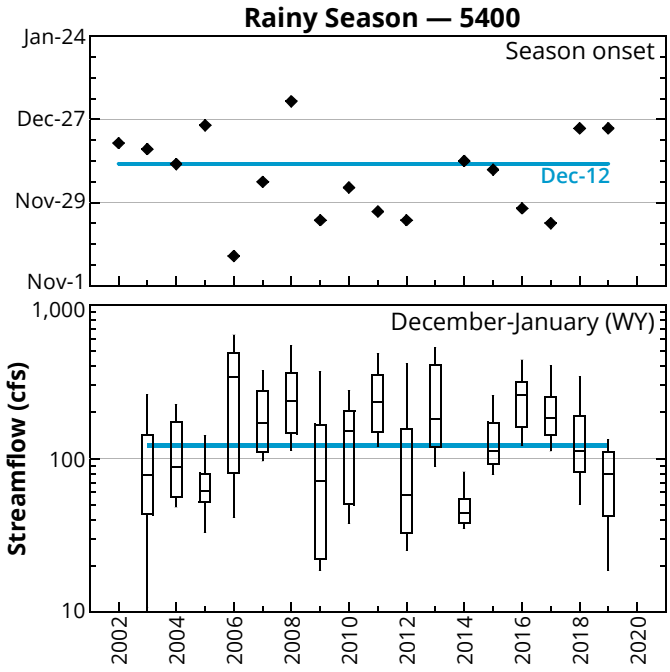
LOW FLOW

- August through October are the months with the lowest average flow and the lowest daily flows.
- Low flow criterion: 7d-Q ≤ 16 cfs (~26th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.
- No trends are evident in the magnitude of the flow for August–September.
- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.

RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 100 cfs (~74th pctl)
- No trend is evident in the magnitude of the flow for December–January.



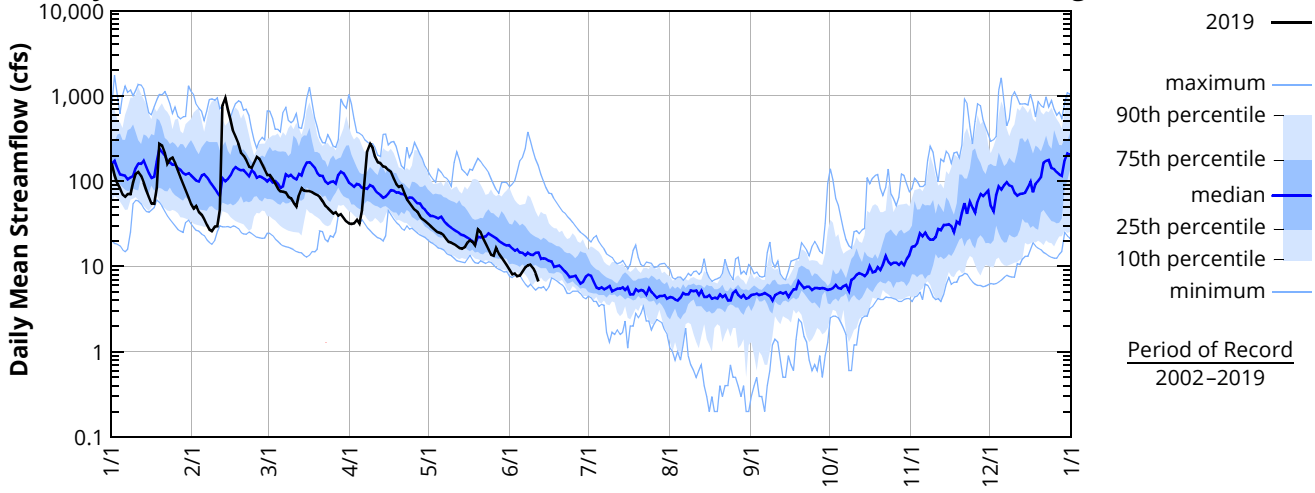


2019 — MEAN STREAMFLOW (cfs) — MCSC

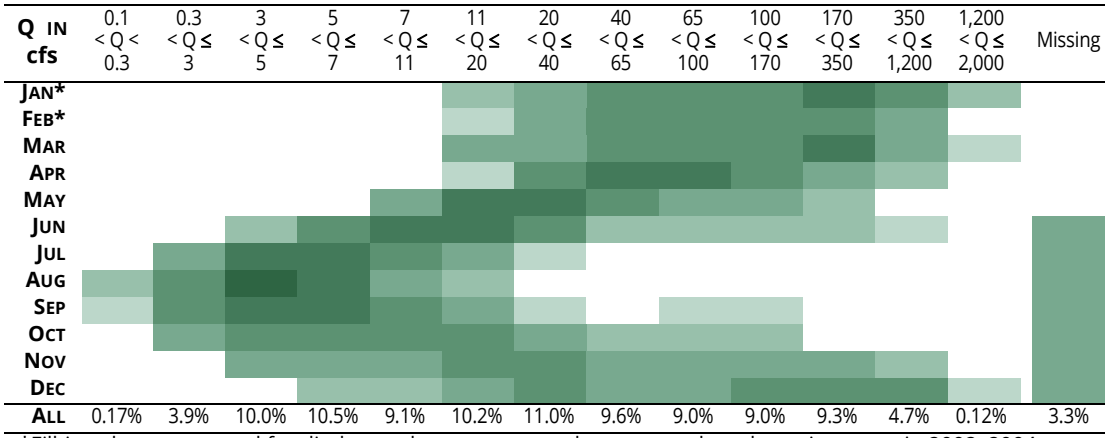
DAY	Jan	Feb	Mar	Apr	May	Jun*	Jul*	Aug*	Sep*	Oct*	Nov*	Dec*
1	157	47.7	118	31.4	29.8	8.10						
2	118	51.0	105	31.9	27.8	8.26						
3	93.5	43.7	92.9	35.2	26.3	7.69						
4	81.7	40.2	82.2	31.7	25.1	7.76						
5	69.5	35.8	75.8	45.7	24.5	8.73						
6	65.5	30.8	75.2	94.0	23.2	9.75						
7	70.4	27.2	73.1	225	21.1	10.3						
8	70.3	25.9	65.3	274	19.4	10.5						
9	96.1	29.4	63.2	248	19.1	9.59						
10	122	29.5	56.0	191	18.3	8.38						
11	128	46.5	50.6	166	17.3	6.72						
12	116	783	69.4	162	16.5							
13	96.4	955	82.8	148	16.2							
14	78.4	691	77.3	146	16.8							
15	64.9	530	76.4	135	19.0							
16	54.8	388	76.2	128	20.2							
17	53.9	333	74.2	107	19.6							
18	83.1	274	71.6	92.1	17.8							
19	275	216	68.8	85.3	27.1							
20	262	200	64.8	88.5	25.3							
21	214	176	57.8	73.3	21.2							
22	160	148	51.2	61.4	18.6							
23	182	144	48.2	55.9	15.9							
24	190	166	45.2	50.8	13.7							
25	163	193	41.7	46.3	13.3							
26	133	183	43.1	43.5	16.5							
27	110	157	39.6	38.5	14.2							
28	92.3	136	41.0	35.8	12.7							
29	77.8	—	37.2	33.8	11.4							
30	64.4	—	33.7	31.9	10.3							
31	53.8	—	31.9	—	9.16	—		—			—	
Mean	3597	6081	1989	2937	587							
Max	116	217	64.2	97.9	18.9							
Min	275	955	118	274	29.8							
Ac-Ft	53.8	25.9	31.9	31.4	9.16							

*Measurements at this site were discontinued on June 12 because of bridge reconstruction.

McKay Creek at Scotch Church Road above Waible Creek near North Plains, Oregon — 14206070



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — MCSC



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2002–2019

*Fill-in values were used for discharge that was reported as greater than the rating curve in 2002–2004.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — MCSC

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002		130	91.8	46.1	17.0	9.18	3.18	0.45	0.69	4.15	7.67	52.7
2003	170	123	153	115	34.5	9.52	3.85	2.25	5.50	11.2	23.3	82.4
2004			86.9	41.4	14.9	8.67	4.30	3.45	5.40	10.6	16.5	31.4
2005	59.0	41.2	19.5	94.2	91.3	20.5	8.80	2.84	4.98	13.4	47.8	124
2006	573	82.4	94.8	72.9	26.5	18.2	6.24	5.49	5.35	29.8	140	
2007	95.9	65.9	94.4	53.3	21.6	9.63	5.37	4.61	7.93	5.61	11.0	230
2008	359	253	126	78.4	22.3	10.2	4.95	5.24	4.89	6.50	21.8	19.8
2009	109	29.4	61.3	43.9	35.3	12.4	5.20	3.62	4.19	5.86	39.1	29.6
2010	274	117	97.0	115	62.4	77.7	8.54	4.76	8.78	10.7	53.3	246
2011	149	88.3	311	117	54.3	20.4	8.86	5.62	3.60	4.49	9.20	22.0
2012	160	105	238	92.5	43.9	22.5	8.89	6.64	5.57	9.92	48.3	364
2013	75.4	57.7	75.7	39.6	15.2	18.7	7.10	6.44	9.52	10.1	33.6	25.8
2014	35.1	149	127	94.0	43.8	12.0	6.86	5.20	4.85	9.05	46.0	156
2015	87.3	96.3	82.5	45.7	13.7	6.35	5.12	5.32	6.62	5.51	19.2	540
2016	232	153	171	37.7	11.9	6.58	4.27	3.77	4.78	62.4	121	204
2017	146	447	278	145	67.1	11.5	4.51	4.20	4.93	10.4	104	122
2018	173	70.1	124	100	17.8	10.2	4.54	2.88	2.56	5.11	7.12	38.8
2019	96.1	153	68.8	79.3	19							
median	145	110	112	82.3	26.4	11.8	5.34	4.41	5.22	7.99	31.1	104

KEY

Q in cfs

$Q \leq 3.34$
$3.34 < Q \leq 4.32$
$4.32 < Q \leq 5.06$
$5.06 < Q \leq 5.82$
$5.82 < Q \leq 8.53$
$8.53 < Q \leq 14.6$
$14.6 < Q \leq 26.5$
$26.5 < Q \leq 95.1$
$95.1 < Q \leq 229$
$229 < Q \leq 348$
$Q > 348$

Q as percentile

$Q \leq 5$th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

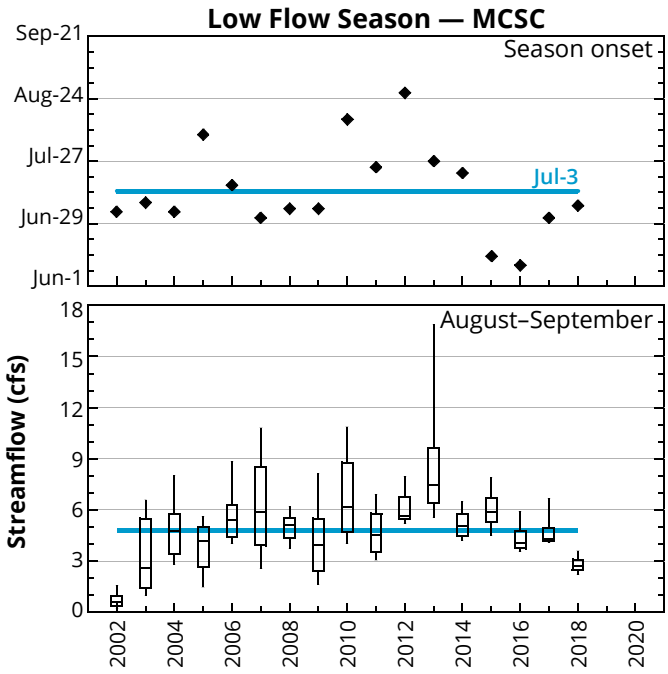
- Except during periods of rainfall, flow in the first half 2019 was below the median. Record low flows were set for 9 consecutive days from March 28 to April 5, and for June 4–5.
- Flow measurements were discontinued on June 12 due to bridge reconstruction.

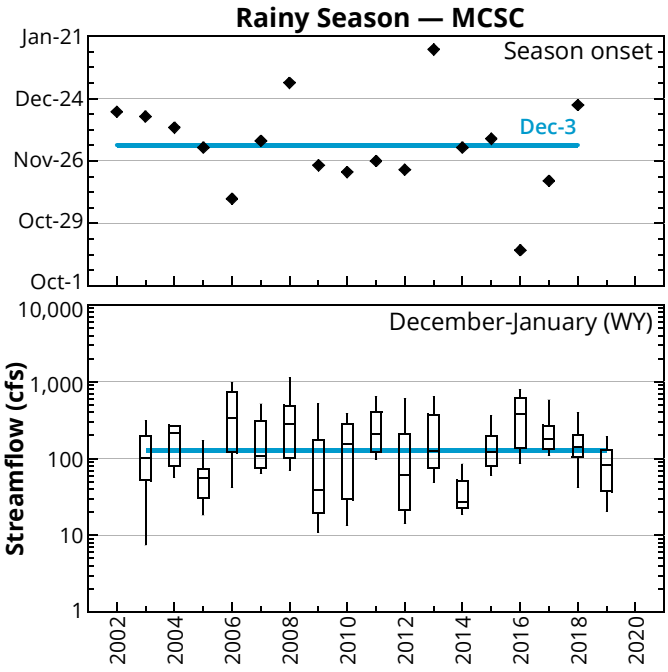
Low flow

- July through September are the months with the lowest average flow. The lowest daily flows occur in August and September.
- Low flow criterion: 7d-Q ≤ 7 cfs (~25th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.
- July–August flows have been variable over the period of record. Understanding any trends at this site is complicated by:
  - —Monitoring of streamflow changed from OWRD (2002–2007) to West Consultants (2008–present).
  - —Various rates of flow augmentation have supplemented streamflow in McKay Creek during July–October since 2005. The augmentation point is about a mile upstream of this site. Flow augmentation rates have varied over the years from about 0.5 cfs in the early years to 1–3 cfs since 2012.

Rainy season flow

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 90 cfs (~74th pctl)
- No trend is evident in the magnitude of the flow for December–January.





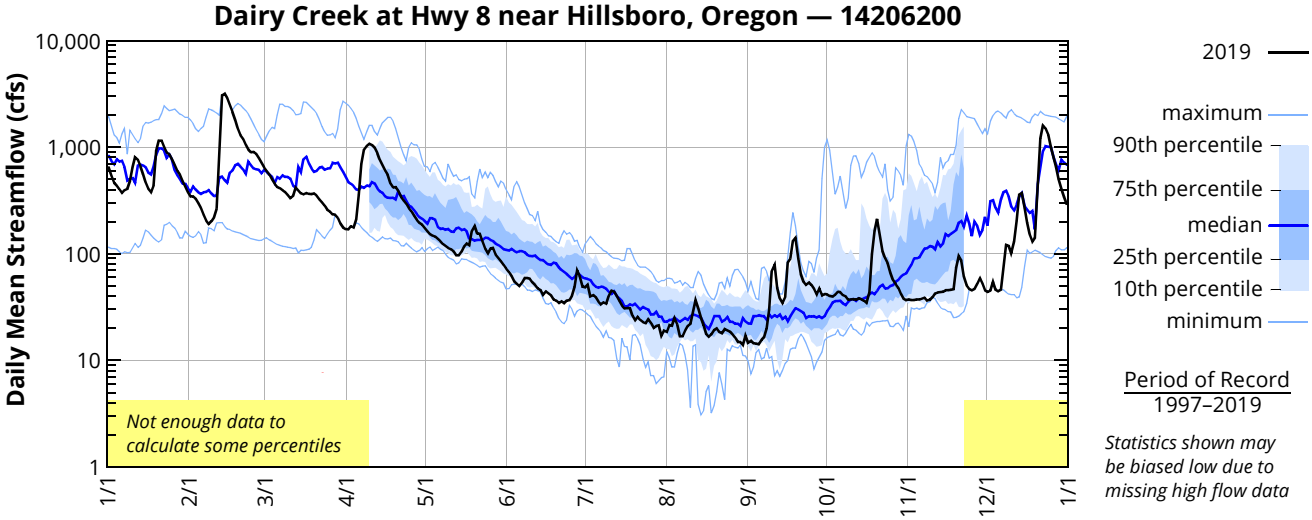
DAIRY – DAIRY CREEK AT HWY 8 NEAR HILLSBORO, OREGON – 14206200

Data source: Oregon Water Resources Department
River Mile: 2.06 *Latitude:* 45 30 38 *Longitude:* 123 06 56

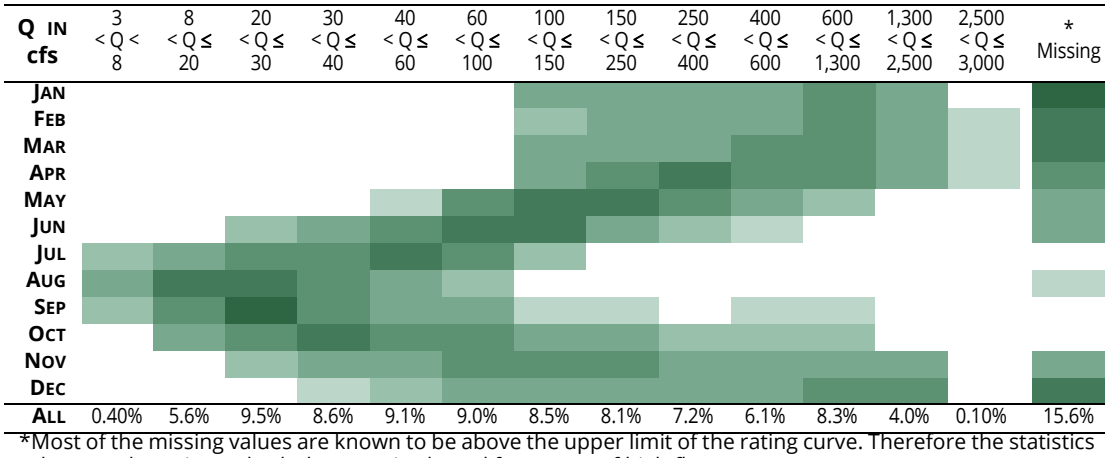
2019 — MEAN STREAMFLOW† (cfs) — DAIRY

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	640e	346	645e	171	177	72.7	48.5	18.6	14.7	41.5	37.2	44.1
2	540e	346	600e	169	163	67.3	51.2	21.4	15.3	40.2	36.7	45.2
3	460e	329	550e	181	154	61.7	40.0	21.1	14.5	39.6	36.7	54.6
4	437	297	499	177	148	55.2	41.1	25.0	14.4	41.4	37.2	46.1
5	403	267	453	210	145	52.3	39.1	21.6	14.2	44.0	37.4	44.6
6	371	233	423	358	138	49.8	35.8	16.8	15.6	43.7	38.0	46.2
7	397	206	413	696e	131	53.8	33.7	16.9	16.5	41.2	38.9	74.2
8	408	190	394	946e	123	59.3	35.0	19.1	19.9	39.9	36.5	122
9	480e	202	381	1030e	118	59.1	34.0	21.0	30.1	37.1	36.9	119
10	640e	220	358	1080e	113	58.3	40.4	22.0	69.6	37.3	39.2	101
11	800e	263	332	1050e	110	54.0	45.2	28.5	79.9	37.5	42.5	130
12	760e	800e	349	990e	105	50.7	44.4	36.7	47.8	37.1	43.3	205
13	660e	3070e	417	877e	96.6	47.5	39.9	31.2	38.1	38.2	43.6	359
14	560e	3160e	393	755e	96.7	45.8	35.9	25.1	34.5	37.5	43.9	372
15	466	2870e	370	676e	105	41.2	32.8	21.5	39.7	36.2	45.7	268
16	409	2490e	363	605e	117	44.3	30.8	17.8	83.0	34.6	45.7	194
17	381	2150e	372	550e	125	42.5	30.9	16.7	90.0	43.3	45.9	151
18	440e	1800e	364	456	121	40.7	31.0	17.6	132	99.2	46.6	130
19	920e	1490e	361	417	163	37.2	26.3	19.3	141	162	74.0	142
20	1150e	1300e	367	421	183	36.5	23.8	20.0	90.0	212	94.7	450e
21	1150e	1200e	351	388	155	34.5	25.7	18.6	64.3	155	86.2	1200e
22	1000e	1050e	325	342	154	35.7	24.0	18.0	55.0	106	61.2	1600e
23	890e	943e	305	317	131	34.3	22.8	19.7	51.3	91.0	50.6	1500e
24	850e	894e	285	297	111	36.3	22.3	19.2	53.7	81.3	46.7	1300e
25	770e	899e	259	269	101	36.8	24.5	18.7	50.8	67.1	45.6	1000e
26	680e	863e	250	251	112	40.4	22.6	17.7	46.7	56.5	46.9	800e
27	600e	786e	234	227	113	48.9	20.1	16.5	41.5	51.9	52.5	650e
28	550e	710e	232	208	98.8	70.1	21.0	14.9	47.5	48.0	59.2	500e
29	484	—	219	196	91.6	61.6	21.3	14.9	40.9	42.1	52.5	403
30	423	—	193	189	85.3	49.0	17.1	14.0	41.9	38.1	45.7	343
31	376	—	176	—	79.2	—	19.1	17.1	—	36.7	—	295
Mean	616	1049	362	483	125	49.3	31.6	20.2	49.8	61.8	48.3	409
Max	1150	3160	645	1080	183	72.7	51.2	36.7	141	212	94.7	1600
Min	371	190	176	169	79.2	34.3	17.1	14.0	14.2	34.6	36.5	44.1
Ac-Ft	37874	58262	22280	28758	7665	2931	1944	1244	2964	3803	2871	25168

†All 2019 data are provisional—subject to revision; e-estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — DAIRY



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1997–2019

*Most of the missing values are known to be above the upper limit of the rating curve. Therefore the statistics above underestimate both the magnitude and frequency of high flow.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — DAIRY

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1997				383	200	167	61.7	38.4	52.4	224		
1998				400	224	155	58.7	31.7	28.5	59.7	156	
1999				622	203	97.2	48.9	34.7	26.4	36.8	270	
2000				198	111	58.4	24.8	17.7	19.0	30.2	31.5	114
2001	140	207	157	142	92.7	45.5	16.4	13.9	16.3	44.2		
2002				388	115	54.9	27.0	19.3	19.0	36.3	64.6	
2003					171	70.9	30.7	16.5	27.3	52.0	62.7	
2004				210	90.7	57.9	21.0	13.0	26.2	46.8	69.2	114
2005		182	122			86.2	45.1	18.4	20.5	36.4	255	
2006				488	165	123	41.9	23.7	19.5	20.7		
2007				285	114	58.2	26.0	18.9	15.9	43.4	82.1	
2008				505	156	93.0	33.0	29.0	18.5	34.0	99.5	103
2009		198		300	216	82.5	34.0	27.0	30.0	60.0		
2010							85.0	39.0	53.5	47.0		
2011					309	130	71.0	40.0	34.0	38.0	70.5	136
2012	994	672	1240	620	254	137	54.0	34.0	27.0	55.0	388	1850
2013	552	367	460	255	116	103	35.0	30.0	41.5	76.0	149	136
2014	203	1245	1430	703	264	106	46.0	26.0	25.5	55.0	218	885
2015	697	740	603	266	103	44.0	23.0	17.0	25.0	26.0	157	1790
2016	1700	1010	1470	245	99.0	51.5	32.0	18.0	24.0	381	555	1080
2017	750	1475	1220	849	330	116	42.0	26.0	24.0	34.0	650	550
2018	950	536	675	825	128	65.7	30.4	19.0	20.3	25.8	51.2	263
2019	550	832	363	373	118	49.0	31.0	19.1	44.3	41.5	45.7	205
median	634	519	599	363	157	81.0	37.7	24.0	26.0	41.5	127	457

KEY

Q in cfs

$Q \leq 17.8$
$17.8 < Q \leq 22.3$
$22.3 < Q \leq 27.0$
$27.0 < Q \leq 31.0$
$31.0 < Q \leq 42.0$
$42.0 < Q \leq 61.9$
$61.9 < Q \leq 100$
$100 < Q \leq 346$
$346 < Q \leq 829$
$829 < Q \leq 1290$
$Q > 1290$

Q as percentile

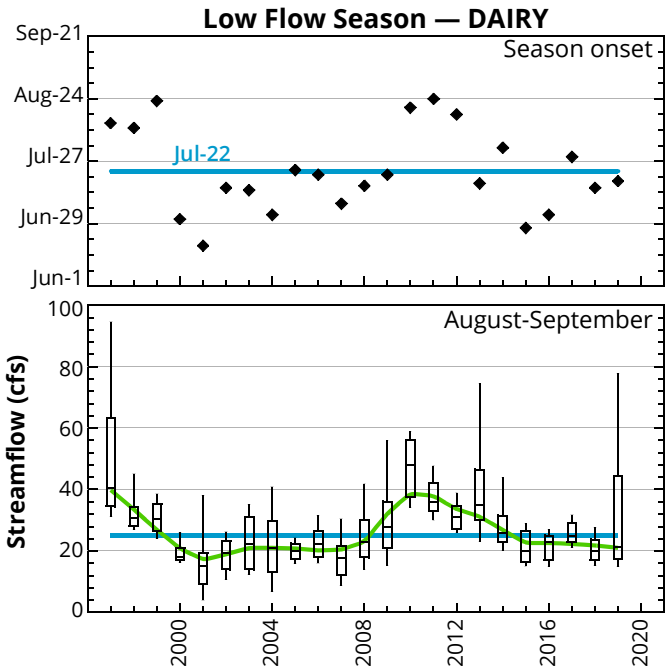
$Q \leq$ 5th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

- Flow in 2019 was below the median for February through early September and again from late October through mid-December. Record low flows were set on 22 days, including several long periods: March 28 to April 4, November 24–27 and November 29–December 6.
- Record high flows occurred on February 13–16 and September 10–11, however, relatively little high flow data are available for this site making the status of these records somewhat dubious.

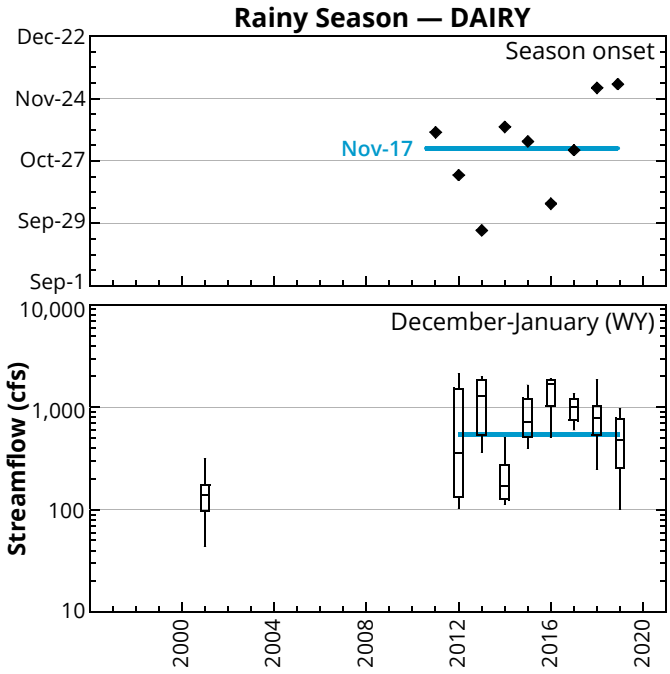
LOW FLOW

- August and September are the months with the lowest average flow and the lowest daily flows.
- Low flow criterion: 7d-Q ≤ 35 cfs (~24th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.
- Various rates of flow augmentation have supplemented streamflow in several tributaries of Dairy Creek during July–October. Flow augmentation rates varied from year-to-year.
  - —McKay Ck at RM 7.0, since 2005, 0.5–3 cfs
  - —EF Dairy Ck at RM 4.9, since 2010, 0.5–1.6 cfs
  - —WF Dairy Ck at RM 5.2, since 2011, 0.4–1 cfs
- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.



RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- A large portion of high flow data are missing for this site. Most of these data are known to be above the upper limit of the rating curve. These missing values will result in the under-representation of high flows in the frequency distribution as well as skewing the magnitude of high flow data.
- Too few high flow data are available to assess trends. No trends are evident in the onset of the rainy season or in the magnitude of the flow for December–January.
- Rainy season criterion: 7d-Q ≥ 350 cfs (~76th pctl)



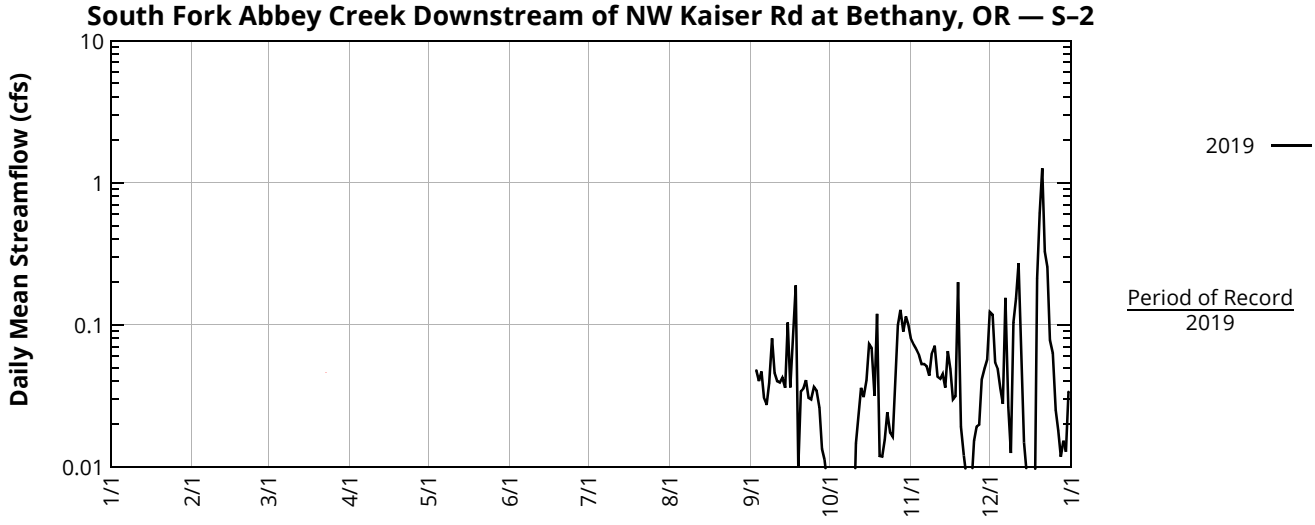
S-2 – South Fork Abbey Creek Downstream of NW Kaiser Rd at Bethany, OR

Data source: WEST Consultants for Clean Water Services

2019 — MEAN STREAMFLOW (cfs) — S-2

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1										0.01e	0.08e	0.13e
2										0.01e	0.07e	0.12e
3									0.05e	0.01e	0.07e	0.05e
4									0.04e	0.01e	0.06e	0.05e
5									0.05e	0.01e	0.05e	0.04e
6									0.03e	0.01e	0.05e	0.03e
7									0.03e	0.01e	0.05e	0.16e
8									0.04e	0.01e	0.04e	0.03e
9									0.08e	0.00e	0.06e	0.01e
10									0.05e	0.00e	0.07e	0.11e
11									0.04e	0.02e	0.04e	0.16e
12									0.04e	0.02e	0.04e	0.27e
13									0.04e	0.04e	0.05e	0.07e
14									0.04e	0.03e	0.04e	0.02e
15									0.11e	0.04e	0.07e	0.01e
16									0.04e	0.07e	0.05e	0.01e
17									0.08e	0.07e	0.03e	0.01e
18									0.19e	0.03e	0.03e	0.00e
19									0.01e	0.12e	0.20e	0.22e
20									0.03e	0.01e	0.02e	0.62
21									0.04e	0.01e	0.01e	1.27
22									0.04e	0.02e	0.01e	0.33
23									0.03e	0.02e	0.01e	0.26
24									0.03e	0.02e	0.01e	0.08e
25									0.04e	0.02e	0.02e	0.06e
26									0.04e	0.04e	0.02e	0.03e
27									0.03e	0.10e	0.02e	0.02e
28									0.01e	0.13e	0.04e	0.01e
29		—							0.01e	0.09e	0.05e	0.02e
30		—							0.01e	0.12e	0.06e	0.01e
31		—		—		—			—	0.10e	—	0.03e
Mean									0.04	0.04	0.05	0.14
Max									0.19	0.13	0.20	1.27
Min									0.01	0.00	0.01	0.00
Ac-Ft									0.09	0.08	0.09	0.27

e-estimated or poor data quality



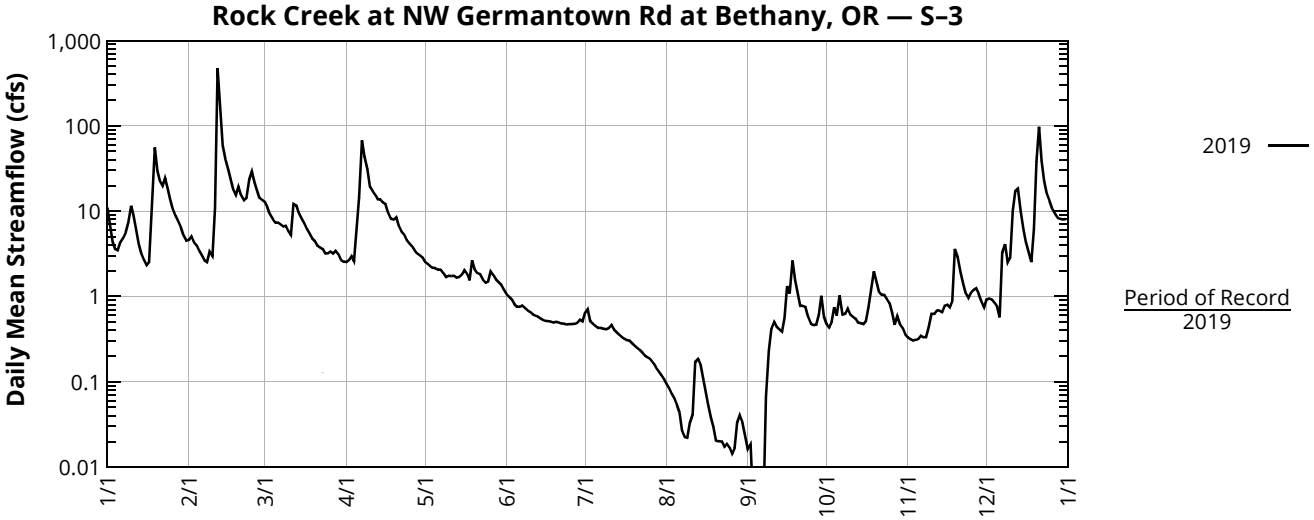
S-3 – Rock Creek at NW Germantown Rd at Bethany, OR

Data source: WEST Consultants for Clean Water Services

2019 — MEAN STREAMFLOW (cfs) — S-3

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	10.8	4.55	12.8	2.52	2.54	1.08e	0.64e	0.09e	0.02e	0.48e	0.33e	0.92e
2	6.80	5.04	11.1	2.66	2.40	1.00e	0.71e	0.08e	0.02e	0.43e	0.31e	0.94e
3	4.41	4.32	9.23	2.94	2.26	0.91e	0.51e	0.07e	<0.01	0.50e	0.30e	0.92e
4	3.60	3.98	7.99	2.57	2.17	0.81e	0.48e	0.06e	<0.01	0.75e	0.31e	0.84e
5	3.48	3.44	7.32	6.10	2.13	0.75e	0.45e	0.05e	<0.01	0.60e	0.32e	0.75e
6	4.32	2.98	7.29	14.5	2.05	0.76e	0.43e	0.04e	<0.01	1.03e	0.35e	0.57e
7	4.86	2.64	6.91	67.4	2.06	0.78e	0.43e	0.03e	<0.01	0.61e	0.33e	3.29e
8	5.64	2.52	6.58	43.5	1.89	0.73e	0.42e	0.02e	0.07e	0.63e	0.33e	4.10e
9	7.31	3.33	6.74	30.9	1.69e	0.69e	0.41e	0.02e	0.23e	0.72e	0.43e	2.54e
10	11.5	2.95	5.77	19.2	1.74e	0.66e	0.43e	0.03e	0.42	0.61e	0.62e	2.89e
11	8.62	10.9	5.22	17.2	1.72e	0.62e	0.46e	0.04e	0.50	0.58e	0.62e	10.1e
12	5.86	474e	12.1	15.7	1.75e	0.60e	0.41e	0.17e	0.44	0.55e	0.69e	17.3e
13	4.06	151e	11.7	13.7	1.66e	0.58e	0.38e	0.19e	0.41	0.50e	0.68e	18.3e
14	3.14	58.7	9.43	13.8	1.68e	0.55e	0.36e	0.16e	0.38	0.48e	0.66e	9.83e
15	2.67	39.8	8.02	12.7	1.79e	0.53e	0.34e	0.11e	0.56	0.47e	0.78e	6.23e
16	2.33	30.8	7.12	12.1	2.03e	0.52e	0.32e	0.08e	1.32	0.51	0.80e	4.30e
17	2.51	23.5	6.19	9.65	1.85e	0.51e	0.31e	0.05e	1.09	0.74	0.75e	3.24e
18	10.2	17.8	5.43	8.10	1.54e	0.50e	0.30e	0.04e	2.64	1.21	0.89e	2.54e
19	55.6	15.4	4.80	8.01	2.62e	0.49e	0.28e	0.03e	1.56	1.97	3.60e	6.15e
20	29.7	19.2	4.47	8.46	2.07e	0.50e	0.26e	0.02e	1.08	1.50	2.89e	38.5
21	22.3	15.4	3.96	6.70	1.89e	0.50e	0.25e	0.02e	0.77	1.13	1.90e	97.6
22	19.7	13.4	3.75	5.77	1.83e	0.48e	0.23e	0.02e	0.77e	1.05	1.41e	38.8
23	24.3	14.2	3.61	5.36	1.59e	0.48e	0.22e	0.02e	0.75e	1.04	1.09e	22.5
24	18.4	23.6	3.18	4.64	1.46e	0.47e	0.20e	0.02e	0.58e	0.91	0.96e	16.0
25	13.6	29.0	3.19	4.25	1.49e	0.47e	0.19e	0.02e	0.48e	0.83	1.10e	13.0
26	10.5	21.8	3.36	3.93	1.96e	0.47e	0.18e	0.01e	0.46e	0.65e	1.19e	10.4
27	8.81	17.4	3.19	3.48	1.78e	0.48e	0.17e	0.02e	0.46e	0.46e	1.25e	9.21
28	7.53	14.2	3.39	3.19	1.58e	0.49e	0.15e	0.03e	0.61e	0.59e	1.09e	8.32
29	6.50	—	3.13	3.03	1.48e	0.53e	0.13e	0.04e	1.02e	0.47e	0.87e	8.13
30	5.12	—	2.68	2.85	1.38e	0.51e	0.12e	0.03e	0.58e	0.43e	0.74e	7.95
31	4.51	—	2.55	—	1.21e	—	0.11e	0.02e	—	0.36e	—	8.03
Mean	10.6	36.6	6.20	11.8	1.85	0.62	0.33	0.05	0.57	0.74	0.92	12.07
Max	55.6	474	12.8	67.4	2.62	1.08	0.71	0.19	2.64	1.97	3.60	97.60
Min	2.33	2.52	2.55	2.52	1.21	0.47	0.11	0.01	<0.01	0.36	0.30	0.57
Ac-Ft	21.0	72.7	12.3	23.5	3.67	1.22	0.66	0.11	1.14	1.46	1.82	23.94

e-estimated or poor data quality



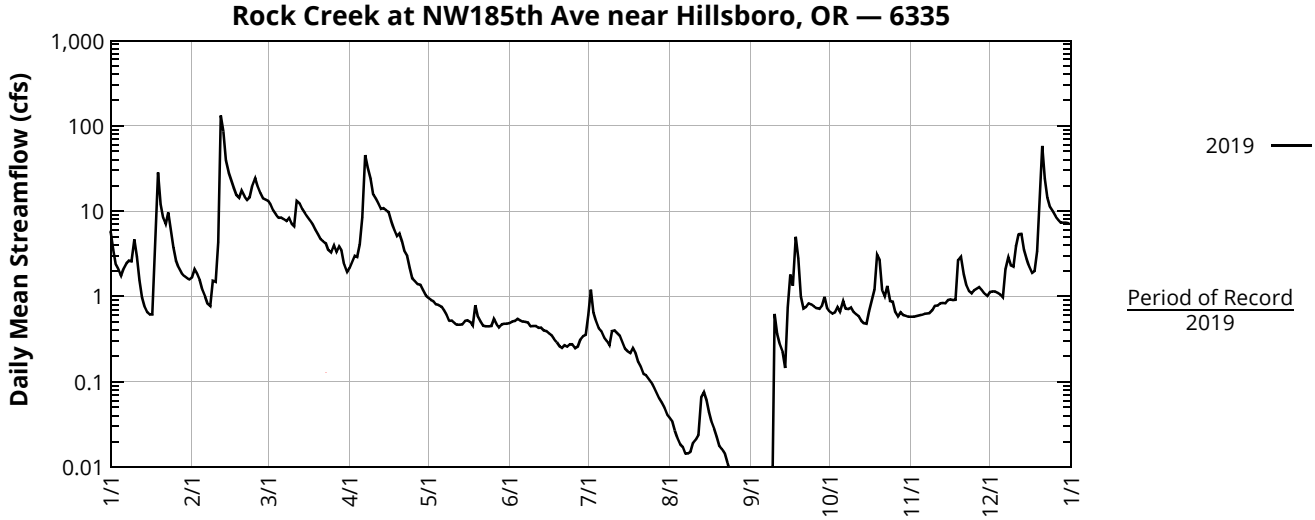
6335 – Rock Creek at NW 185th Ave near Hillsboro, OR – 14206335

Data source: WEST Consultants for Clean Water Services

2019 — MEAN STREAMFLOW (cfs) — 6335

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5.76e	1.67e	13.2	2.16e	0.97	0.48	0.61	0.04	dry	0.66e	0.58e	1.12e
2	3.53e	2.08	11.9	2.56e	0.91	0.51	1.20	0.03	dry	0.63e	0.58e	1.14e
3	2.36e	1.84	10.2	2.99e	0.88	0.52	0.64	0.03	dry	0.65e	0.59e	1.14e
4	2.07e	1.56	9.04	2.90e	0.81	0.54	0.51	0.02	dry	0.75e	0.60e	1.10e
5	1.74e	1.20	8.26	4.07e	0.79	0.52	0.43	0.02	dry	0.66e	0.61e	1.06e
6	2.11e	0.99	8.41	8.48	0.76	0.51	0.39	0.02	dry	0.87e	0.62e	0.98e
7	2.44e	0.81	8.07	45.2	0.69	0.50	0.33	0.01	dry	0.72e	0.63e	2.08
8	2.60e	0.77	7.59	32.4	0.61	0.49	0.30	0.01	dry	0.71e	0.64e	2.88
9	2.58e	1.52	8.31	23.9	0.52	0.44	0.27	0.02	<0.01	0.74e	0.69e	2.31
10	4.67	1.48	7.11	15.7	0.52	0.45	0.39	0.02	0.62e	0.66e	0.77e	2.23
11	2.93	4.32	6.62	14.0	0.48	0.45	0.40	0.02	0.36e	0.62e	0.78e	3.88
12	1.55	132	13.1	12.3	0.46	0.42	0.37	0.02	0.27e	0.59e	0.83e	5.33
13	0.97	86.4	12.3	10.6	0.47	0.43	0.34	0.07	0.22e	0.52e	0.83e	5.41
14	0.75	39.4	10.6	10.8	0.47	0.40	0.29	0.08	0.15e	0.48e	0.83e	3.51
15	0.66	28.0	9.41	10.2	0.51	0.39	0.25	0.06	0.75e	0.48e	0.90e	2.75
16	0.61	22.8	8.54	9.77	0.52	0.37	0.23	0.04	1.80e	0.67e	0.92e	2.25
17	0.61	18.6	7.77	7.68	0.50	0.35	0.22	0.03	1.33e	0.87e	0.90e	1.89
18	3.71	15.4	6.92	5.98	0.45	0.32	0.25	0.03	5.01e	1.20e	0.91e	1.99
19	28.5	14.4	6.02	5.08	0.79	0.29	0.21	0.02	2.80e	3.06e	2.67e	3.39
20	12.0	17.3	5.36	5.45	0.58	0.26	0.17	0.02	1.00e	2.66e	2.93e	16.6
21	8.31	14.8	4.69	4.43	0.50	0.25	0.15	0.02	0.72e	1.17e	1.80e	57.9
22	7.01	13.5	4.37	3.35	0.45	0.27	0.12	0.01	0.75e	1.00e	1.34e	24.1
23	9.62	14.5	4.19	2.97	0.44	0.26	0.12	0.01	0.83e	1.32e	1.15e	14.4
24	5.99	20.5	3.47	2.17	0.45	0.27	0.11	0.01	0.81e	0.87e	1.08e	11.2
25	3.77	24.4	3.28	1.62	0.45	0.27	0.10	0.01	0.76e	0.86e	1.18e	9.92
26	2.65e	19.4	3.99	1.52	0.54	0.25	0.08	<0.01	0.73e	0.66e	1.24e	8.56
27	2.18e	16.3	3.34	1.39	0.47	0.26	0.07	dry	0.72e	0.58e	1.28e	7.85
28	1.89e	14.2	3.88	1.37	0.43	0.31	0.06	dry	0.78e	0.65e	1.19e	7.33
29	1.72e	—	3.44	1.19	0.47	0.34	0.06	dry	0.98e	0.60e	1.07e	7.31
30	1.64e	—	2.38	1.03	0.48	0.36	0.05	dry	0.73e	0.59e	1.01e	7.29
31	1.59e	—	1.93	—	0.48	—	0.04	dry	—	0.57e	—	7.16
Mean	4.15	18.93	7.02	8.44	0.58	0.38	0.28	0.03	1.01	0.87	1.04	7.29
Max	28.50	132.00	13.20	45.20	0.97	0.54	1.20	0.08	5.01	3.06	2.93	57.90
Min	0.61	0.77	1.93	1.03	0.43	0.25	0.04	dry	0.00	0.48	0.58	0.98
Ac-Ft	8.22	37.55	13.93	16.74	1.14	0.76	0.56	0.05	1.99	1.73	2.06	14.46

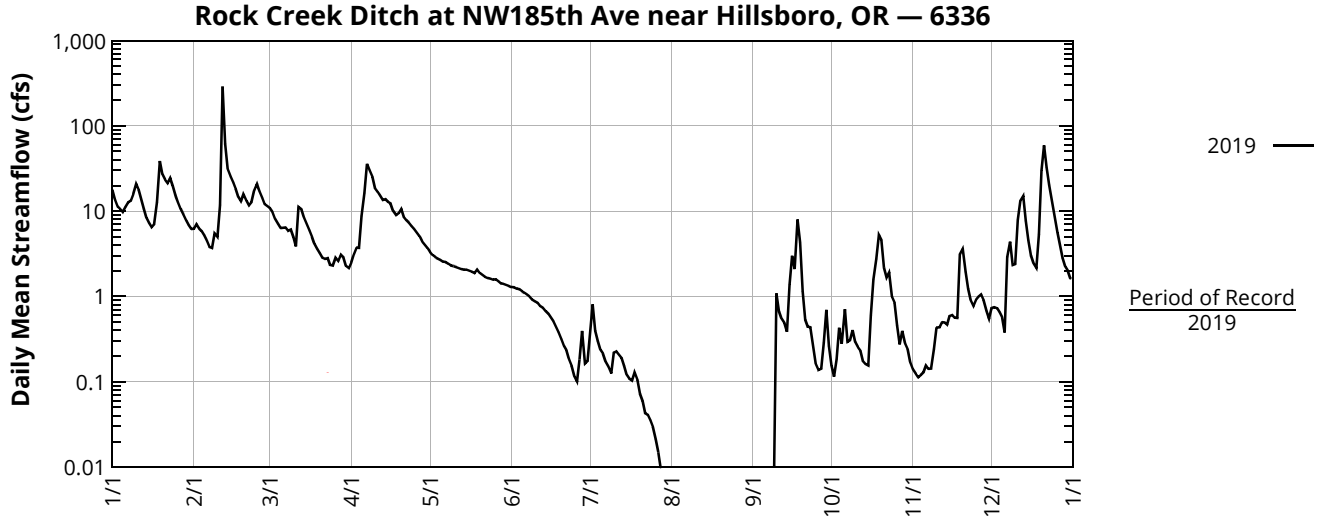
e-estimated or poor data quality



2019 — MEAN STREAMFLOW (cfs) — 6336

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	17.4	6.19	10.9	2.50	3.31	1.29e	0.37e	dry	dry	0.16	0.14	0.73
2	13.5	6.99	9.75	3.11	3.05	1.27e	0.81e	dry	dry	0.11	0.12	0.75
3	11.3	6.27	8.14	3.73	2.91	1.23e	0.39e	dry	dry	0.18	0.11	0.73
4	10.6	5.84	7.08	3.69	2.79	1.21e	0.30e	dry	dry	0.43	0.12	0.65
5	9.79	5.20	6.30	8.79	2.68	1.15e	0.24e	dry	dry	0.28	0.13	0.56
6	11.1	4.47	6.37	16.4	2.55	1.10e	0.21e	dry	dry	0.71	0.16	0.38
7	12.6	3.78	6.41	35.9	2.51e	1.05e	0.17e	dry	dry	0.29e	0.14	2.90
8	13.3	3.68	5.87	30.2	2.41e	1.00e	0.15e	dry	dry	0.31e	0.14	4.38
9	15.9	5.49	6.07	25.1	2.30e	0.92e	0.13e	dry	0.01e	0.40e	0.24	2.35
10	20.8	5.01	5.00	18.5	2.26e	0.88e	0.22e	dry	1.09	0.29e	0.43	2.39
11	17.6	11.8	3.87	16.8	2.19e	0.84e	0.23e	dry	0.67	0.26e	0.43	7.88
12	13.7	287e	11.2	15.1	2.13e	0.78e	0.21e	dry	0.55	0.23e	0.50	13.2
13	10.6	61.8	10.5	13.5	2.09e	0.74e	0.19e	dry	0.49	0.18e	0.49	15.1
14	8.26	30.8	8.37	13.8	2.05e	0.67e	0.15e	dry	0.38	0.16e	0.47	7.70
15	7.24	25.3	7.00	12.9	2.04e	0.63e	0.12e	dry	1.37	0.16e	0.59	4.53
16	6.51	21.7	5.97	12.4	2.00e	0.57e	0.11e	dry	3.01	0.61	0.61	3.03
17	6.95	18.1	4.97	10.1	1.94e	0.51e	0.10e	dry	2.09	1.59	0.56	2.40
18	12.6	14.6	4.10	9.01	1.87e	0.44e	0.13e	dry	7.93	2.75	0.56	2.13
19	38.7	13.0	3.59	9.47	2.07e	0.38e	0.10e	dry	4.31	5.25	3.15	5.33
20	26.9	15.8	3.22	10.6	1.87e	0.32e	0.07e	dry	1.15	4.54	3.62	29.9
21	23.4	13.2	2.84	8.53	1.78e	0.26e	0.06e	dry	0.53	2.16	1.95	59.3
22	21.3	11.6	2.75	7.80	1.70e	0.23e	0.04e	dry	0.44	1.67	1.22	32.6
23	24.4	12.7	2.83	7.35	1.64e	0.18e	0.04e	dry	0.43	1.91	0.90	20.1
24	19.9	17.9	2.33	6.68	1.61e	0.15e	0.04e	dry	0.26	0.98	0.77	12.6
25	15.7	21.0	2.30	6.20	1.57e	0.11e	0.03e	dry	0.16	0.84	0.91	8.73
26	12.6	17.0	2.85	5.64	1.59e	0.10e	0.02e	dry	0.14	0.46	1.00	5.57
27	10.7	14.5	2.60	5.07	1.50e	0.18e	0.01e	dry	0.14	0.27	1.06	3.97
28	9.16	12.0	3.08	4.43	1.42e	0.40e	0.01e	dry	0.29	0.40	0.90	2.80
29	7.76	—	2.89	4.07	1.41e	0.16e	0.01e	dry	0.70	0.28	0.68	2.24
30	6.84	—	2.28	3.72	1.37e	0.17e	0.01e	dry	0.26	0.24	0.55	2.00
31	6.13	—	2.14	—	1.33e	—	<0.01	dry	—	0.17	—	1.63
Mean	14.3	24.0	5.28	11.0	2.06	0.63	0.15	dry	1.20	0.91	0.75	8.34
Max	38.7	287	11.2	35.9	3.31	1.29	0.81	dry	7.93	5.25	3.62	59.3
Min	6.13	3.68	2.14	2.50	1.33	0.10	0.00	dry	0.01	0.11	0.11	0.38
Ac-Ft	28.4	47.7	10.5	21.9	4.09	1.25	0.30	dry	2.38	1.81	1.50	16.5

e-estimated data or poor data quality



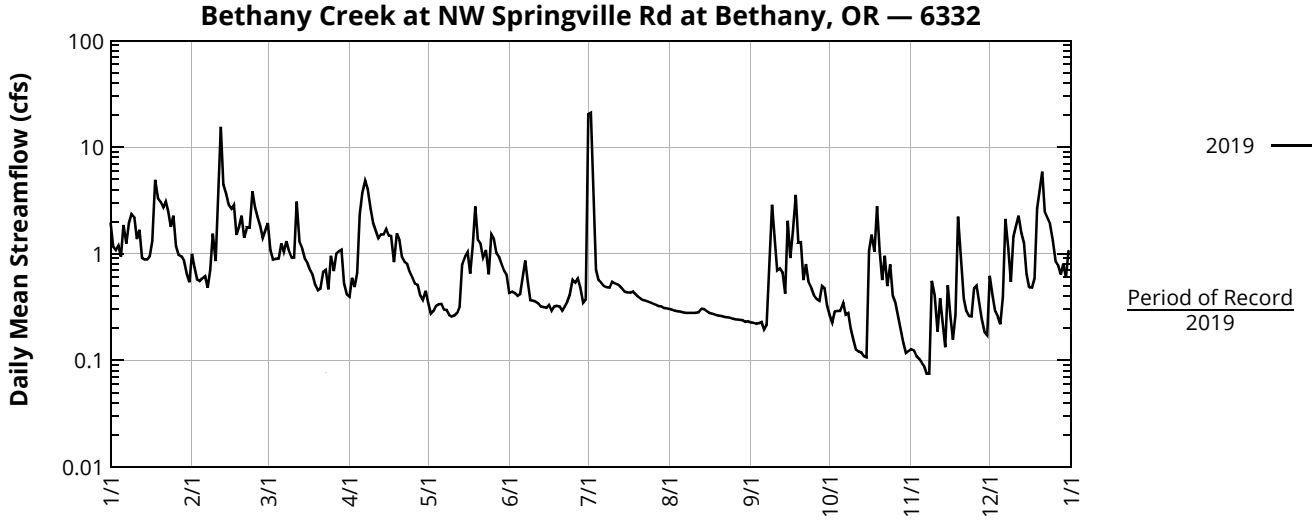
6332 – Bethany Creek at NW Springville Rd at Bethany, OR – 14206332

Data source: WEST Consultants for Clean Water Services

2019 — MEAN STREAMFLOW (cfs) — 6332

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.94	1.00	1.95	0.40	0.35	0.43	20.5e	0.30e	0.23	0.27e	0.13	0.62
2	1.17	0.75	1.08	0.60	0.28	0.44	21.2e	0.30e	0.23	0.23e	0.13	0.40
3	1.09	0.58	0.89	0.49	0.29	0.43	3.54e	0.29e	0.22	0.29e	0.11	0.29
4	1.20	0.56	0.90	0.66	0.33	0.41	0.71e	0.29e	0.22	0.29e	0.10	0.26
5	0.94	0.59	0.90	2.34	0.34	0.42	0.56e	0.29e	0.23	0.29e	0.10	0.22
6	1.87	0.62	1.25	3.72	0.34	0.60	0.54e	0.28e	0.20	0.35e	0.09	0.39
7	1.25	0.48	1.04	4.85	0.30	0.87	0.50e	0.28e	0.22	0.27e	0.08	2.12
8	1.95	0.71	1.31	4.06	0.30	0.54	0.49e	0.28e	0.81	0.28	0.08	1.12
9	2.36	1.55	1.06	2.65	0.27	0.37	0.48e	0.28e	2.88	0.20	0.56	0.55
10	2.20	0.85	0.92	1.95	0.26	0.36	0.55e	0.28e	1.48	0.16	0.41	1.45
11	1.38	3.89	0.92	1.66	0.26	0.35	0.53e	0.28e	0.70	0.13e	0.19	1.82
12	1.68	15.4	3.10	1.40	0.28	0.34	0.52e	0.28e	0.73	0.12	0.38	2.28
13	0.91	4.45	1.29	1.51	0.32	0.32	0.50e	0.31e	0.67	0.12	0.23e	1.56
14	0.89	3.71	1.13	1.52	0.81	0.32	0.47e	0.30e	0.42	0.11	0.13e	1.26
15	0.89	2.86	0.89	1.72	0.95	0.31	0.44e	0.29e	2.04	0.11	0.51e	0.64
16	0.95	2.64	0.81	1.49	1.05	0.33	0.44e	0.28e	0.91	1.07	0.26	0.49
17	1.32	2.87	0.70	1.47	0.65	0.29	0.43e	0.28e	1.61	1.51	0.16	0.48
18	4.96	1.50	0.63	0.84	1.19	0.32	0.44e	0.27e	3.57	1.04	0.27	0.59
19	3.31	1.79	0.51	1.56	2.79	0.33	0.42e	0.27e	1.27	2.80	2.23	2.67
20	3.07	2.27	0.46	1.35	1.36	0.32	0.39e	0.26e	1.29	1.08	0.92	4.02
21	2.73	1.41	0.47	0.93	1.26	0.29	0.38e	0.26e	0.57	0.57	0.38	5.91
22	3.12	1.77	0.68	0.84	0.93	0.32	0.37e	0.26e	0.80	0.96	0.29	2.46
23	2.47	1.76	0.71	0.81	1.09	0.36	0.36e	0.25e	0.54	0.50	0.26	2.17
24	1.80	3.84	0.46	0.67	0.64	0.42	0.35e	0.25e	0.48e	0.80	0.26	1.91
25	2.28	2.73	0.96	0.60	1.52	0.58	0.35e	0.25e	0.41e	0.41	0.48	1.34
26	1.18	2.19	0.69	0.53	1.38	0.54	0.34e	0.24e	0.38e	0.35	0.50	0.84
27	0.98	1.83	1.01	0.51	1.02	0.59e	0.33e	0.24e	0.36e	0.27	0.34	0.77
28	0.95	1.42	1.06	0.41	0.94	0.49	0.32e	0.24e	0.50e	0.21	0.24	0.64
29	0.86	—	1.10	0.37	0.80	0.35	0.32e	0.24e	0.48e	0.15	0.18	0.81
30	0.64	—	0.53	0.45	0.69	0.37	0.31e	0.23e	0.33e	0.12	0.17	0.60
31	0.54	—	0.41	—	0.63	—	0.31e	0.23	—	0.12	—	1.06
Mean	1.71	2.36	0.96	1.41	0.76	0.41	1.85	0.27	0.83	0.49	0.34	1.35
Max	4.96	15.40	3.10	4.85	2.79	0.87	21.20	0.31	3.57	2.80	2.23	5.91
Min	0.54	0.48	0.41	0.37	0.26	0.29	0.31	0.23	0.20	0.11	0.08	0.22
Ac-Ft	3.38	4.68	1.91	2.80	1.51	0.82	3.67	0.54	1.64	0.97	0.67	2.67

e-estimated or poor data quality



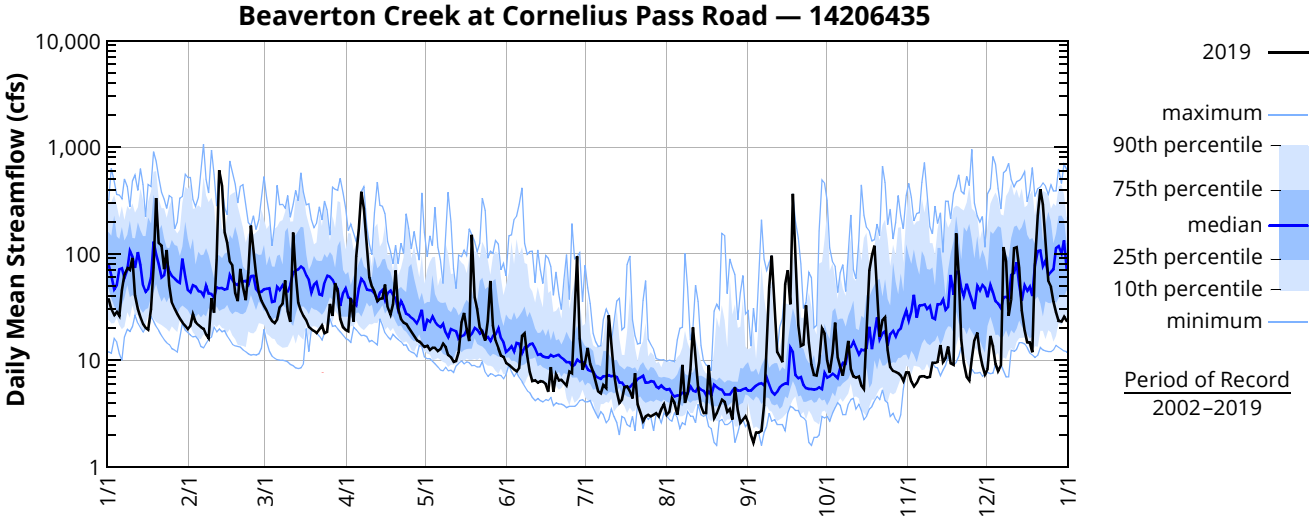
BVTS – Beaverton Creek at Cornelius Pass Road – 14206435

Data source: WEST Consultants for Clean Water Services
River Mile: 1.2 *Latitude:* 45 31 15 *Longitude:* 122 53 59

2019 — MEAN STREAMFLOW (cfs) — BVTS

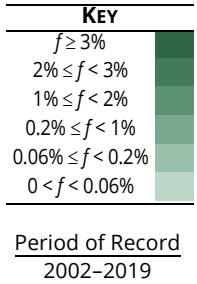
DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	37.2	21.2	32.3	19.3	13.4	9.48	9.55	3.06	2.64e	9.98	7.66	8.25
2	30.3	27.1	29.2	18.8	13.7	9.07	13.1	3.26	2.03e	7.68	6.27	17.0
3	26.5	23.0	25.5	38.5	12.5	8.56	9.34	4.38	1.68e	11.8	5.68	13.5
4	28.4	21.4	23.3	23.1	13.1	8.15	7.75	4.03	2.09e	22.7	6.23	9.31
5	26.1	20.5	22.3	94.6	13.1	7.93	6.29	3.05	2.11e	10.7	7.00	7.96
6	45.7	19.9	24.3	168	12.3	8.53	5.09	4.44	2.18e	8.69	7.14	9.11
7	64.3	17.4	31.6	382	12.8	17.0	4.87	9.11	3.82e	7.15	7.11	116
8	73.3	16.1	34.0	266	14.5	17.9	5.93	3.97	11.0e	10.4	6.86	85.3
9	70.5	38.2	56.6	118	13.5	11.2	5.49	4.85	48.7	15.3	6.98	26.3
10	91.8	28.0	28.8	60.0	11.2	7.82	26.5	8.24	96.3	8.25	9.47	37.5
11	40.8	87.9	23.0	49.0	10.7	6.40	14.3	20.5	33.3	7.10	9.53	113
12	30.3	607	158	43.9	9.70	6.53	7.66	10.4	11.9	6.92	9.70	116
13	25.4	434	64.6	36.0	9.86	6.20	5.14	5.55	10.8	7.06	14.0	73.8
14	21.9	159	34.8	37.7	11.9	6.38	3.96	3.66	9.62	5.81	9.74	29.4
15	20.2	127	29.2	38.1	22.7	6.34	4.31	3.23	51.9	5.44	10.5	19.1
16	19.4	84.2	26.1	51.5	27.9	5.97	5.57	3.23	70.3	18.9	13.5	14.8
17	30.2	77.6	23.6	31.5	19.8	5.13	5.71	8.98	33.5	70.2	9.41	14.8
18	73.8	42.9	20.6	26.7	15.2	8.71	5.06	4.71	365	95.8	9.14	11.9
19	332	36.1	19.6	33.6	150	5.07	4.44	2.94e	107	119	156	80.6
20	126	72.2	19.0	69.9	39.1	7.41	7.56	3.18e	21.4	48.0	64.9	230
21	119	49.0	18.0	30.6	30.1	6.48	3.85	3.72e	13.7	16.7	15.7	405
22	72.1	36.7	19.6	24.4	20.2	6.57	3.28	4.28e	14.1	23.9	9.50	291
23	109	66.6	21.3	22.7	18.4	6.24	2.69	4.11e	32.9	25.5	7.04	128
24	50.6	184	18.1	22.0	15.4	5.82	3.03	3.34e	14.7	12.5	6.52	55.1
25	34.9	108	18.5	20.1	23.5	7.92	3.10	3.45e	9.11	8.73	10.4	49.0
26	30.2	65.0	33.8	18.5	55.7	7.62	2.95	2.83e	7.34	8.04	15.6	35.4
27	27.2	43.1	26.3	16.9	21.3	28.1	3.08	5.61e	7.17	7.76	18.3	28.2
28	24.7	36.0	53.0	15.5	15.4	94.9	3.21	3.35e	9.49	7.57	11.8	23.5
29	22.6	—	45.0	15.1	13.0	16.1	2.97	2.61e	19.9	7.23	8.95	23.2
30	21.1	—	24.7	14.3	11.1	8.16	3.49	2.76e	17.8	6.41	7.35	25.7
31	19.7	—	20.5	—	10.8	—	3.87	2.98e	—	7.67	—	23.4
Mean	1745	2549	1025	1806	682	358	193	154	1033	629	488	2121
Max	56.3	91.0	33.1	60.2	22.0	11.9	6.23	4.96	34.4	20.3	16.3	68.4
Min	332	607	158	382	150	94.9	26.5	20.5	365	119	156	405
Ac-Ft	19.4	16.1	18.0	14.3	9.70	5.07	2.69	2.61	1.68	5.44	5.68	7.96

e-estimated data or poor data quality



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — BVTS

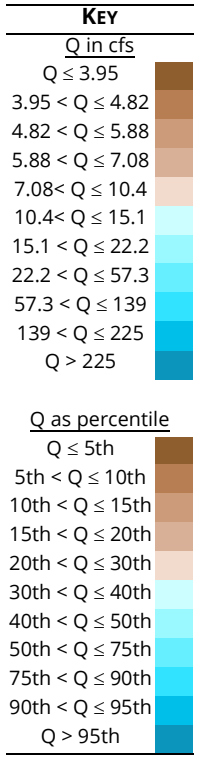
Q IN cfs	1 < Q < 2	2 < Q ≤ 4	4 < Q ≤ 6	6 < Q ≤ 9	9 < Q ≤ 13	13 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 40	40 < Q ≤ 60	60 < Q ≤ 100	100 < Q ≤ 250	250 < Q ≤ 700	700 < Q ≤ 1,100
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.14%	5.2%	10.1%	10.6%	9.9%	11.1%	11.6%	8.1%	9.5%	9.8%	9.9%	4.0%	0.14%



*Fill-in values were used for discharge that was reported as greater than the rating curve in 2002–2003.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — BVTS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002		61.9	52.9	25.8	12.8	8.77	5.97	4.24	4.56	9.48	15.5	
2003	77.1	48.3	82.9	74.1	24.0	10.5	7.43	6.78	5.87	13.8	20.6	93.3
2004	115	80.7	35.5	19.3	13.1	10.1	7.52	7.46	9.08	29.1	25.0	37.6
2005	31.4	17.8	15.1	44.6	45.0	25.4	10.7	6.85	6.14	23.4	57.2	79.8
2006	272	42.7	49.5	38.5	21.3	14.0	8.24	6.22	7.69	10.8	130	88.6
2007	53.5	60.0	51.7	35.3	16.9	10.8	6.23	5.00	4.52	19.3	22.6	126
2008	145	44.9	46.7	30.1	15.8	9.33	5.02	5.93	4.64	4.61	27.4	21.9
2009	32.1	18.6	30.1	21.5	25.9	9.54	4.32	4.67	4.22	13.3	77.9	25.8
2010	101	60.7	44.0	51.0	35.1	39.8	9.57	7.97	12.9	14.4	54.5	143
2011	65.4	50.8	114	57.2	33.6	18.7	14.3	8.81	5.23	7.60	43.7	16.7
2012	74.5	46.9	102	65.9	30.5	22.4	7.12	5.90	5.23	29.9	86.2	154
2013	36.5	29.3	23.0	20.2	16.3	13.8	5.58	4.74	17.1	13.2	24.7	14.6
2014	19.1	67.9	66.0	53.4	28.4	11.3	6.08	3.95	3.24	25.7	34.3	59.6
2015	26.5	35.2	28.5	23.3	10.2	4.33	4.07	3.24	5.06	6.06	27.5	269
2016	149	67.1	85.2	25.6	12.8	8.39	5.60	3.81	5.04	70.6	59.2	63.5
2017	58.7	265	136	49.8	19.0	11.4	5.20	4.44	6.00	14.8	94.1	36.4
2018	92.6	36.3	32.6	30.9	9.96	7.52	2.99	2.78	3.88	6.08	11.9	51.3
2019	30.3	43.0	25.5	32.6	13.7	7.87	5.06	3.72	12.8	8.73	9.44	28.2
median	69.2	48.2	49.8	37.0	18.5	11.3	6.52	5.14	5.88	13.3	35.4	59.2



2019

- Except during periods of rainfall and the latter half of September (which was rainy), flow in 2019 was well below the median. Record low flows were set for 40 days in all. More than half of the days from October 31 through December 6 had low flow records in 2019.
- Intermittent storms throughout the year caused high flows; record high flows were recorded in February, April, May, June, July, August and September. The high flows were short-lived which is typical for this site. The latter half of September had unusually high flows due to rainy weather.

CHANGE IN MEASUREMENT

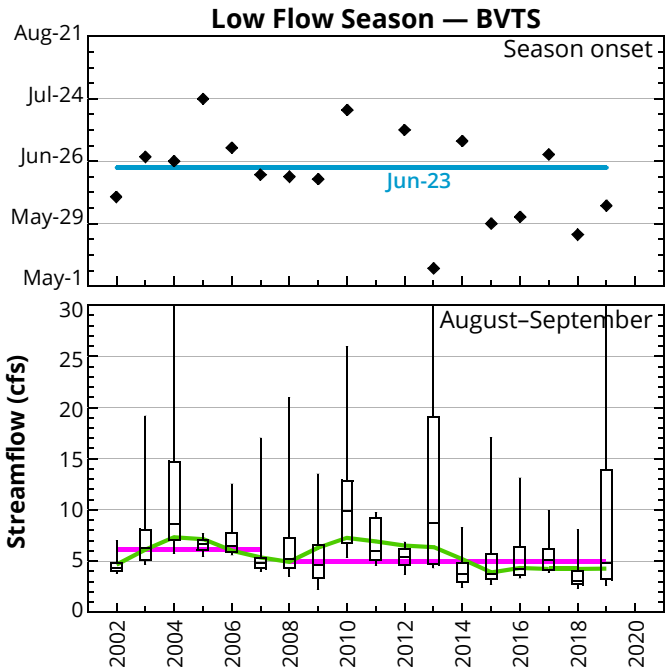
- OWRD monitored flow at this site from 2002 through 2007. Beginning in 2008, monitoring was done by WEST Consultants.
- Flows from 2007 and before (OWRD) are higher than those from 2008 to present (WEST Consultants). Despite considerable variability, the difference is statistically significant and occurs for both high flow and low flow periods.
- Reasons for the difference include:
  - —The rating curve and monitoring procedures may have changed.
  - —2002–2007 could have been too short a period to capture a dry period.
  - —The flow regime truly may have changed.

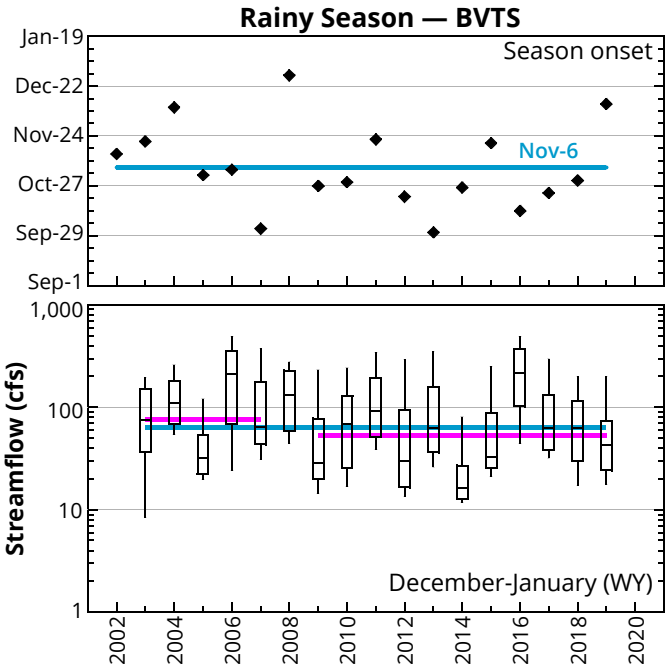
LOW FLOW

- July through September are the months with the lowest average flow and the lowest daily flows.
- Although the August–September median flows are low, higher flows in these months are not uncommon. This pattern is typical of flashy urban streams such as Beaverton Creek.
- Low flow criterion: 7d-Q ≤ 9 cfs (~25th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December and January are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 60 cfs (~75th pctl)





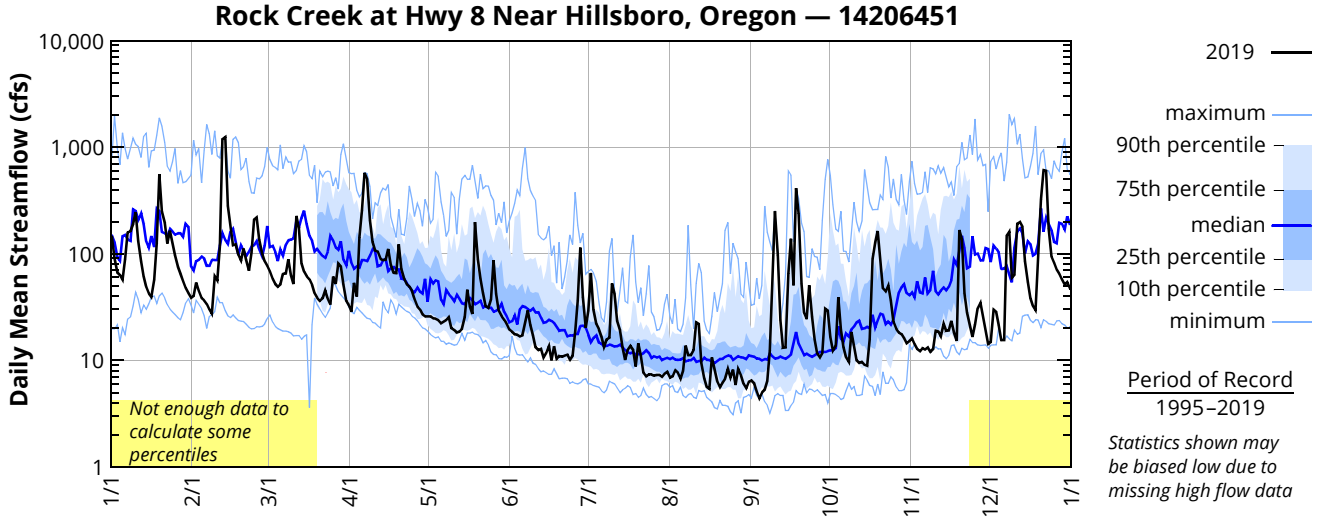
RCTV – Rock Creek at Hwy 8 near Hillsboro, Oregon – 14206451**

Data source: WEST Consultants for Clean Water Services
River Mile: 1.2 *Latitude:* 45 30 08 *Longitude:* 122 56 52

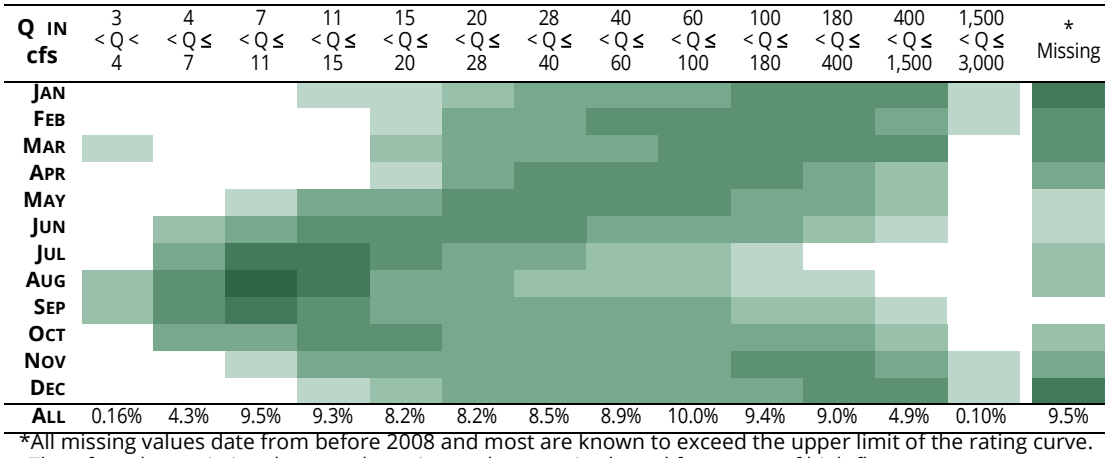
2019 — MEAN STREAMFLOW (cfs) — RCTV

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	143	40.3	77.2	32.6	25.8	19.5	29.3	6.92e	6.46	16.6	16.1	14.9
2	91.2	53.7	68.6	28.6	25.8	18.6	66.3	7.06e	6.11	12.4	14.2	29.9
3	66.8	45.0	58.0	53.4	24.8	17.5	29.9	8.12e	5.05	13.8	12.8	28.5
4	62.9	38.4	51.9	39.8	24.6	17.4	21.9	7.71e	4.40	39.2	12.2	21.5
5	56.7	36.5	49.0	143	23.9	16.8	19.6	6.67e	5.02e	19.6	13.0	15.5
6	89.0	33.9	51.5	257	22.3	17.2	16.7	8.00e	5.33	13.3	12.7	15.5
7	159	30.1	65.0	576	23.1	22.9	13.4	13.8e	6.36	10.7	13.2	148
8	163	27.3	65.4	502	24.0e	29.5	15.7	11.2e	12.4	9.63e	12.0	161
9	191	61.3	89.3	205	25.5	21.4	16.4	11.2e	64.8	18.5e	12.8	59.8
10	246	56.1	63.1	129	20.2	17.2	52.6	12.6	251	13.5e	19.0	63.5
11	132	116	51.9	107	19.4	13.3	41.9	22.9	97.1	9.97e	18.7	192
12	85.6	1190	227	105	18.3	12.5	23.5e	22.1	24.0	9.50	16.7	199
13	61.5	1250	174	89.4	18.5	12.9	19.2	9.54	13.1	9.68	22.1	179
14	48.8	283e	81.3	87.2	19.7	10.7	13.2	6.84	13.2	9.08	19.0	85.2
15	42.4	184e	67.9	87.9	25.5	11.8	10.1	5.58	65.8	8.91	19.1	54.4
16	39.3	121	61.9	111	46.3	13.8	12.6	5.39	139	15.8	23.5	38.4
17	57.2	123	57.6	79.4	32.2	10.0	13.7	10.7	50.5	89.7	18.4	32.2
18	127	97.7	51.1	66.2	27.3	13.6	12.5	8.40	414	127e	15.3	29.4
19	559	85.8	42.5	65.9	198	10.4	8.81e	6.28	238	164e	167	106
20	249e	112	38.6	123	89.3	11.0	14.5e	5.61	52.7	92.4e	137	324
21	196e	87.9	36.3	72.1	59.0	10.8	11.1	6.18	27.9	47.8	42.8	609
22	125	69.6	38.2	58.0	42.8	11.1	7.73e	6.74	24.5	44.7	28.0	599
23	165	103	45.1	51.6	32.5	11.4	7.10e	8.28	51.0	50.7	21.1	173
24	126	210	37.7	49.1	31.2	10.2	7.39e	6.85	25.6	36.6	16.6	93.7
25	96.8	220	33.4	45.0	37.4	11.1e	7.40e	8.17e	15.7	23.2	21.7	82.0
26	75.9	136	61.2	37.5	87.4	18.5	7.18e	5.93	11.6	19.8	30.8	70.8
27	65.2	101	52.4	32.0	42.1	36.6	7.26e	8.33	10.7	18.3	34.9	65.0
28	55.3	84.9	81.6	30.0	29.2	114	7.32e	7.23	11.8	17.7	25.9	57.6
29	47.8	—	76.7	26.9	26.1	39.4	7.02e	6.00	30.5	16.2	19.5	51.3
30	42.5	—	51.7	25.9	24.1	20.3	7.47e	5.49	29.2	14.5	14.3	54.2
31	38.5	—	35.9	—	21.9	—	7.79e	6.25	—	15.2	—	47.4
Mean	3704	4998	2043	3317	1168	601	537	272	1713	1008	850	3701
Max	119	178	65.9	111	37.7	20.0	17.3	8.78	57.1	32.5	28.3	119
Min	559	1250	227	576	198	114	66.3	22.9	414	164	167	609
Ac-Ft	38.5	27.3	33.4	25.9	18.3	10.0	7.02	5.39	4.40	8.91	12.0	14.9

**Site moved 120 feet downstream in 2012, previous ID was 14206450; e=estimated



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — RCTV



Q IN cfs	3 < Q < 4	4 < Q ≤ 7	7 < Q ≤ 11	11 < Q ≤ 15	15 < Q ≤ 20	20 < Q ≤ 28	28 < Q ≤ 40	40 < Q ≤ 60	60 < Q ≤ 100	100 < Q ≤ 180	180 < Q ≤ 400	400 < Q ≤ 1,500	1,500 < Q ≤ 3,000	* Missing
JAN														
FEB														
MAR														
APR														
MAY														
JUN														
JUL														
AUG														
SEP														
OCT														
NOV														
DEC														
ALL	0.16%	4.3%	9.5%	9.3%	8.2%	8.2%	8.5%	8.9%	10.0%	9.4%	9.0%	4.9%	0.10%	9.5%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1995–2019

*All missing values date from before 2008 and most are known to exceed the upper limit of the rating curve. Therefore the statistics above underestimate the magnitude and frequency of high flow.

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — RCTV

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1995				102	40.2	22.2	12.3	10.2	9.5	24.9		
1996					161	30.0	15.8	10.2	15.9	50.8		
1997				81.0	41.8	38.4	16.5	11.3	15.1			
1998				53.3	153	35.4	18.3	14.3	13.7	26.9		
1999				60.8	39.6	22.0	15.8	14.9	12.0	14.3		
2000		206	149	37.2	30.0	17.9		11.7	12.9	26.6	20.1	61.2
2001	37.5	41.1	35.9	38.1	17.9	16.0	9.8	9.5	8.6	13.7	83.6	
2002			125	41.1	22.8	16.8	13.2	10.0	9.4	17.7	27.0	133
2003			368	155	37.8	17.3	12.5	12.0	11.1	23.3	30.6	178
2004	288		61.6	30.4	18.8	16.2	11.5	11.3	14.0	31.4	30.6	50.5
2005	52.2	30.4	21.6	81.0	82.4	32.7	16.4	13.0	10.7	31.1	104	
2006			118	70.9	28.4	26.7	11.1	10.8	11.9	15.8	447	
2007		147	182	53.5	22.5	19.2	10.7		17.4	26.3	35.4	
2008	334	127	121	68.0	33.7	16.5	8.7	9.0	6.1	7.8	44.7	31.3
2009	102	45.1	71.3	49.7	54.7	28.1	7.6	7.0	8.0	25.2	177	59.9
2010	377	217	151	176	67.0	85.3	19.8	15.8	20.7	19.9	122	352
2011	231	103	265	118	64.8	29.9	19.5	9.0	6.8	18.6	43.8	30.0
2012	104	96.7	291	118	66.0	37.6	14.0	9.8	8.2	49.1	126	434
2013	91.1	70.7	56.0	41.5	24.2	32.4	9.6	7.3	28.2	19.8	42.2	26.8
2014	43.6	132	135	122	47.7	19.6	12.6	5.9	5.2	50.4	61.8	143
2015	54.0	53.4	53.7	55.5	18.2	7.8	5.8	4.5	8.1	10.5	68.4	433
2016	357	181	226	53.6	21.9	15.3	10.3	5.8	9.5	108	111	196
2017	147	404	295	137	62.5	20.8	8.2	7.2	8.1	24.2	146	92.0
2018	182	93.1	96.5	79.2	20.1	12.4	6.1	5.6	5.9	8.5	19.8	131
2019	89.0	92.8	57.6	69.2	25.8	15.3	13.2	7.2	24.3	16.6	18.9	63.5
median	156	109	121	69.7	35.9	22.5	12.4	10.2	11.3	23.0	65.0	128

KEY

Q in cfs

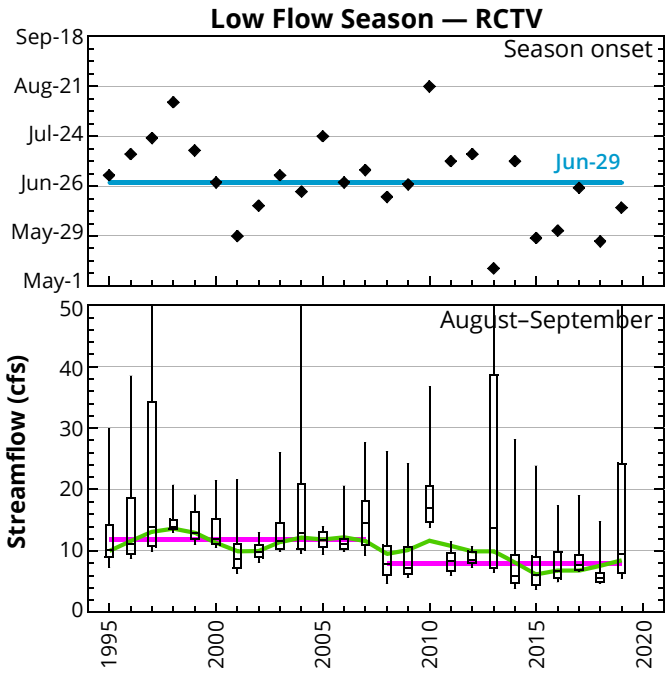
$Q \leq 7.0$
$7.0 < Q \leq 9.1$
$9.1 < Q \leq 11.0$
$11.0 < Q \leq 13.0$
$13.0 < Q \leq 17.0$
$17.0 < Q \leq 24.0$
$24.0 < Q \leq 35.0$
$.530 < Q \leq 107$
$107 < Q \leq 276$
$276 < Q \leq 423$
$Q > 423$

Q as percentile

$Q \leq$ 5th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
Q > 95th

2019

- Baseflows in 2019 were well below the median. Record low flows were set for 14 days in all, including eight consecutive days in November (2–9). Still, this site had fewer days with record low flows than many other tributary sites.
- Storms scattered throughout the year caused the highest flows, including record high flows in February, April, September and late December. High flows were short-lived as is typical for this site.



CHANGE IN MEASUREMENT

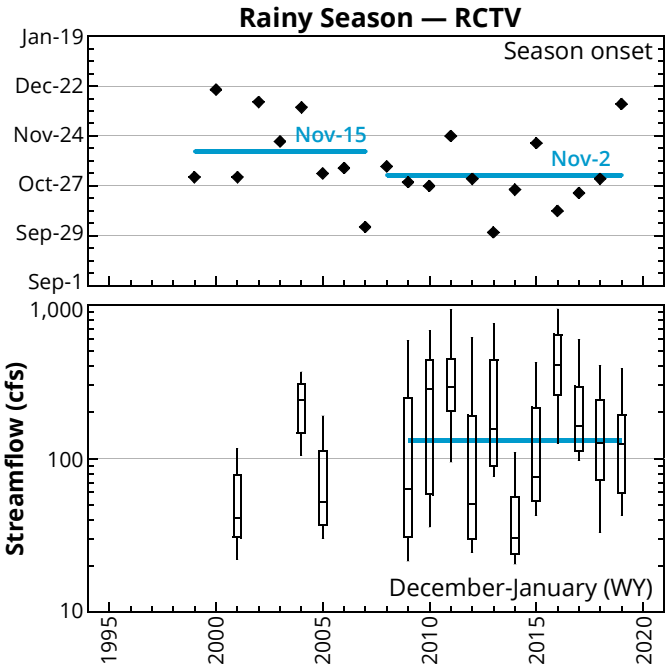
- OWRD monitored flow at this site from 1995 through 2007. Beginning in 2008, monitoring was done by WEST Consultants.
- Flows during the August–September period from 2007 and before (OWRD) are higher than those from 2008 to present (WEST Consultants). Despite considerable variability, the difference is statistically significant.
- Rainy season onset since 2008 appears to be earlier than from 1999–2007, but the difference is not statistically significant.
- These differences are probably due to differences in rating curves and monitoring, although true changes in the flow regime are possible.

LOW FLOW

- July through September are the months with the lowest average flow and the lowest daily flows.
- Although the August–September median flows are low, higher flows in these months are not uncommon. This pattern is typical of flashy urban streams such as Rock Creek.
- Low flow criterion: 7d-Q ≤ 15 cfs (~25th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 100 cfs (~74th pctl)
- Boxplots and onset of rainy season flow are not shown for years with too much missing data.

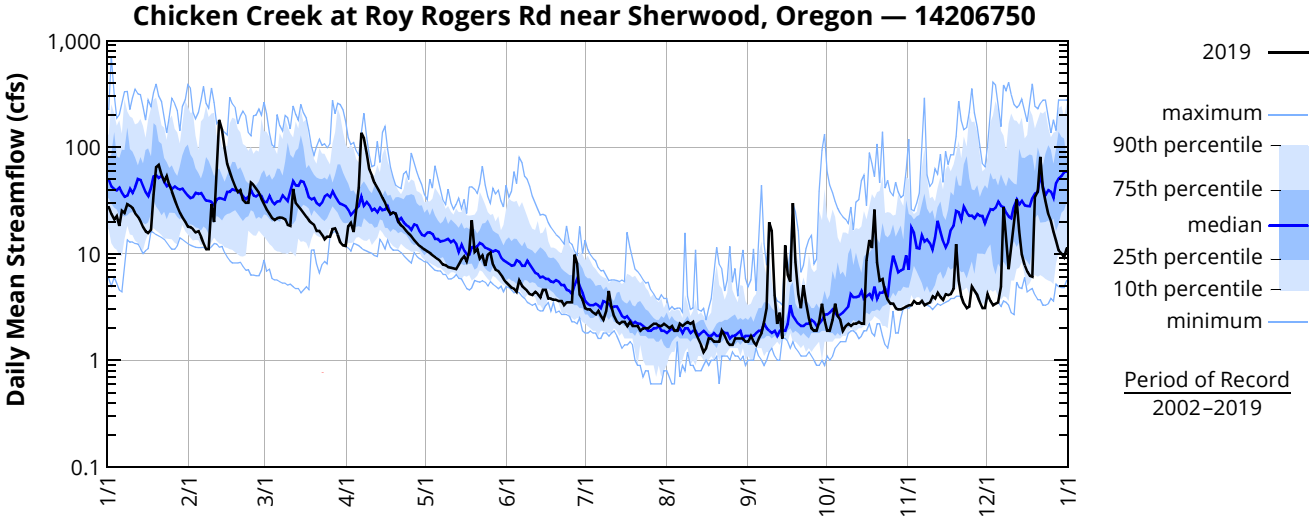


CCSR — Chicken Creek at Roy Rogers Rd near Sherwood, Oregon — 14206750

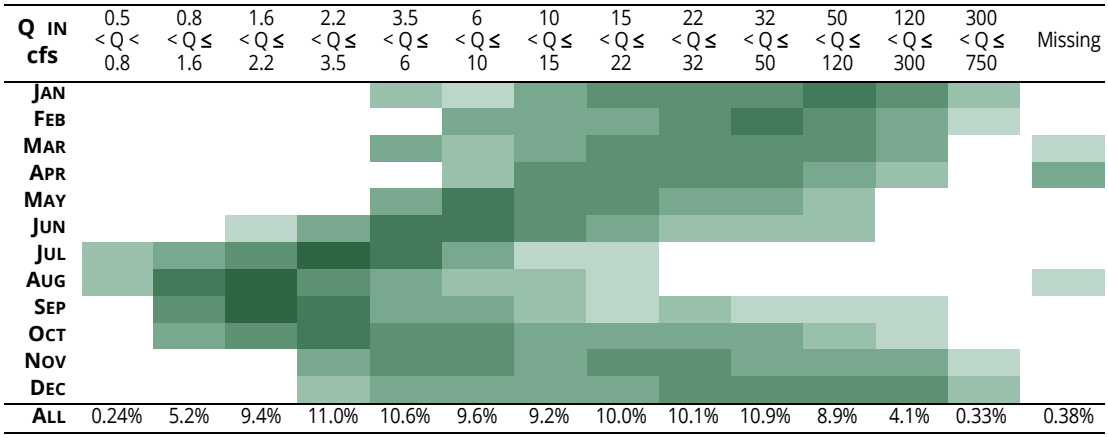
Data source: WEST Consultants for Clean Water Services
River Mile: 2.3 *Latitude:* 45 22 31 *Longitude:* 122 51 24

2019 — MEAN STREAMFLOW (cfs) — CCSR

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	27.2	17.8	29.1	11.8	11.0	5.35	3.12	2.08	1.53	1.90	3.26	4.21
2	23.5	17.1	26.0	18.1	10.6	5.14	3.01	2.03	1.66	1.86	3.32	3.64
3	20.9	15.9	23.5	19.6	10.2	4.84	2.95	2.09	1.52	2.36	3.58	3.33
4	22.6	16.3	21.6	16.0	9.66	4.67	2.76	1.86	1.42	3.37	3.41	3.37
5	18.2	14.5	20.7	26.6	9.25	4.40	2.71	1.86	1.58	2.55	3.37	3.54
6	25.3	12.5	21.6	41.8	8.85	5.57	2.86	2.17	1.80	2.37	3.55	4.86
7	24.1	11.0	21.9	136	8.47	5.01	2.57	2.08	2.28	1.93	3.33	27.4
8	29.2	11.0	21.7	121	7.93	4.74	2.35	2.15	3.11	2.13	3.44	13.2
9	28.2	29.4	21.1	86.9	7.80	4.49	2.90	2.34	19.7	2.15	3.47	7.16
10	26.8	19.9	18.6	61.6	7.54	4.18	4.54	2.24	16.3	2.06	4.01	11.4
11	24.0	61.8	18.3	54.1	7.41	4.10	3.15	2.31	4.09	2.18	3.84	19.3
12	22.3	180	40.6	46.0	7.34	4.35	2.60	1.81	2.20	2.20	4.25	32.3
13	20.1	144	30.0	41.4	7.20	4.15	2.32	1.60	2.78	2.26	3.92	16.3
14	17.8	97.6	28.1	37.5	7.93	3.86	2.15	1.40	1.59	2.19	3.70	9.85
15	16.2	69.8	26.1	33.2	8.90	4.55	2.25	1.17	12.0	2.15	4.15	7.80
16	15.7	58.8	24.2	30.1	9.47	4.58	2.34	1.34	6.36	8.70	4.12	6.75
17	16.8	49.6	22.3	26.0	8.42	3.84	2.12	1.59	5.46	13.5	4.20	6.17
18	35.9	42.3	20.6	23.6	10.5	3.78	2.27	1.61	29.9	11.3	4.68	6.11
19	65.0	37.7	19.5	24.4	20.7	3.69	2.06	1.49	8.44	25.9	12.3	34.2
20	68.4	39.6	18.7	23.9	10.4	3.70	2.12	1.49	4.23	8.30	5.56	38.4
21	54.8	32.1	16.4	20.1	11.1	3.57	2.07	1.52	3.11	5.56	3.95	81.0
22	48.1	30.1	16.4	18.4	9.00	3.55	1.91	1.94	5.06	5.81	3.41	40.9
23	53.7	30.1	15.2	17.7	9.65	3.32	1.95	1.71	3.48	4.35	3.11	31.1
24	44.0	46.5	13.7	16.5	7.71	3.50	1.99	1.52	2.47	3.72	3.22	23.4
25	38.4	44.2	14.4	15.5	9.75	3.45	1.98	1.41	2.00	3.38	4.93	20.3
26	32.1	41.0	14.4	14.6	10.3	3.48	2.13	1.38	1.85	3.39	4.53	16.1
27	27.7	37.5	17.0	13.5	7.91	9.78	2.22	1.55	1.93	3.05	4.13	13.3
28	24.3	32.5	17.3	12.7	7.11	8.07	2.24	1.59	2.33	2.97	3.45	10.8
29	21.8	—	15.2	11.9	6.86	4.05	2.14	1.60	3.37	2.98	3.14	10.1
30	19.8	—	12.8	11.4	6.43	3.68	2.11	1.59	2.38	3.09	3.05	9.21
31	17.9	—	12.0	—	5.82	—	2.19	1.54	—	3.24	—	11.1
Mean	27.2	17.8	29.1	11.8	11.0	5.35	3.12	2.08	1.53	1.90	3.26	4.21
Max	23.5	17.1	26.0	18.1	10.6	5.14	3.01	2.03	1.66	1.86	3.32	3.64
Min	20.9	15.9	23.5	19.6	10.2	4.84	2.95	2.09	1.52	2.36	3.58	3.33
Ac-Ft	22.6	16.3	21.6	16.0	9.66	4.67	2.76	1.86	1.42	3.37	3.41	3.37



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — CCSR



MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — CCSR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002	65.0	48.5	46.5		9.80	5.00	2.20	1.70	1.70	2.70	6.95	30.0
2003	33.0	39.1	47.9	36.3	14.6	6.08	2.49	1.52	1.98	4.31	7.26	37.0
2004	45.2	43.2	21.7	12.8	6.82	4.22	1.50	1.27	1.93	4.47	5.68	14.7
2005	15.1	9.74	6.59	23.7	23.0	6.80	2.17	1.04	1.29	3.16	18.1	32.8
2006	180	31.2	30.2	20.8	9.49	5.37	2.33	1.47	1.26	2.50	54.0	62.4
2007	37.7	37.7	33.7	26.5	11.2	4.79	2.22	1.91	3.06	20.4	30.8	62.1
2008	61.1	44.9	41.9	27.2	14.4	7.23	2.92	3.16	3.51	4.37	7.97	8.68
2009	20.5	11.7	19.5	13.1	16.8	6.88	2.43	1.48	2.03	4.20	21.3	16.8
2010	66.6	36.7	36.5	28.0	16.4	21.2	4.05	1.82	2.83	4.29	27.7	77.3
2011	51.6	33.6	76.5	39.7	18.7	10.3	5.59	1.93	2.12	4.51	9.08	5.94
2012	40.5	34.8	67.7	43.0	22.9	11.9	5.59	2.33	1.83	10.1	25.7	102
2013	19.4	16.7	16.7	14.1	7.74	11.5	3.49	1.95	4.04	14.1	21.4	8.12
2014	15.5	42.0	43.2	30.1	14.9	6.04	3.38	2.15	2.18	4.02	15.7	39.3
2015	19.1	29.5	25.0	17.6	7.10	3.35	1.87	1.78	1.80	2.17	15.1	167
2016	74.0	43.5	49.1	15.3	7.34	4.52	2.57	1.84	2.12	26.5	32.9	53.2
2017	42.4	141	88.1	34.3	19.2	9.64	4.07	2.39	3.20	4.36	41.0	30.0
2018	55.4	27.5	32.7	33.2	8.39	5.50	1.68	1.49	1.47	3.00	3.86	23.0
2019	24.3	35.0	20.6	23.8	8.85	4.17	2.25	1.60	2.63	2.98	3.64	11.1
median	42.2	34.8	34.8	24.1	11.7	6.14	2.60	1.79	2.09	4.29	17.0	33.6

KEY

Q in cfs
- Q ≤ 1.56
- 1.56 < Q ≤ 1.85
- 1.855 < Q ≤ 2.20
- 2.20 < Q ≤ 2.70
- 2.70< Q ≤ 4.35
- 4.35< Q ≤ 7.04
- 7.04 < Q ≤ 11.7
- 11.7 < Q ≤ 31.2
- 31.2 < Q ≤ 62.0
- 62.0 < Q ≤ 110
- Q > 110

Q as percentile
- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

2019

- Flow in 2019 was below the median for most of the first half of the year, near average during July–August, and very low from late October through mid-December.
- Record low flows were set on 25 days, 13 of which were in November. Record low flows also occurred in early February, late March–early April and early December.
- September was particularly rainy and resulted in high flow records for 5 days.

CHANGE IN MEASUREMENT

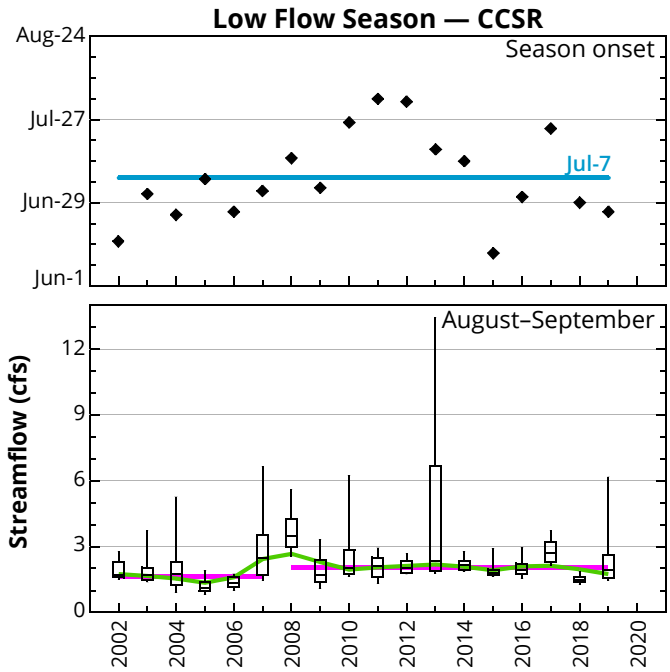
- OWRD monitored flow at this site from 2002 through 2007. Beginning in 2008, monitoring was done by WEST Consultants.
- Flows during the August–September period from 2007 and before (OWRD) are lower than those from 2008 to present (WEST Consultants). Despite considerable variability, the difference is statistically significant.
- This difference is most likely due to differences in rating curves and monitoring, although true changes in the flow regime are possible.

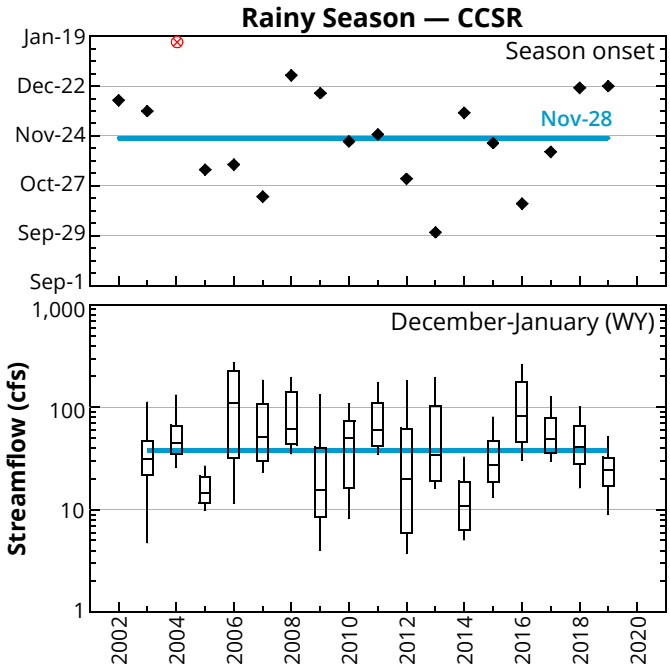
LOW FLOW

- July through September are the months with the lowest average flows, with August consistently having the lowest of the three. The lowest daily flows occur in July and August.
- September often has very low flow, but early fall rains may cause high flows as was the case in 2013 and 2019.
- Low flow criterion: 7d-Q ≤ 3.5cfs (~25th pctl)
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 30 cfs (~73th pctl)
- Rainy season flow for 2004 did not occur until the following March (3/30/2005)



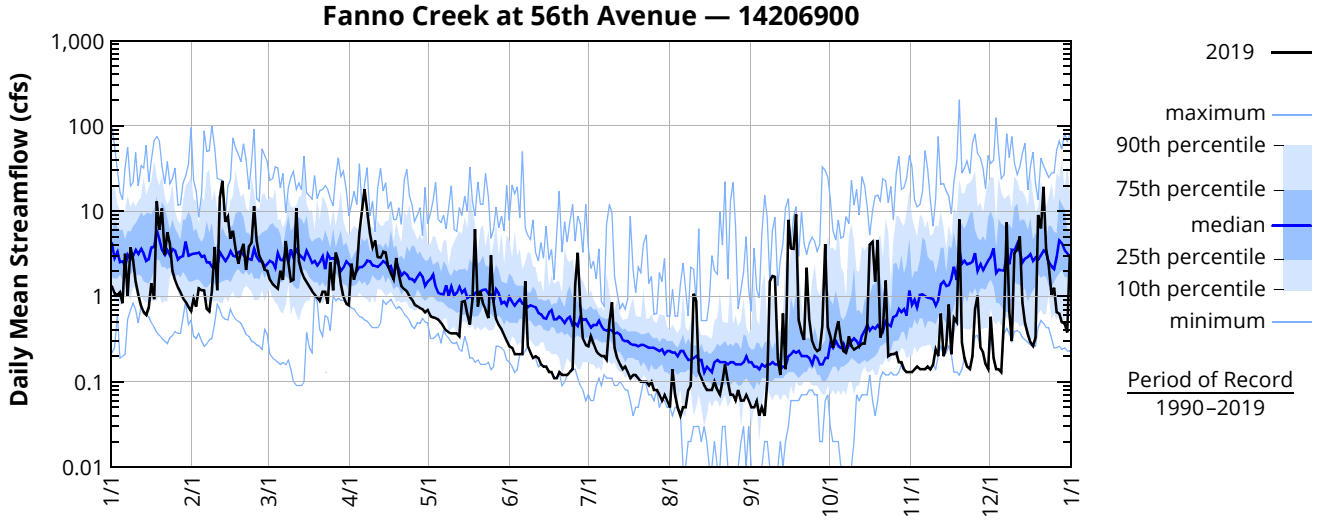


6900 – Fanno Creek at 56th Avenue – 14206900

Data source: U.S. Geological Survey, Oregon Water Science Center
River Mile: 12.6 *Latitude:* 45 29 17 *Longitude:* 122 44 01 *Drainage area:* 2.37 sq mile

2019 — MEAN STREAMFLOW (cfs) — 6900

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.30	0.94	2.01	0.79	0.69	0.26	0.26	0.05	0.05	0.34	0.13	0.58
2	1.09	0.76	1.58	2.43	0.59	0.25	0.34	0.14	0.05	0.25	0.14	0.19
3	1.04	1.25	1.39	1.57	0.57	0.21	0.28	0.07	0.06	0.38	0.15	0.14
4	1.12	1.18	1.30	2.14	0.56	0.21	0.23	0.05	0.04	0.51	0.14	0.14
5	0.83	1.17	1.23	5.67	0.54	0.21	0.21	0.04	0.05	0.31	0.14	0.13
6	3.16	0.72	2.01	10.5	0.49	0.21	0.20	0.05	0.04	0.23	0.14	0.61
7	1.01	0.67	1.58	18.1	0.44	1.51	0.20	0.05	0.10	0.22	0.15	7.41
8	3.78	1.13	4.46	10.6	0.40	0.26	0.18	0.08	1.52	0.34	0.14	0.67
9	2.69	3.80	2.51	5.46	0.38	0.22	0.50	0.09	1.74	0.26	0.16	0.30
10	1.49	1.18	1.52	3.81	0.37	0.19	0.85	1.08	1.70	0.24	0.24	3.26
11	1.06	14.3	1.58	4.56	0.37	0.20	0.25	0.89	0.19	0.25	0.20	3.55
12	0.77	22.7	10.8	2.88	0.37	0.19	0.19	0.13	0.12	0.26	0.63	5.05
13	0.65	7.50	2.59	2.85	0.34	0.16	0.16	0.11	0.63	0.28	0.20	0.85
14	0.61	8.73	1.95	3.33	0.86	0.15	0.14	0.09	0.14	0.28	0.26	0.49
15	0.74	4.74	1.65	3.29	0.88	0.15	0.15	0.08	7.94	0.43	0.80	0.36
16	1.43	5.90	1.47	2.22	0.62	0.13	0.13	0.08	3.65	4.03	0.21	0.29
17	0.93	3.68	1.29	1.85	0.47	0.13	0.11	0.08	3.60	4.36	0.56	0.26
18	13.0	2.43	1.15	1.58	0.91	0.11	0.12	0.10	9.19	1.49	0.50	0.33
19	6.05	3.37	1.06	2.83	6.14	0.11	0.12	0.08	0.53	4.61	7.99	8.98
20	10.8	4.14	0.97	1.80	0.76	0.13	0.11	0.07	0.38	0.33	0.29	6.28
21	3.05	2.06	0.89	1.32	1.15	0.12	0.10	0.10	0.31	0.41	0.19	19.2
22	5.65	3.86	1.13	1.21	0.82	0.12	0.10	0.16	2.16	1.53	0.15	3.64
23	4.13	4.27	1.13	1.14	0.70	0.12	0.10	0.10	0.55	0.20	0.14	2.36
24	1.99	11.5	0.82	1.00	0.56	0.13	0.09	0.07	0.30	0.21	0.20	1.05
25	1.54	4.51	2.53	0.92	3.04	0.14	0.10	0.07	0.25	0.21	0.71	1.27
26	1.27	3.00	1.18	0.80	0.85	1.37	0.08	0.06	0.23	0.22	1.02	0.66
27	1.11	2.55	3.28	0.77	0.54	3.24	0.08	0.08	0.24	0.17	0.25	0.63
28	0.95	2.06	2.58	0.73	0.46	0.78	0.07	0.06	0.45	0.17	0.22	0.50
29	0.87	—	1.40	0.71	0.41	0.32	0.06	0.06	4.12	0.14	0.16	0.48
30	0.75	—	0.99	0.65	0.35	0.27	0.07	0.07	0.44	0.13	0.14	0.38
31	0.67	—	0.82	—	0.30	—	0.06	0.06	—	0.13	—	2.99
Mean	75.5	124	60.9	97.5	25.9	11.6	5.64	4.30	40.8	22.9	16.4	73.0
Max	2.44	4.43	1.96	3.25	0.84	0.39	0.18	0.14	1.36	0.74	0.55	2.36
Min	13.0	22.7	10.8	18.1	6.14	3.24	0.85	1.08	9.19	4.61	7.99	19.2
Ac-Ft	0.61	0.67	0.82	0.65	0.30	0.11	0.06	0.04	0.04	0.13	0.13	0.13



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — 6900

Q IN cfs	0.01 < Q < 0.02	0.02 < Q ≤ 0.1	0.1 < Q ≤ 0.2	0.2 < Q ≤ 0.3	0.3 < Q ≤ 0.5	0.5 < Q ≤ 0.8	0.8 < Q ≤ 1.3	1.3 < Q ≤ 2	2 < Q ≤ 3	3 < Q ≤ 5	5 < Q ≤ 12	12 < Q ≤ 80	80 < Q ≤ 300
JAN													
FEB													
MAR													
APR													
MAY													
JUN													
JUL													
AUG													
SEP													
OCT													
NOV													
DEC													
ALL	0.26%	4.0%	10.1%	8.2%	10.7%	9.6%	10.6%	11.2%	10.3%	9.8%	9.9%	5.3%	0.09%

*Data from October – December 1990 not used to prevent skewing distribution.

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1990*–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — 6900

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990										0.46	1.50	2.10
1991	2.20	3.45	2.60	1.95	1.30	0.92	0.65	0.39	0.21	0.16	2.35	2.60
1992	2.50	2.95	1.50	1.70	0.50	0.26	0.14	0.09	0.08	0.19	0.85	1.60
1993	1.90	1.25	2.90	3.80	2.10	0.97	0.62	0.52	0.38	0.49	0.55	0.71
1994	1.30	1.50	1.40	1.60	0.70	0.49	0.34	0.19	0.13	0.15	2.05	5.30
1995	4.20	3.40	3.20	2.65	1.20	0.93	0.41	0.36	0.33	0.56	2.85	5.30
1996	6.40	9.55	2.20	2.75	2.30	0.75	0.43	0.22	0.20	1.70	4.10	12.0
1997	4.00	1.85	5.90	2.00	0.80	0.68	0.30	0.25	0.33	0.74	2.00	2.10
1998	6.50	4.85	3.30	1.20	2.80	1.00	0.44	0.27	0.21	0.41	4.85	7.30
1999	6.30	9.60	4.30	1.80	1.10	0.59	0.34	0.22	0.10	0.16	2.25	2.20
2000	4.80	3.35	2.70	1.05	1.00	0.50	0.28	0.20	0.20	0.37	0.60	1.00
2001	0.73	0.81	1.30	1.20	0.65	0.46	0.26	0.20	0.16	0.22	2.08	5.11
2002	4.71	3.21	2.76	1.24	0.65	0.46	0.20	0.14	0.19	0.21	0.40	2.92
2003	3.60	2.49	2.95	3.79	1.57	0.69	0.30	0.25	0.22	0.28	1.19	5.63
2004	6.56	3.93	1.67	0.69	0.27	0.20	0.13	0.16	0.24	0.44	0.90	2.35
2005	2.02	0.73	0.25	2.53	2.85	1.17	0.30	0.16	0.12	0.46	0.78	1.46
2006	8.45	2.41	2.47	1.99	1.03	0.78	0.30	0.14	0.12	0.24	6.16	3.46
2007	2.71	3.32	3.14	1.76	0.75	0.48	0.27	0.16	0.16	0.65	1.07	5.60
2008	5.28	3.16	3.42	1.84	0.79	0.57	0.19	0.21	0.11	0.16	1.44	1.56
2009	2.91	1.78	1.48	1.00	1.14	0.40	0.25	0.12	0.17	0.33	2.84	1.65
2010	5.31	2.58	1.93	2.60	2.01	2.05	0.42	0.21	0.27	0.43	2.53	4.60
2011	2.97	2.50	6.27	3.55	1.95	0.86	0.54	0.32	0.19	0.35	1.60	0.57
2012	2.70	1.95	6.18	3.60	1.89	1.17	0.38	0.11	0.08	0.53	2.03	5.63
2013	1.83	1.40	1.22	1.05	0.51	0.75	0.22	0.05	0.31	0.47	0.48	0.42
2014	0.43	1.96	3.27	3.45	2.08	0.74	0.54	0.09	0.07	0.40	1.42	3.15
2015	1.47	3.44	4.12	2.66	0.88	0.40	0.19	0.03	0.20	0.48	1.68	11.5
2016	6.76	5.53	5.12	1.50	1.03	0.37	0.09	0.03	0.12	3.12	2.24	3.00
2017	2.96	7.22	6.58	3.22	1.58	0.55	0.22	0.12	0.16	0.49	2.41	1.09
2018	3.48	1.87	1.90	2.76	0.49	0.30	0.11	0.08	0.13	0.21	0.32	2.23
2019	1.12	3.19	1.47	2.00	0.56	0.20	0.13	0.08	0.35	0.26	0.20	0.63
median	3.20	2.79	2.69	2.12	1.10	0.64	0.30	0.18	0.18	0.40	1.50	2.87

KEY

Q in cfs

$Q \leq 0.10$
$0.10 < Q \leq 0.15$
$0.15 < Q \leq 0.20$
$0.20 < Q \leq 0.26$
$0.26 < Q \leq 0.43$
$0.43 < Q \leq 0.69$
$0.69 < Q \leq 1.10$
$1.10 < Q \leq 3.00$
$3.00 < Q \leq 7.26$
$7.26 < Q \leq 12.1$
$Q > 12.1$

Q as percentile

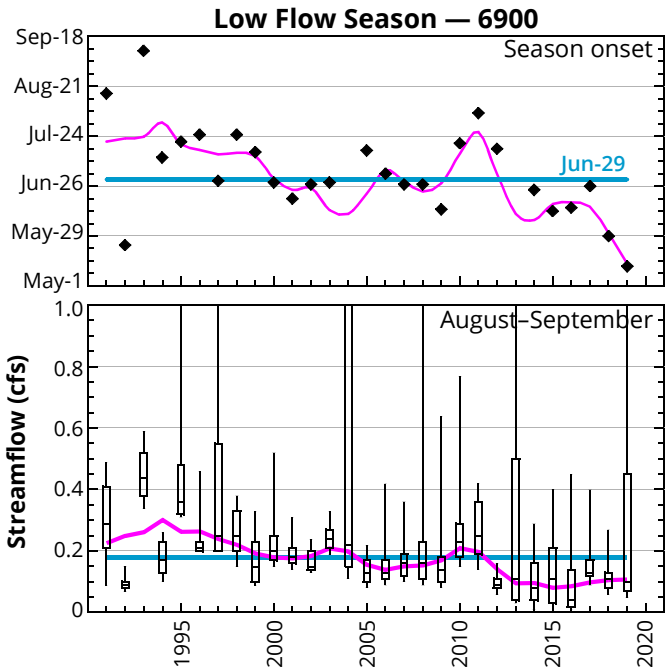
$Q \leq$ 5th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

- Baseflows in 2019 were well below the median. Record low flows were set for 57 days in all, including 16 days in June and 20 days in November.
- September had high flows due to prolonged rainy weather.

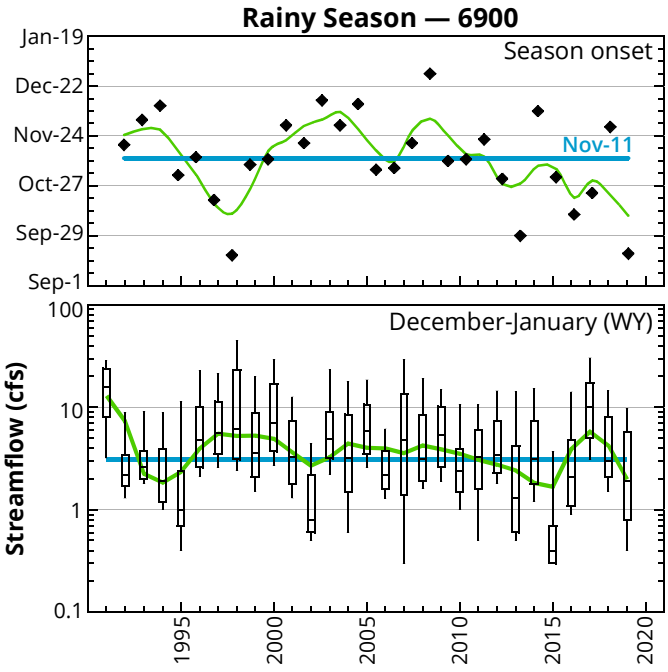
LOW FLOW

- August and September are the months with the lowest average flow and the lowest daily flows.
- August–September flows show a statistically significant decreasing trend. The reason for the decrease is unknown. Monitoring protocols have not changed at this site.
- Low flow criterion: 7d-Q ≤ 0.4 cfs (~27th pctl)
- Low flow onset is occurring earlier in the year. The trend is statistically significant. Since 2013, low flow began in on or before June 15th five times of the past 6 years (60%). Between 1991 and 2015, the low flow began that early only three times (14%).
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.
- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.



RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- No trends are evident in the magnitude of the flow for December–January.
- Rainy season criterion: 7d-Q ≥ 3.0 cfs (~74th pctl)
- Rainfall in the fall of 2014 was low compared to most years, resulting in low WY 2015 December–January flow.



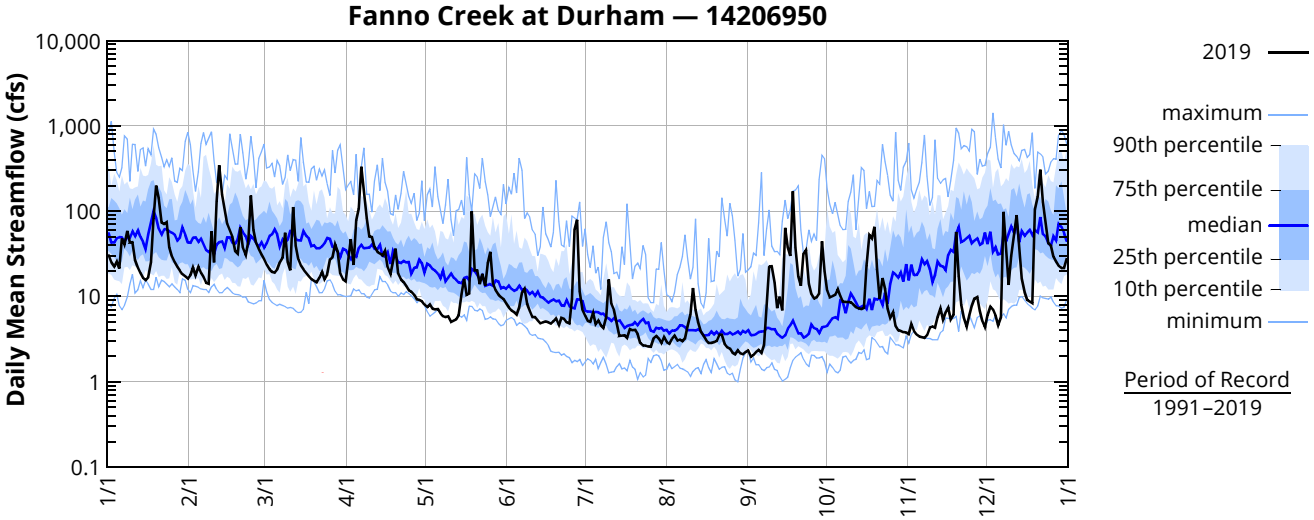
FANO – FANNO CREEK AT DURHAM – 14206950

Data source: U.S. Geological Survey, Oregon Water Science Center
River Mile: 1.2 *Latitude:* 45 24 13 *Longitude:* 122 45 13 *Drainage area:* 31.50 sq mile

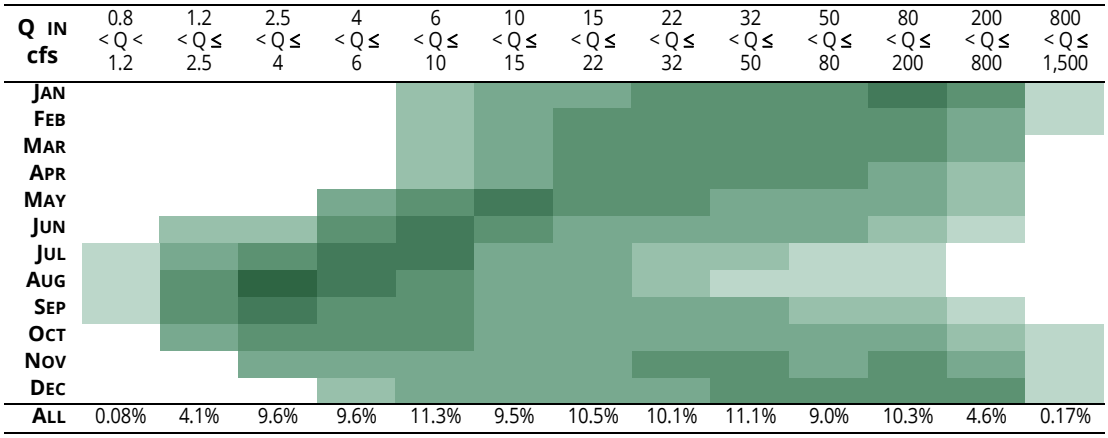
2019 — MEAN STREAMFLOW† (cfs) — FANO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	30.2	17.8	27.4	15.0	8.00	8.30	5.95	2.92	2.34	11.7	3.63	6.01
2	25.0	21.9	23.7	26.9	7.52	7.41	5.18	2.80	1.96	9.76	4.74	7.59
3	22.5	17.8	20.7	47.2	8.02	6.88	5.04	3.19	2.07	10.1	3.96	7.04
4	25.8	22.2	19.3	23.4	7.17	6.58	6.40	3.47	2.23	10.5	3.57	5.99
5	21.2	18.8	19.0	77.8	7.05	6.16	4.73	3.05	2.37	12.2	3.37	4.61
6	47.9	16.9	20.8	107	7.13	7.45	5.22	3.12	2.17	10.1	3.32	5.75
7	40.4	14.4	25.1	333	6.37	11.1	4.56	3.00	2.70	8.68	3.28	97.8
8	58.5	14.1	28.5	174	5.90	12.4	4.28	3.20	7.69	8.56	3.53	39.3
9	42.9	57.9	55.9	82.7	5.72	8.25	5.71	4.47	22.4	8.58	4.34	13.7
10	43.1	25.1	25.3	50.6	5.84	6.75	15.9	6.13	22.6	8.49	4.46	29.8
11	26.8	130	20.2	49.6	5.05	5.74	8.18	12.6	14.6	7.99	4.31	54.6
12	21.6	346	112	38.1	5.23	5.72	6.95	6.91	7.32	7.48	5.74	89.9
13	18.7	156	39.2	33.4	5.41	5.26	4.73	5.00	9.99	7.25	7.22	35.5
14	16.5	107	27.4	31.9	6.01	4.87	3.44	3.83	6.88	7.09	5.33	16.2
15	15.4	71.0	23.1	30.2	10.7	4.98	3.48	3.45	63.5	7.39	6.50	11.2
16	16.7	59.3	20.8	34.6	16.2	5.07	3.51	3.07	37.6	22.8	7.40	9.15
17	25.2	49.9	18.9	22.1	10.5	5.01	3.28	2.85	29.8	52.7	5.39	8.71
18	82.9	33.9	17.3	18.3	10.9	4.83	4.18	2.85	171	48.1	6.13	8.35
19	200	31.7	16.0	25.5	99.5	5.10	4.01	2.91	37.5	65.3	56.8	104
20	142	65.1	15.3	36.5	20.2	5.52	4.07	3.03	17.2	20.9	17.5	149
21	74.0	37.1	14.7	18.5	20.2	4.61	3.62	3.57	13.3	9.37	7.95	308
22	70.7	30.3	16.7	15.7	13.9	5.62	2.84	3.55	31.8	16.5	5.64	128
23	74.4	44.6	19.5	14.7	18.4	5.48	2.65	2.77	35.1	12.3	4.42	77.2
24	37.8	152	16.0	13.2	13.3	5.01	2.66	2.55	14.1	7.19	6.00	41.7
25	29.5	59.9	18.1	11.8	24.5	4.84	2.59	2.46	10.6	5.64	7.83	39.2
26	25.0	42.4	27.2	11.4	33.4	9.36	2.57	2.20	9.48	6.59	9.49	29.0
27	22.3	35.5	28.7	10.5	14.2	60.6	3.23	2.11	9.79	4.47	9.89	25.6
28	20.0	30.9	40.8	9.23	11.8	79.2	3.43	2.35	10.9	3.99	6.76	22.9
29	18.3	—	33.7	9.13	10.5	11.5	3.21	2.16	44.2	3.94	5.12	21.5
30	17.1	—	18.6	8.82	9.79	6.89	2.84	2.10	19.8	3.81	4.36	21.5
31	16.2	—	15.8	—	9.28	—	3.36	2.24	—	3.77	—	27.4
Mean	42.9	61.1	26.6	46.0	14.1	10.9	4.57	3.55	22.1	13.7	7.60	46.7
Max	200	346	112	333	99.5	79.2	15.9	12.6	171	65.3	56.8	308
Min	15.4	14.1	14.7	8.82	5.05	4.61	2.57	2.10	1.96	3.77	3.28	4.61
Ac-Ft	2635	3391	1638	2739	868	648	281	218	1315	839	452	2868

† Data after Oct 16, 2019 are provisional—subject to revision



FREQUENCY OF MEAN DAILY STREAMFLOW BY MONTH — FANO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1991–2019

MEDIAN OF DAILY MEAN STREAMFLOW BY MONTH AND YEAR — FANO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1991	28	44	33	25	17	12	7.5	4.8	3.3	3.1	34	40
1992	42	50	22	33	12	5.2	3.4	2.8	2.9	3.7	20	56
1993	44	21	56	73	38	17	8.7	4.7	3.5	3.8	5.8	26
1994	41	37	34	25	12	8.7	3.8	3.8	3.4	3.6	49	68
1995	62	59	59	39	19	15	9.8	6.7	5.5	15	50	71
1996	95	124	25	37	25	7.8	6.6	5.9	7.5	19	80	221
1997	74	41	110	34	21	20	8.9	6.5	9.3	31	39	39
1998	100	73	58	21	54	18	9.2	7.8	24	34	70	100
1999	90	155	71	30	20	11	6.8	6.3	4.5	6.3	53	48
2000	61	68	52	17	17	7.5	5.6	3.9	3.8	12	8.9	21
2001	13	17	21	22	11	10	5.5	5.4	4.4	7.1	39	99
2002	86	54	44	19	11	7.9	5.5	3.8	4.0	4.1	8.5	66
2003	58	41	71	63	20	9.2	5.6	4.5	3.7	12	17	78
2004	100	64	25	12	9.1	6.7	3.8	5.2	6.5	17	15	25
2005	22	13	11	33	33	14	5.4	4.9	3.5	14	39	64
2006	195	32	42	33	15	9.5	4.3	3.0	2.7	4.4	117	65
2007	38	47	44	28	11	6.5	4.0	3.0	3.3	15	18	105
2008	109	34	54	29	16	9.0	4.5	4.6	3.4	4.9	19	17
2009	26	16	27	21	23	8.2	3.3	3.2	3.4	7.3	48	18
2010	86	41	31	36	21	28	6.0	3.5	6.5	5.6	46	96
2011	51	32	101	50	26	13	9.5	4.0	2.4	8.3	28	13
2012	50	35	81	46	23	15	5.5	2.7	2.0	21	49	137
2013	27	23	18	17	11	9.2	2.4	3.0	13	7.3	12	8.9
2014	20	50	67	48	21	7.6	4.8	2.2	2.2	17	26	53
2015	23	31	28	21	7.1	3.0	1.8	1.4	2.4	2.8	28	183
2016	84	55	67	16	11	6.9	3.5	1.7	3.6	58	48	55
2017	47	160	104	35	20	10	3.8	2.6	3.9	11	66	33
2018	72	36	33	35	7.7	5.3	2.0	3.0	3.2	4.7	14	42
2019	26	36	21	26	9.8	6.0	4.0	3.0	12	8.6	5.4	26
median	53	42	43	30	17	9.9	5.1	3.9	3.9	9.3	29	53

KEY

Q in cfs

$Q \leq 2.6$
$2.6 < Q \leq 3.4$
$3.4 < Q \leq 4.2$
$4.2 < Q \leq 5.2$
$5.2 < Q \leq 8.1$
$8.1 < Q \leq 12$
$12 < Q \leq 19$
$19 < Q \leq 48$
$48 < Q \leq 116$
$116 < Q \leq 194$
$Q > 194$

Q as percentile

$Q \leq$ 5th
5th $< Q \leq$ 10th
10th $< Q \leq$ 15th
15th $< Q \leq$ 20th
20th $< Q \leq$ 30th
30th $< Q \leq$ 40th
40th $< Q \leq$ 50th
50th $< Q \leq$ 75th
75th $< Q \leq$ 90th
90th $< Q \leq$ 95th
$Q >$ 95th

2019

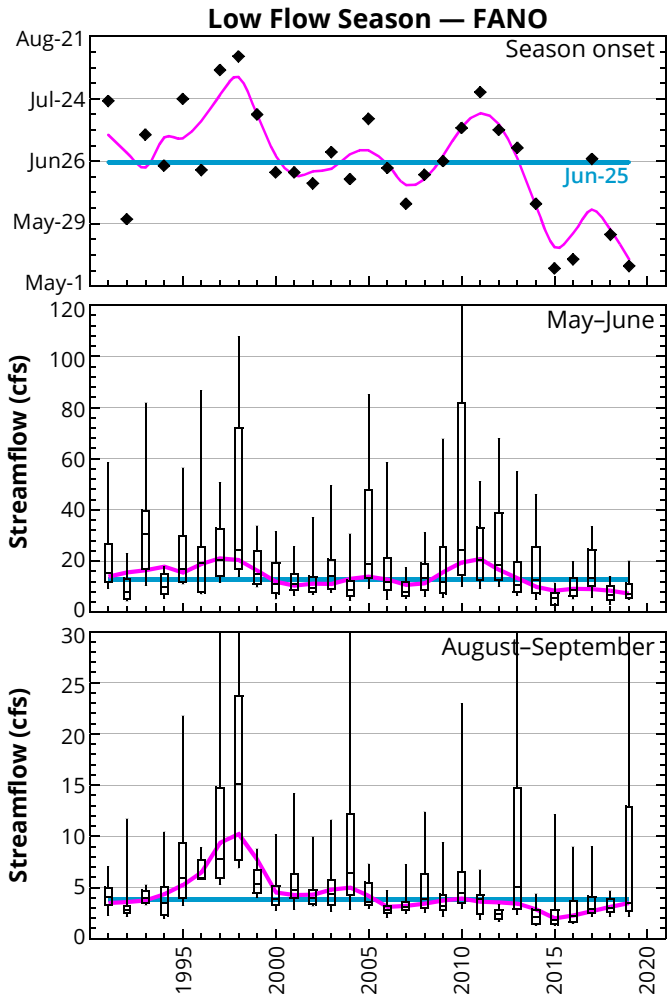
- Baseflows in 2019 were well below the median. Record low flows were set for 28 days in all, including 11 days in late April to mid May and 13 days in November through early December.
- September had high flows due to prolonged rainy weather.

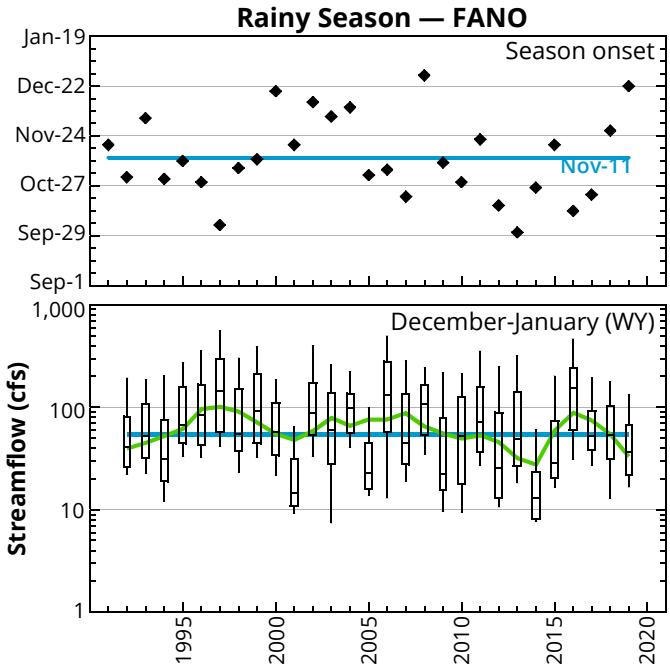
LOW FLOW

- July through September are the months with the lowest average flow and the lowest daily flows.
- Although median flows usually are low during the July through September period, flows that are much higher are not uncommon. The August–September boxplots show this variability. This pattern is typical of flashy urban streams such as Fanno Creek.
- May–June and August–September flows show a statistically significant decreasing trend, despite considerable variability. The reason is unknown.
- Low flow criterion: 7d-Q ≤ 7 cfs (~26th pctl)
- Low flow onset is occurring earlier in the year. The trend is weak, but statistically significant. Low flow began in May in four of the past five years. Between 1991 and 2015, the earliest low flow onset was May 31 in 1992.
- Low flow onsets for recent years were not correct in the 2018 flow report. The values shown in the graph here have been corrected.

RAINY SEASON FLOW

- December through March are the months with the highest average flows.
- Rainy season criterion: 7d-Q ≥ 50 cfs (~75th pctl)
- No trends are evident in the magnitude of the flow for December–January.
- Rainfall in the fall of 2004 was low compared to most years, resulting in low WY-2005 December–January flows.
- The winter of 2000–2001 was very dry as evident in the boxplots.



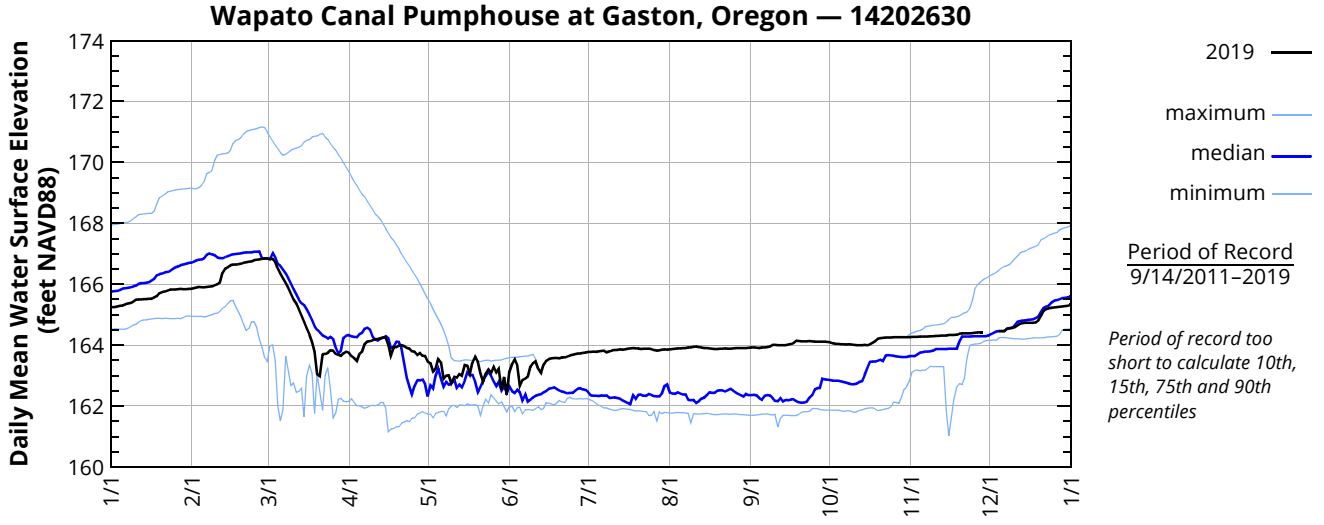


WPH – WAPATO CANAL PUMPHOUSE AT GASTON, OREG. – 14202630

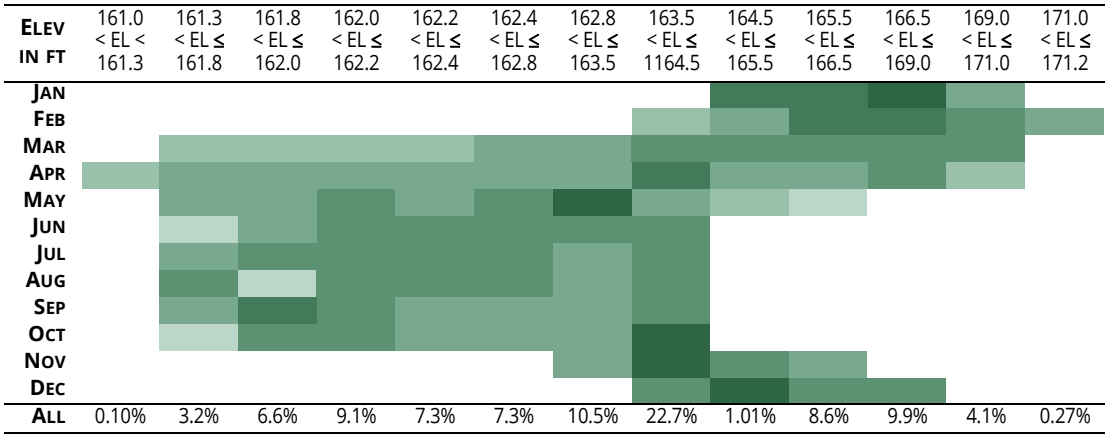
Data source: U.S. Geological Survey, Oregon Water Science Center
Latitude: 45 26 25 *Longitude:* 123 07 31

2019 — MEAN WATER SURFACE ELEVATION ABOVE NAVD88 (feet) — WPH

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	165.25	165.87	166.84	163.76	163.46	163.12	163.78	163.86	163.92	164.09	164.27	
2	165.25	165.89	166.82	163.64	163.41	163.39	163.78	163.87	163.92	164.06	164.27	
3	165.27	165.91	166.83	163.58	163.14	163.54	163.79	163.88	163.91	164.04	164.27	
4	165.29	165.90	166.74	163.48	163.23	163.34	163.78	163.89	163.90	164.04	164.28	164.46
5	165.30	165.90	166.51	163.72	163.55	162.68	163.80	163.89	163.92	164.03	164.28	164.46
6	165.34	165.91	166.34	163.79	163.43	162.86	163.81	163.90	163.92	164.03	164.28	164.46
7	165.36	165.92	166.19	164.03	162.91	162.91	163.82	163.90	163.94	164.02	164.28	164.53
8	165.38	165.93	166.03	164.11	163.00	162.97	163.77	163.92	163.96	164.03	164.29	164.56
9	165.43	165.97	165.87	164.14	163.01	163.29	163.80	163.93	164.01	164.02	164.29	164.57
10	165.49	166.00	165.68	164.17	162.76	163.41	163.83	163.95	164.01	164.01	164.30	164.59
11	165.50	166.06	165.50	164.20	162.97	163.47	163.84	163.96	164.00	164.00	164.30	164.65
12	165.50	166.37	165.36	164.20	162.94	163.21	163.84	163.94	164.00	164.00	164.31	164.70
13	165.51	166.52	165.16	164.23	163.05	163.09	163.86	163.92	164.00	164.00	164.31	164.72
14	165.51	166.56	164.96	164.25	163.00	163.36	163.85	163.90	164.00	164.01	164.31	164.73
15	165.52	166.62	164.77	164.26	163.35	163.48	163.86	163.90	164.02	164.00	164.33	164.73
16	165.52	166.65	164.56	164.03	163.33	163.55	163.88	163.89	164.04	164.03	164.33	164.73
17	165.57	166.65	164.35	163.66	163.06	163.57	163.89	163.88	164.07	164.08	164.33	164.73
18	165.62	166.66	164.10	163.94	163.44	163.58	163.90	163.87	164.15	164.14	164.35	164.74
19	165.71	166.68	163.78	163.94	163.62	163.58	163.89	163.87	164.13	164.21	164.38	164.81
20	165.74	166.71	163.04	163.99	163.44	163.57	163.89	163.88	164.12	164.23	164.39	164.97
21	165.76	166.72	162.98	164.00	163.07	163.60	163.87	163.88	164.12	164.24	164.39	165.13
22	165.79	166.74	163.70	163.97	162.81	163.60	163.88	163.89	164.12	164.25	164.39	165.18
23	165.83	166.75	163.72	163.90	163.06	163.63	163.88	163.88	164.13	164.25	164.39	165.21
24	165.83	166.79	163.75	163.89	163.21	163.66	163.88	163.88	164.12	164.25	164.40	165.23
25	165.83	166.80	163.83	163.80	163.10	163.68	163.87	163.89	164.11	164.26	164.41	165.24
26	165.84	166.81	163.82	163.79	163.29	163.70	163.84	163.90	164.11	164.26	164.42	165.25
27	165.85	166.83	163.71	163.68	163.11	163.73	163.82	163.90	164.11	164.26	164.42	165.26
28	165.84	166.84	163.68	163.75	163.23	163.73	163.83	163.90	164.11	164.26	164.42	165.27
29	165.84	—	163.65	163.65	162.54	163.75	163.85	163.90	164.11	164.26		165.28
30	165.85	—	163.74	163.64	162.96	163.76	163.86	163.9	164.1	164.26		165.29
31	165.85	—	163.79	—	162.38	—	163.85	163.91	—	164.26	—	165.32
Mean	165.59	166.39	164.83	163.91	163.12	163.43	163.84	163.90	164.04	164.13	164.34	164.89
Max	165.85	166.84	166.84	164.26	163.62	163.76	163.90	163.96	164.15	164.26	164.42	165.32
Min	165.25	165.87	162.98	163.48	162.38	162.68	163.77	163.86	163.90	164.00	164.27	164.46



FREQUENCY OF DAILY MEAN WATER SURFACE ELEVATION BY MONTH — WPH



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
9/14/2011–2019

MEDIAN OF DAILY MEAN WATER SURFACE ELEVATION BY MONTH AND YEAR — WPH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2011									163.66	163.43	163.33	164.25
2012	165.06	166.32	164.45	161.89	162.23	162.24	161.90	161.74	161.73	161.95	163.58	166.04
2013	167.47	165.73	162.59	162.12	162.59	162.20	162.14	162.46	162.36	163.94	164.21	164.48
2014	164.86	165.42	166.23	164.54	162.13	162.14	162.07	162.18	161.91	162.03	163.82	164.84
2015	165.89	167.33	165.24	162.47	162.15	162.29	162.75	162.37	161.97	161.94	163.58	166.18
2016	168.31	169.40	169.29	166.37	163.49	163.00	162.37	162.21	161.94	163.51	164.88	167.18
2017	168.33	170.36	170.55	167.75	162.74	162.35	162.24	162.95	162.81	162.85	164.22	165.35
2018	166.35	167.29	165.10	163.75	163.38	163.54	163.52	163.60	163.52	163.64	163.88	164.68
2019	165.52	166.59	164.56	163.92	163.10	163.55	163.85	163.90	164.03	164.08	164.32	164.74
median	166.25	166.92	165.53	163.89	162.81	162.48	162.34	162.40	162.28	163.41	164.11	165.18

KEY

EL in feet

EL ≤ 161.87
161.87 < EL ≤ 162.01
1612.0 < EL ≤ 162.12
162.12 < EL ≤ 162.23
162.23< EL ≤ 162.59
162.59< EL ≤ 163.32
163.62< EL ≤ 163.65
163.65 < EL ≤ 165.13
162.13 < EL ≤ 167.26
167.26 < EL ≤ 168.47
EL > 168.47

EL as percentile

EL ≤ 5th
5th < EL ≤ 10th
10th < EL ≤ 15th
15th < EL ≤ 20th
20th < EL ≤ 30th
30th < EL ≤ 40th
40th < EL ≤ 50th
50th < EL ≤ 75th
75th < EL ≤ 90th
90th < EL ≤ 95th
EL > 95th

2019

- Water levels from June through November were higher than in any of the past 6 years, including 2018 when leaking water control structures led to higher water levels. The reason for the higher water levels in 2019 is unknown.

GENERAL

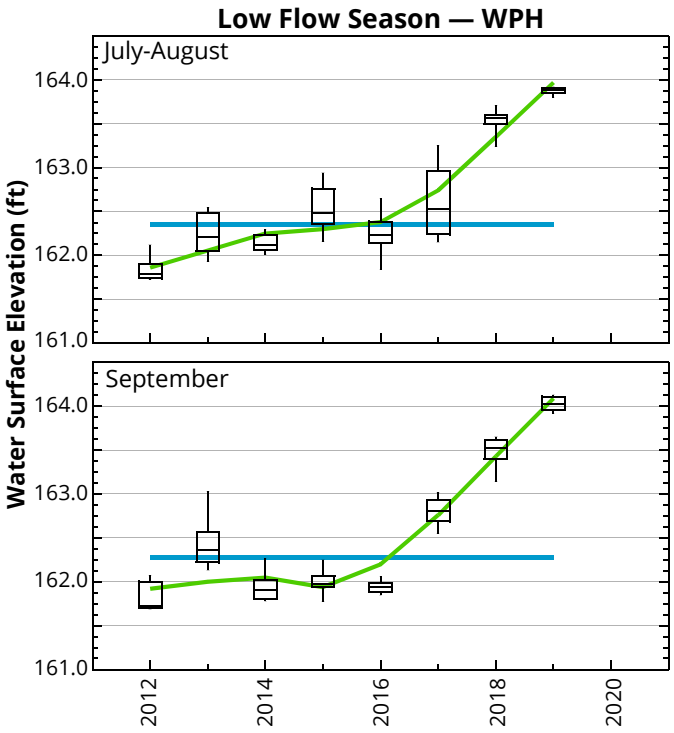
- Wapato Canal Pumphouse is located at Wapato Lake. Water surface elevation reflects lake level.
- During the rainy season, water accumulates in the lake from rainfall and groundwater seepage.
- During March and April, water is pumped out of the lake, lowering the surface elevation. Pumping has continued into May some years.
- Historically the lake was managed by the Wapato Improvement District who pumped enough water out of the lake to allow farming on the lake bed during the summer.
- From 2007–2013, ownership of Wapato Lake transitioned to the US Fish and Wildlife Service who now manages it as the Wapato Lake National Wildlife Refuge. Pumping and some farming still occur, but the management priorities are different than in the past and are evolving.

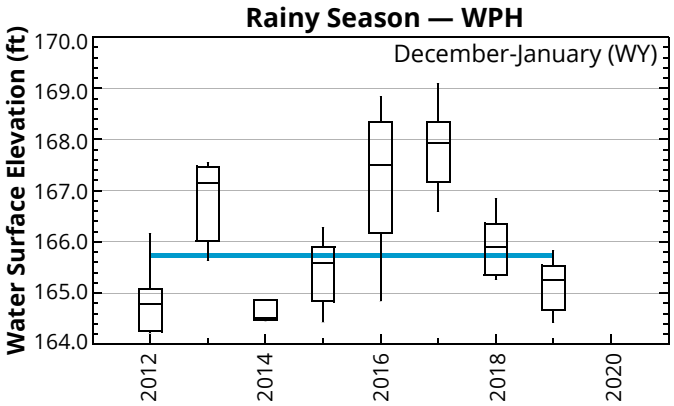
LOW FLOW

- June through October are the months with the lowest average water levels.
- Water levels during the July–September have increased markedly in the past 2 years.

RAINY SEASON

- January through March are the months with the highest average water levels.



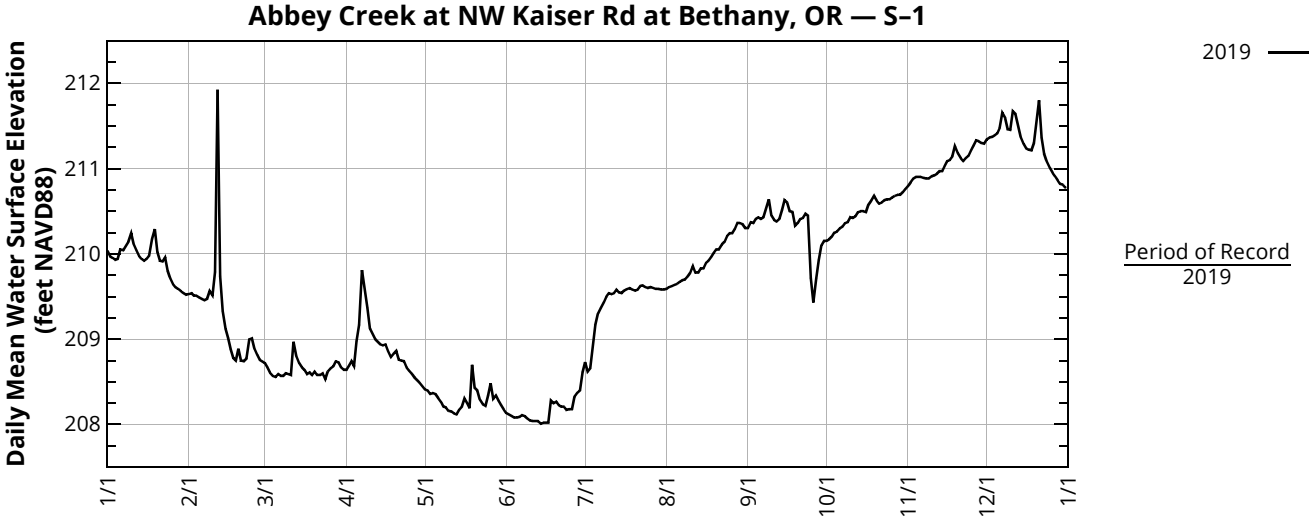


S–1 – Abbey Creek at NW Kaiser Rd at Bethany, OR

Data source: WEST Consultants for Clean Water Services

2019 — MEAN WATER SURFACE ELEVATION ABOVE NAVD88 (feet) — S–1

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	210.03	209.53	208.72	208.64	208.41	208.14	208.73	209.59	210.30	210.15	210.79	211.34
2	209.97	209.54	208.67	208.69	208.40	208.12	208.62	209.61	210.37	210.17	210.84	211.36
3	209.95	209.51	208.61	208.74	208.36	208.10	208.66	209.62	210.36	210.20	210.88	211.37
4	209.93	209.51	208.57	208.68	208.37	208.08	208.93	209.64	210.41	210.25	210.90	211.39
5	209.94	209.49	208.56	208.98	208.36	208.08	209.17	209.65	210.43	210.26	210.90	211.41
6	210.05	209.47	208.59	209.17	208.31	208.09	209.30	209.67	210.41	210.30	210.90	211.48
7	210.04	209.46	208.57	209.81	208.27	208.11	209.37	209.69	210.43	210.32	210.89	211.65
8	210.09	209.47	208.57	209.59	208.21	208.10	209.43	209.70	210.53	210.36	210.88	211.59
9	210.14	209.56	208.60	209.37	208.20	208.07	209.50	209.73	210.64	210.37	210.88	211.46
10	210.24	209.51	208.59	209.12	208.16	208.05	209.54	209.78	210.45	210.43	210.91	211.45
11	210.11	209.79	208.58	209.06	208.15	208.04	209.53	209.86	210.40	210.42	210.92	211.67
12	210.04	211.92	208.97	209.00	208.13	208.04	209.54	209.78	210.38	210.44	210.94	211.64
13	209.98	209.74	208.80	208.97	208.12	208.04	209.58	209.78	210.41	210.49	210.97	211.49
14	209.94	209.33	208.72	208.94	208.17	208.01	209.55	209.83	210.51	210.50	210.97	211.36
15	209.92	209.12	208.67	208.93	208.21	208.02	209.54	209.83	210.63	210.50	211.03	211.29
16	209.94	209.01	208.64	208.94	208.30	208.02	209.57	209.89	210.60	210.49	211.09	211.24
17	209.98	208.88	208.59	208.86	208.25	208.02	209.59	209.92	210.50	210.58	211.10	211.22
18	210.17	208.78	208.61	208.79	208.19	208.28	209.60	209.96	210.49	210.63	211.14	211.21
19	210.29	208.75	208.58	208.83	208.70	208.25	209.58	210.01	210.33	210.68	211.26	211.30
20	210.02	208.89	208.62	208.86	208.43	208.27	209.57	210.05	210.36	210.63	211.18	211.56
21	209.92	208.75	208.58	208.76	208.40	208.23	209.58	210.05	210.41	210.59	211.12	211.80
22	209.91	208.74	208.58	208.75	208.29	208.21	209.62	210.11	210.42	210.60	211.09	211.36
23	209.96	208.77	208.60	208.74	208.24	208.21	209.63	210.14	210.47	210.63	211.12	211.17
24	209.80	209.00	208.53	208.67	208.22	208.17	209.61	210.21	210.45	210.64	211.15	211.08
25	209.71	209.01	208.62	208.63	208.34	208.18	209.60	210.24	209.72	210.64	211.21	211.01
26	209.65	208.89	208.66	208.60	208.48	208.18	209.61	210.24	209.43	210.66	211.27	210.95
27	209.61	208.82	208.68	208.55	208.30	208.33	209.60	210.29	209.71	210.68	211.33	210.91
28	209.59	208.76	208.74	208.52	208.34	208.37	209.59	210.36	209.93	210.69	211.32	210.86
29	209.56	—	208.73	208.49	208.28	208.40	209.59	210.36	210.10	210.69	211.30	210.82
30	209.54	—	208.67	208.45	208.23	208.61	209.58	210.35	210.15	210.72	211.29	210.81
31	209.52	—	208.64	—	208.18	—	209.58	210.30	—	210.76	—	210.78
Mean	209.92	209.29	208.64	208.87	208.29	208.16	209.44	209.94	210.32	210.50	211.05	211.29
Max	210.29	211.92	208.97	209.81	208.70	208.61	209.63	210.36	210.64	210.76	211.33	211.80
Min	209.52	208.74	208.53	208.45	208.12	208.01	208.62	209.59	209.43	210.15	210.79	210.78



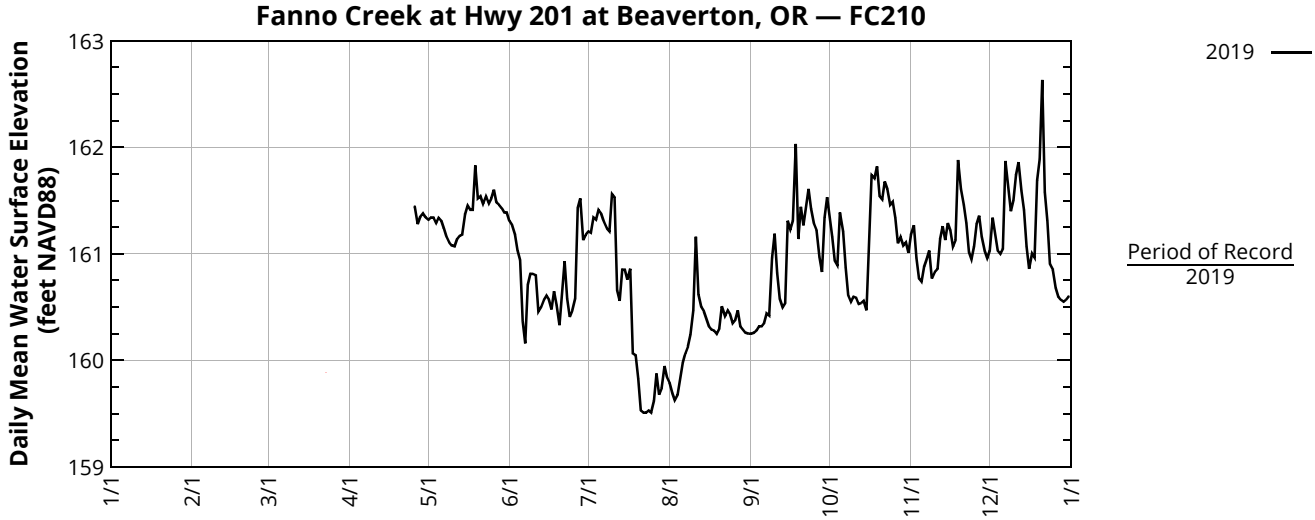
FC210 – Fanno Creek at Hwy 210 at Beaverton, OR

Data source: WEST Consultants for Clean Water Services

2019 — MEAN WATER SURFACE ELEVATION ABOVE NAVD88 (feet) — FC210

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1					161.32	161.31	161.21	159.79e	160.25e	161.35	161.18	161.03
2					161.34	161.27	161.20	159.70e	160.26e	161.16	161.27	161.34
3					161.34	161.18	161.34	159.63e	160.28e	160.93	160.96	161.19
4					161.29	161.03	161.32	159.68e	160.32e	160.89	160.77	161.03
5					161.34	160.94	161.41	159.83e	160.32	161.39	160.74	161.00
6					161.31	160.37	161.38	159.98e	160.35	161.21	160.88	161.05
7					161.24	160.16	161.30	160.07e	160.44	160.87	160.95	161.87
8					161.16	160.71	161.24	160.13e	160.42	160.61	161.03	161.64
9					161.11	160.81	161.21	160.24e	160.96	160.55	160.77	161.40
10					161.08	160.81	161.56	160.47e	161.19	160.60	160.83	161.50
11					161.07	160.80	161.53	161.16e	160.82	160.59	160.86	161.74
12					161.14	160.46	160.66	160.62e	160.58	160.53	161.14	161.86
13					161.17	160.50	160.56	160.50e	160.50	160.54	161.26	161.59
14					161.18	160.57	160.85	160.46e	160.54	160.56	161.13	161.41
15					161.37	160.61	160.85	160.39e	161.31	160.47	161.29	161.07
16					161.45	160.57	160.76	160.32e	161.23	160.99	161.22	160.86
17					161.41	160.48	160.86	160.29e	161.31	161.74e	161.07	161.00
18					161.41	160.65	160.07	160.28e	162.03	161.71	161.13	160.96
19					161.83	160.52	160.05	160.25e	161.14	161.82	161.88	161.69
20					161.52	160.33	159.83	160.30e	161.44	161.54	161.61	161.89
21					161.54	160.66	159.53	160.51e	161.27	161.51	161.46	162.63
22					161.47	160.93	159.51	160.42e	161.43	161.68	161.29	161.58
23					161.54	160.58	159.51	160.47e	161.61	161.61	161.02	161.31
24					161.47	160.41	159.53	160.43e	161.42	161.46	160.95	160.90
25					161.52	160.47	159.51	160.35e	161.28	161.49	161.07	160.85
26				161.44e	161.60	160.58	159.62	160.38e	161.22	161.34	161.28	160.68
27				161.28	161.48	161.43	159.88	160.47e	160.97	161.10	161.36	160.60
28				161.35	161.46	161.52	159.68	160.32e	160.83	161.16	161.16	160.57
29				161.38	161.43	161.13	159.74	160.29e	161.34	161.08	161.03	160.55
30				161.34	161.39	161.18	159.95	160.26e	161.53	161.11	160.96	160.57
31				—	161.39	—	159.84e	160.25e	—	161.01	—	160.60
Mean					161.37	160.77	160.50	160.27	160.95	161.12	161.12	161.22
Max					161.83	161.52	161.56	161.16	162.03	161.82	161.88	162.63
Min					161.07	160.16	159.51	159.63	160.25	160.47	160.74	160.55

e=estimated



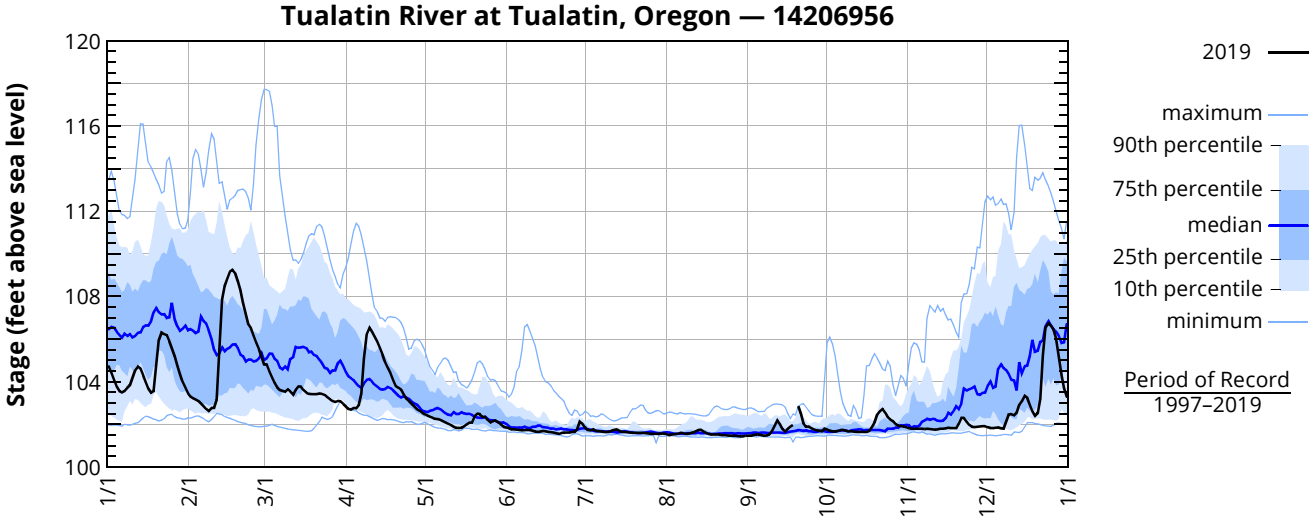
TRT – TUALATIN RIVER AT TUALATIN, OREGON – 14206956 (FORMERLY 14206960)

Data source: Oregon Water Resources Department
River mile: 8.9 *Latitude:* 45 23 14 *Longitude:* 122 45 46

2019 — MEAN WATER SURFACE ELEVATION (feet) — TRT

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP*	OCT	NOV	DEC
1	104.70	103.31	104.81	102.73	102.42	101.82	101.74	101.50	101.47	101.71	101.80	101.83
2	104.42	103.23	104.47	102.69	102.37	101.77	101.72	101.52	101.50	101.68	101.79	101.83
3	104.06	103.18	104.19	102.77	102.32	101.76	101.78	101.54	101.52	101.66	101.79	101.84
4	103.76	103.10	103.94	102.75	102.26	101.75	101.71	101.56	101.52	101.69	101.80	101.85
5	103.56	102.98	103.73	102.91	102.24	101.73	101.68	101.60	101.49	101.74	101.79	101.81
6	103.51	102.86	103.61	103.45	102.22	101.72	101.67	101.60	101.47	101.74	101.78	101.79
7	103.57	102.72	103.57	105.08	102.16	101.73	101.65	101.55	101.48	101.71	101.79	102.13
8	103.71	102.62	103.53	106.25	102.10	101.74	101.64	101.56	101.52	101.68	101.78	102.46
9	103.84	102.77	103.64	106.53	102.04	101.74	101.65	101.58	101.67	101.67	101.76	102.49
10	104.18	102.77	103.55	106.34	101.97	101.71	101.70	101.62	101.94	101.66	101.75	102.42
11	104.52	103.15	103.40	106.11	101.90	101.66	101.74	101.67	102.19	101.65	101.77	102.55
12	104.70	105.03	103.63	105.86	101.84	101.65	101.76	101.74	102.00	101.64	101.79	102.92
13	104.61	107.85	103.78	105.58	101.82	101.66	101.70	101.75	101.78	101.65	101.80	103.08
14	104.32	108.49	103.77	105.27	101.84	101.69	101.65	101.68	101.66	101.65	101.81	103.34
15	103.98	108.85	103.61	104.91	101.91	101.68	101.64	101.60	101.80	101.65	101.84	103.25
16	103.68	109.17	103.49	104.66	102.01	101.64	101.63	101.55	101.90	101.70	101.83	102.91
17	103.49	109.25	103.43	104.39	102.08	101.63	101.62	101.53	101.98	101.89	101.83	102.61
18	103.56	109.09	103.41	104.08	102.08	101.62	101.60	101.53		102.10	101.83	102.39
19	104.76	108.73	103.41	103.81	102.40	101.58	101.60	101.53	102.86	102.45	102.03	102.53
20	105.93	108.30	103.42	103.73	102.50	101.56	101.60	101.53	102.52	102.61	102.31	103.20
21	106.31	107.72	103.45	103.63	102.48	101.60	101.60	101.50	102.05	102.73	102.30	105.24
22	106.24	107.16	103.43	103.40	102.35	101.62	101.60	101.49	101.88	102.56	102.13	106.54
23	106.19	106.68	103.38	103.21	102.35	101.62	101.59	101.48	101.90	102.33	101.98	106.75
24	105.90	106.51	103.28	103.10	102.20	101.62	101.57	101.47	101.83	102.23	101.89	106.63
25	105.58	106.16	103.18	102.98	102.10	101.64	101.56	101.46	101.77	102.15	101.87	106.44
26	105.20	105.85	103.10	102.85	102.16	101.65	101.56	101.46	101.72	102.02	101.88	106.04
27	104.77	105.53	103.05	102.72	102.18	101.77	101.56	101.45	101.70	101.94	101.90	105.29
28	104.37	105.19	103.10	102.65	102.11	102.12	101.55	101.44	101.68	101.92	101.92	104.35
29	104.02	—	103.08	102.56	101.99	102.02	101.57	101.44	101.79	101.90	101.91	103.70
30	103.73	—	102.96	102.48	101.89	101.86	101.57	101.46	101.77	101.87	101.87	103.33
31	103.48	—	102.84	—	101.86	—	101.54	101.47	—	101.83	—	103.10
Mean	104.47	105.65	103.52	103.98	102.13	101.71	101.64	101.54	101.81	101.92	101.88	103.44
Max	106.31	109.25	104.81	106.53	102.50	102.12	101.78	101.75	102.86	102.73	102.31	106.75
Min	103.48	102.62	102.84	102.48	101.82	101.56	101.54	101.44	101.47	101.64	101.75	101.79

* Incomplete record



FREQUENCY OF MEAN WATER SURFACE ELEVATION BY MONTH — TRT

ELEV IN FT	101.0 < EL < 101.3	101.3 < EL ≤ 101.5	101.5 < EL ≤ 101.6	101.6 < EL ≤ 101.7	101.7 < EL ≤ 101.9	101.9 < EL ≤ 102.1	102.1 < EL ≤ 102.6	102.6 < EL ≤ 103.3	103.3 < EL ≤ 104.5	104.5 < EL ≤ 106.5	106.5 < EL ≤ 110.0	110.0 < EL ≤ 116.0	116.0 < EL ≤ 120	Missing
JAN														
FEB														
MAR														
APR														
MAY														
JUN														
JUL														
AUG														
SEP														
OCT														
NOV														
DEC														
ALL	0.02%	4.1%	10.0%	9.9%	12.4%	9.2%	9.0%	9.1%	10.5%	10.4%	10.9%	3.7%	0.11%	0.68%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1997–2019

MEDIAN OF DAILY MEAN WATER SURFACE ELEVATION BY MONTH AND YEAR — TRT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1997											104.87	106.60
1998	109.86	108.00	106.40	103.50	102.61	102.27	102.47	102.56	102.67	102.03	102.26	109.61
1999	110.47	112.37	107.42	104.50	102.61	101.77	101.67	101.66	101.90	101.79	103.16	106.84
2000	107.35	105.61	105.25	102.36	102.20	101.86	101.61	101.78	102.11	101.92	101.71	102.34
2001	102.25	102.53	102.33	102.29	102.03	101.64	101.56	101.47	101.42	101.62	102.67	109.24
2002	108.39	107.15	105.46	103.33	102.09	101.79	101.73	102.23	102.05	101.78	101.71	103.82
2003	106.19	107.07	107.24	105.17	102.61	101.85	101.64	102.23	101.99	101.95	101.65	104.18
2004	106.17	106.45	103.86	102.78	101.99	101.70	101.53	101.60	101.64	101.88	101.89	102.49
2005	103.05	102.39	101.91	103.92	103.66	102.06	101.70	101.47	101.46	101.77	103.45	104.39
2006	112.57	107.80	104.88	103.90	102.27	101.87	101.65	101.54	101.57	101.67	106.92	
2007	107.89	103.45	105.51	103.21	102.07	101.79	101.70	101.69	101.72	101.91	102.14	108.04
2008		107.23	104.42	104.01	102.54	101.89	101.77	101.61	101.64	101.62	102.29	102.20
2009	107.77	102.47	103.79	103.20	103.06	101.73	101.57	101.54	101.54	101.62	103.31	103.78
2010	107.71	104.99	104.66	106.44	103.18	103.68	101.81	101.65	101.72	101.67	102.89	108.91
2011	108.30	104.35	108.52	105.78	103.55	102.17	101.74	101.62	101.59	101.59	101.85	102.21
2012	106.94	104.92	107.55	105.31	102.99	102.19	101.70	101.59	101.59	101.88	103.71	109.58
2013	104.18	103.18	103.62	102.82	101.97	102.01	101.58	101.51	101.72	101.83	102.30	102.30
2014	102.71	107.14	107.29	104.94	103.08	101.83	101.65	101.47	101.58	101.78	102.85	105.62
2015	104.73	106.34	104.58	103.02	101.88	101.59	101.54	101.48	101.55	101.53	102.93	112.01
2016	109.12	106.49	107.28	102.98	101.85	101.64	101.47	101.46	101.52	103.35	104.13	
2017	106.16	111.59	108.95	105.87	103.43	101.99	101.59	101.52	101.57	101.77	104.22	
2018	106.56	103.97	104.65	105.97	102.15	101.72	101.55	101.46	101.55	101.63	101.65	102.93
2019	104.32	105.69	103.49	103.54	102.16	101.69	101.64	101.530	101.77	101.74	101.83	102.91
median	103.05	102.54	102.72	102.45	101.82	101.62	101.52	101.45	101.47	101.54	101.67	102.08

KEY

EL in feet

EL ≤ 101.51
101.51 < EL ≤ 101.56
101.56 < EL ≤ 101.60
101.60 < EL ≤ 101.65
101.65< EL ≤ 101.78
101.78< EL ≤ 102.01
102.01 < EL ≤ 102.36
102.36 < EL ≤ 104.58
104.58 < EL ≤ 107.70
107.70 < EL ≤ 109.50
EL > 109.50

EL as percentile

EL ≤ 5th
5th < EL ≤ 10th
10th < EL ≤ 15th
15th < EL ≤ 20th
20th < EL ≤ 30th
30th < EL ≤ 40th
40th < EL ≤ 50th
50th < EL ≤ 75th
75th < EL ≤ 90th
90th < EL ≤ 95th
EL > 95th

2019

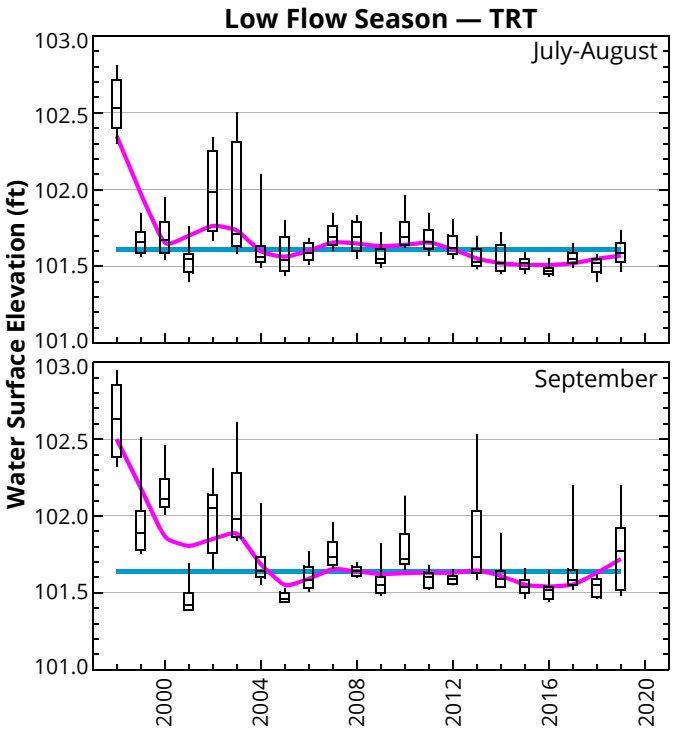
- Except for periods of high rainfall in mid-February and mid-April, water surface elevation in 2019 was lower than usual in the early part of the year.
- Most of November and early December also had particularly low stage due to prolonged dry weather.

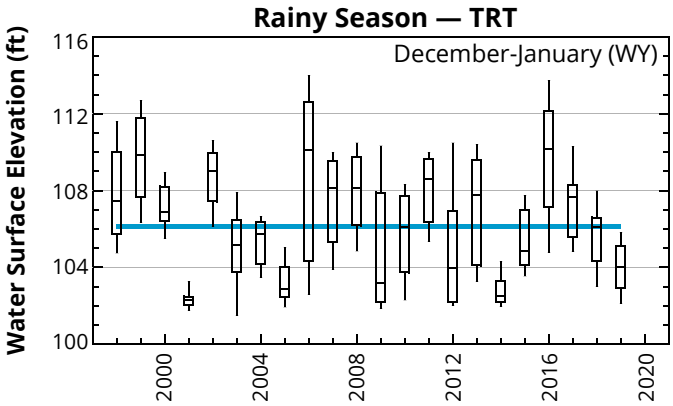
LOW FLOW

- July through September are the months with the lowest average water levels.
- July–August water levels show a statistically significant decreasing trend. The past seven years all have median stage less than the period of record median.
- Water levels in September show a similar decreasing trend that is also statistically significant, although with more variability than the July–August trend.
- The higher water levels in the late 1990s and early 2000s were likely due to the use of flash boards at the Oswego Dam, a practice which has been discontinued.

RAINY SEASON

- January through April are the months with the highest average water levels.





HISTORICAL DATA SOURCES

Data were obtained from several sources. If more than one source had a value for the same date, the values were compared and the one judged as the best quality was used. In some cases, quality could not be determined and none were used. Because data collection changed (for example, different agencies, new rating curves), the measurements may not have been consistent over the period of record.

DATA SOURCES

SITEID	SITE NAME	START DATE	SOURCES OF DATA FOR DISTRIBUTION
14202450	Tualatin River below Lee Falls near Cherry Grove, Oregon	1/1/2003	previous Flow Reports: 2003–2007 OWRD database: 2008–present
14202510	Tualatin River at Gaston, Oregon	1/1/2000	CWS data warehouse: 2000–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14202630	Wapato Canal at Pumphouse at Gaston, Oregon	9/14/2011	USGS database: all
14202850	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	1/1/1975	OWRD database: all (no data WY-1997–WY-2006)
14202860	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	1/12003	Wally Otto, TVID, pers. comm.: 2003 previous Flow Reports: 2004–present (Scoggins Dam Ops tables)
14202920	Sain Creek above Henry Hagg Lake near Gaston, Oregon	1/1/1975	OWRD database: all (no data WY-1997–WY-2006)
14202980	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	1/1/1975	USGS database: 1975–WY-2006 BOR: WY-2007–present (BOR has data back to 1941)
14203500	Tualatin River at Dilley, Oregon	1/1/1975	USGS database: 1975–present (USGS has data back to 1939)
14204530	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	1/1/1996	CWS data warehouse: 1996–2007 (origin: ORWD Dist 18) OWRD database: 2008–present
14204800	Tualatin River at Golf Course Road near Cornelius, Oregon	1/1/1994	previous Flow Report: 1994 CWS data warehouse: 1995–2007 (origin: ORWD Dist 18) OWRD database: 2008–present
14205400	East Fork Dairy Creek near Meacham Corner, OR	5/8/2002	USGS database: all
14206070	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	1/1/2002	previous Flow Reports: all
14206200	Dairy Creek at Hwy 8 near Hillsboro, Oregon	1/1/1997	CWS data warehouse: 1997–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14206241	Tualatin River at Hwy 219 Bridge	10/15/2004	Stewart Rounds, USGS pers. comm.: all (origin: Jackson Bottom Wetland Education Center)
14206295 (old id= 14206440)	Tualatin River at Rood Bridge Road near Hillsboro, Oregon (new siteid in 2002)	1/1/1994	previous Flow Report: 1994 CWS data warehouse: 1995–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14206435	Beaverton Creek at NE Guston Court near Orenco, Oregon	1/1/2002	previous Flow Reports: all
14206450 14206451	Rock Creek at Hwy 8 near Hillsboro, Oregon (site moved 120 ft downstream in 2002)	1/1/1995	CWS data warehouse: 1995–2007 previous Flow Reports: 2008–present
14206500	Tualatin River at Farmington, Oregon	1/1/1989	CWS data warehouse: 1989–2002 (origin: OWRD Dist 18) previous Flow Reports: 2003–WY-2005 OWRD database: WY-2006–present
14206900	Fanno Creek at 56th Avenue	10/1/1990	USGS database: all
14206950	Fanno Creek at Durham, Oregon	1/1/1991	Stewart Rounds, USGS pers. comm.: 1991-WY-1993, 2/4/1996-WY-2000 USGS database: WY-1994-2/5/1996, WY-2001–present
14206956	Tualatin River at Tualatin, Oregon	10/22/1997	previous Flow Reports: 1997-1999 & 2002-2005 Stewart Rounds, USGS pers. comm.: 2000-2001 OWRD database: 2006–present
14207500	Tualatin River at West Linn, OR	1/1/1975	USGS database: all (USGS has data back to 1928)

Abbreviations: BOR=Bureau of Reclamation; CWS=Clean Water Services; OWRD=Oregon Water Resources Department; TVID=Tualatin Valley Irrigation District; USGS=United States Geological Survey; WY=water year

this page intentionally blank

APPENDIX B
SELECTED RELEASES AND WITHDRAWALS

SCOPE

This appendix shows data for selected water releases to and withdrawals from the Tualatin River and its tributaries. It is not a comprehensive listing of releases and withdrawals. Some of the data represent daily mean flows and some represent instantaneous measurements.

Streamflow measurements are in Appendix A.

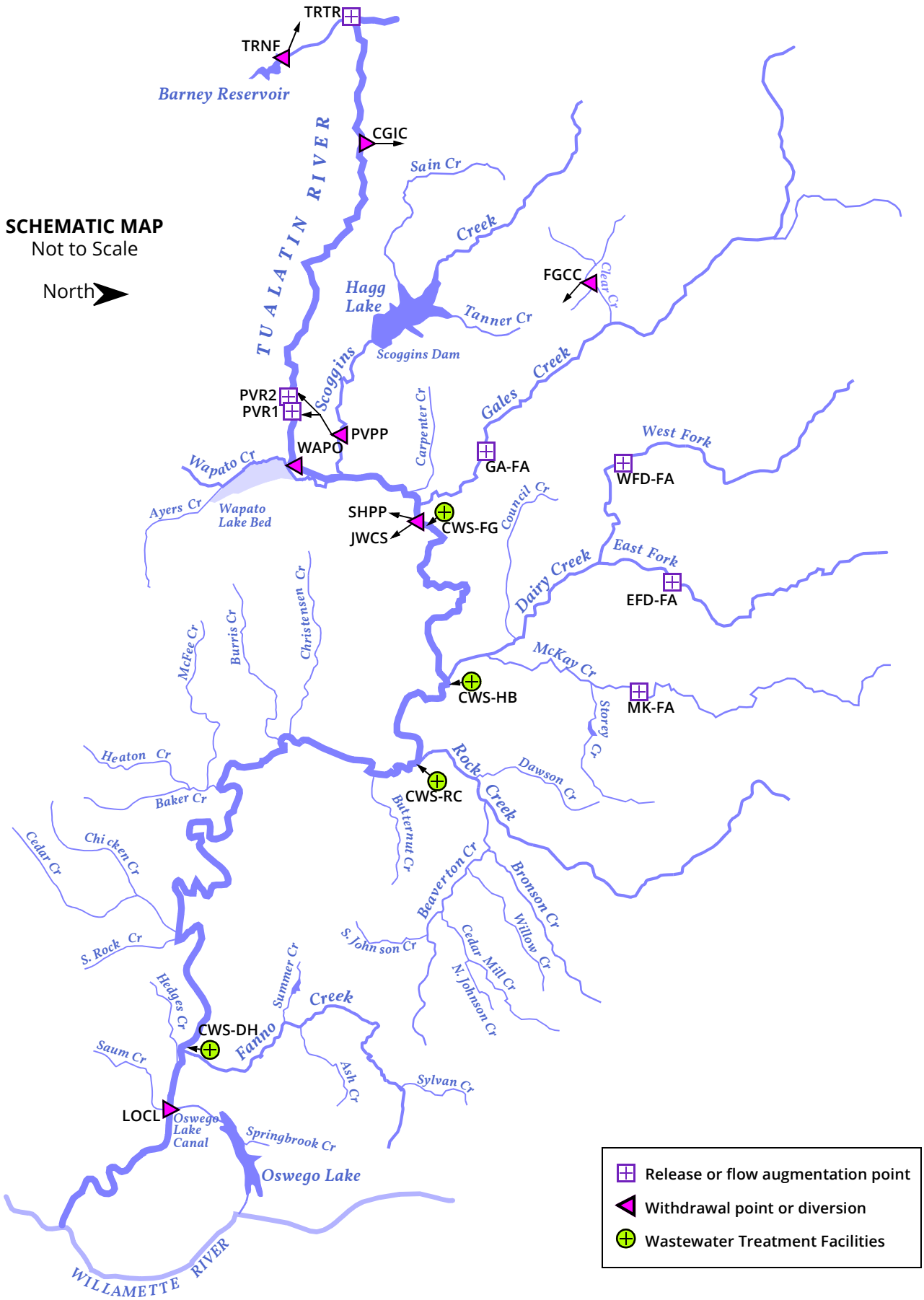
HIGHLIGHTS

- Releases from Barney Reservoir to the Trask River during January–May and December 2019 were much lower than in the past.
- September 2019 withdrawals at SHPP for both JWC and TVID were lower than those in the past several years, although not the lowest on record. The lower withdrawals were likely due to rainy, cool weather in September that decreased the need for irrigation water by homeowners, farmers and nurseries.
- In 2019, Clean Water Services' Fernhill Natural Treatment System (NTS) operated continuously during June and July and intermittently during May and August. No discharges from the NTS to the Tualatin River occurred in September and October. From May–October, all effluent from the FG-WWTF was discharged either to the NTS or transferred to the Rock Creek WWTF. Outside May–October, discharge from the FG-WWTF may be discharged directly to the Tualatin River, or be routed through the NTS.
- Clean Water Services continued its summer flow augmentation program to selected tributaries in cooperation with Tualatin Valley Irrigation District.

TRENDS OF NOTE

- Withdrawals in July-August by Joint Water Commission at the Springhill Pump Plant increased almost linearly from 1991 through about 2003. Similarly, July-August discharges from Clean Water Services' Rock Creek WWTF increased almost linearly from to 1991 to about 2003. Both JWC withdrawals and RC-WWTF discharges have been relatively constant since 2004, with only minor year-to-year variation.
- Withdrawals in July-August by Tualatin Valley Irrigation District at the Springhill Pump Plant have remained relatively constant over the period of record 1991–2019.

Selected Release and Withdrawal Sites



SELECTED RELEASE AND WITHDRAWAL SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	PAGE
CGIC	City of Hillsboro Withdrawal at Cherry Grove	73.3	B-8
CWS-DH	CWS Durham WWTF Discharge	9.33	B-20
CWS-FG	CWS Forest Grove WWTF Discharge (with Fernhill NTS)	51.2	B-14
CWS-HB	CWS Hillsboro WWTF Discharge	43.8	B-16
CWS-RC	CWS Rock Creek WWTF Discharge	38.08	B-18
EFD-FA	CWS East Fork Dairy Creek Flow Augmentation with TVID	4.9	B-22
FGCC	City of Forest Grove Withdrawals in Clear Creek Watershed	—	*
GA-FA	CWS Gales Creek Flow Augmentation with TVID	5.0	B-22
JWCS	Joint Water Commission Withdrawal at Spring Hill Pump Plant	56.1	B-12
LOCL	Lake Oswego Corp. Canal Diversion	6.7	**
MK-FA	CWS McKay Creek Flow Augmentation with TVID	7.0	B-22
PVPP	TVID Withdrawal at Patton Valley Pump Plant	1.71	***
PVR1	TVID—Patton Valley River Turnout #1 Release	63.13	***
PVR2	TVID—Patton Valley River Turnout #2 Release	64.26	***
SHPP	TVID–Withdrawal at Spring Hill Pump Plant	56.1	B-10
TRNF	Barney Reservoir Measured Flow to North Fork Trask River	—	B-4
TRTR	Barney Reservoir (Trask River) Release to Tualatin River	78.0	B-6
WAPO	Wapato Canal Diversion	62.0	***
WFD-FA	CWS West Fork Dairy Creek Flow Augmentation with TVID	5.2	B-22

*The City of Forest Grove withdraws water at several locations in the Clear Creek watershed. The data are not included in this report.
**Monitoring of the Lake Oswego Canal Diversion was discontinued 8/23/2012.
***Withdrawals and releases at Patton Valley Pump Plant, Patton Valley River turnouts and Wapato Canal Diversion were not measured in 2019.

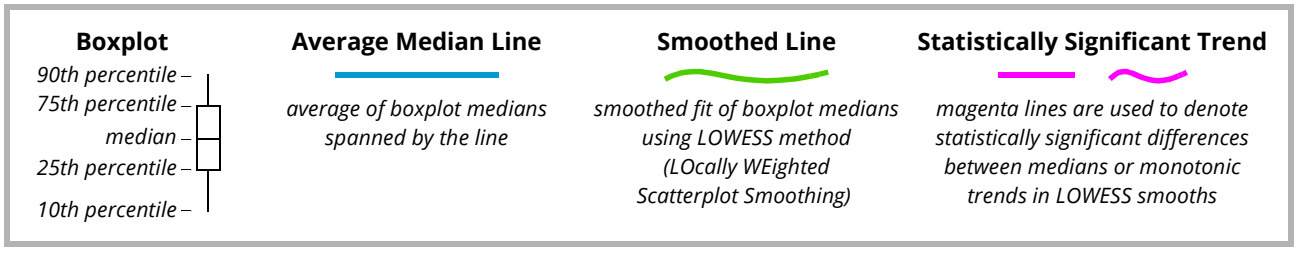
Explanation of Figures and Tables in this Appendix

Two pages of tables and graphs are included for every site.

Page 1–current year: Page 1 includes tabled data for daily releases or withdrawals plus a graph showing data for the current year compared to that of the previous year.

Page 2–statistical summary: A brief summary for the site is at the top of the page. The summary is followed by:

- a *color-coded table of the monthly medians* of daily mean releases or withdrawals for the period of record. The color-code is based on percentiles and is keyed to both cubic feet per second (cfs) and the equivalent percentile.
- a *graph showing boxplots for July-August* of daily releases or withdrawals by year for the period of record. July-August was chosen because it is typically a critical time for water management. An explanation of the features of these graphs is below.

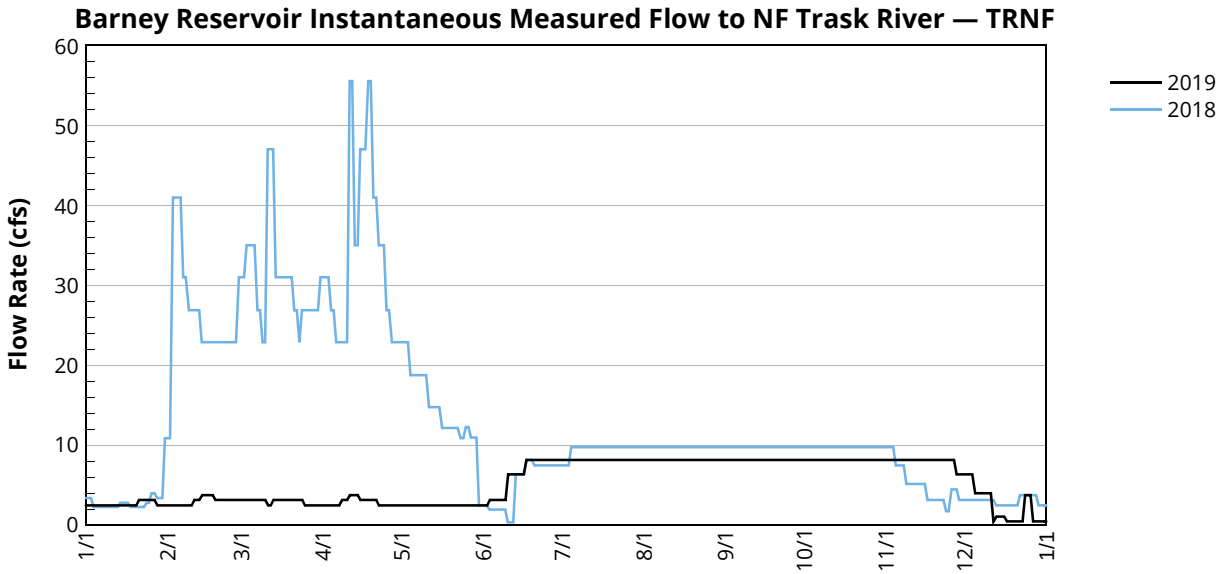


TRNF – Barney Reservoir Measured Flow to North Fork Trask River

Data source: Barney Reservoir Joint Ownership Commission

2019 — INSTANTANEOUS MEASURED FLOW (cfs) — TRNF

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1				2.5	2.5		8.2				8.2	
2	2.5				2.5			8.2	8.2	8.2		6.4
3				2.5		3.2	8.2					
4	2.5		3.2	2.5						8.2	8.2	4.0
5		2.5				3.2	8.2	8.2	8.2			
6		2.5	3.2		2.5				8.2		8.2	4.0
7	2.5		3.2			3.2		8.2		8.2		
8		2.5	3.2	3.2	2.5		8.2				8.2	
9	2.5				2.5			8.2	8.2	8.2		4.0
10				3.2		6.4	8.2					
11	2.5	3.2	2.5	3.8					8.2	8.2	8.2	0.5
12						6.4	8.2	8.2				1.1
13			3.2		2.5				8.2		8.2	
14	2.5	3.8				6.4		8.2		8.2		
15		3.8	3.2	3.2	2.5		8.2				8.2	
16	2.5							8.2	8.2	8.2		0.5
17	2.5			3.2	2.5	8.2	8.2					
18			3.2						8.2	8.2	8.2	0.5
19		3.2		3.2		8.2	8.2	8.2				0.5
20		3.2	3.2		2.5			8.2	8.2		8.2	
21	3.2					8.2		8.2		8.2		
22		3.2	3.2	2.5	2.5		8.2				8.2	
23	3.2							8.2	8.2	8.2		3.8
24				2.5	2.5	8.2	8.2					
25	3.2	3.2	2.5	2.5					8.2		8.2	
26		3.2				8.2	8.2	8.2				0.5
27		3.2	2.5		2.5				8.2		6.4	0.5
28	2.5	3.2	2.5			8.2		8.2		8.2		
29		—		2.5	2.5					8.2	6.4	
30	2.5	—					8.2	8.2	8.2	8.2		0.5
31	2.5	—		—	2.5	—	8.2		—	8.2	—	



TRNF – Barney Reservoir measured flow to North Fork Trask River

Data source: Barney Reservoir Joint Ownership Commission

Summary

- Winter and spring releases from Barney Reservoir to the NF Trask River depend on inflow and whether or not the reservoir is filling. No trends are evident for 2011–2019.
- Winter and spring releases in 2019 (January through mid-June) were much lower than those in recent years.
- Summer releases from Barney Reservoir to the North Fork Trask River have generally been constant (about 8.4 cfs). Releases were slightly lower in 2019 (8.2 cfs).

MEDIAN OF INSTANTANEOUS MEASURED FLOW — TRNF

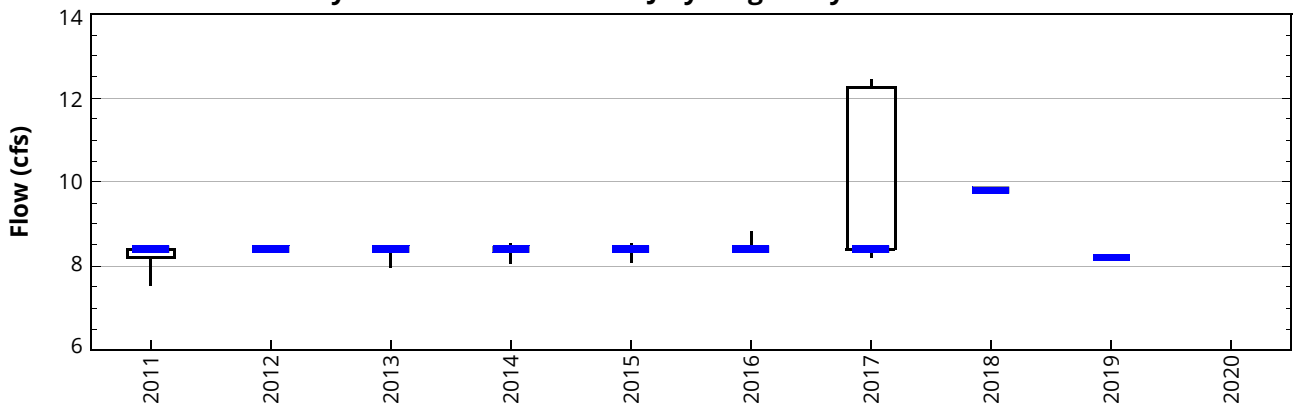
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	47.0	38.0	79.6	55.5	35.0	16.5	8.4	8.4	9.5	9.5	7.3	6.2
2012	7.3	4.0	4.0	47.0	35.0	14.8	8.4	8.4	8.4	8.4	9.0	6.2
2013	47.0	47.0	41.0	35.0	8.4	8.4	8.4	8.4	8.4	8.4	8.4	0.5
2014	0.5	2.3	79.6	41.0	35.0	8.4	8.4	8.4	8.4	8.4	6.2	1.1
2015	1.1	51.3	35.0	27.6	7.3	8.4	8.4	8.4	8.4	8.4	6.2	2.8
2016	2.3	64.0	79.6	33.2	6.2	8.4	8.4	8.4	8.4	8.4	8.4	1.7
2017	4.0	0.0	110.8	79.6	47.0	20.2	8.4	12.3	12.3	9.6	9.6	2.3
2018	2.3	22.9	31.0	31.0	12.3	6.4	9.8	9.8	9.8	9.8	4.9	3.2
2019	2.5	3.2	3.2	2.5	2.5	6.4	8.2	8.2	8.2	8.2	8.2	1.1
median	3.2	30.5	60.3	38.0	23.7	8.4	8.4	8.4	8.4	8.4	7.9	2.6

Key

Q in cfs
- 0. < Q ≤ 2.5
- 2. < Q ≤ 8.4
- 8.4 < Q ≤ 31
- 31 < Q ≤ 56
- Q > 56

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Daily Flow Distributions for July–August by Year — TRNF



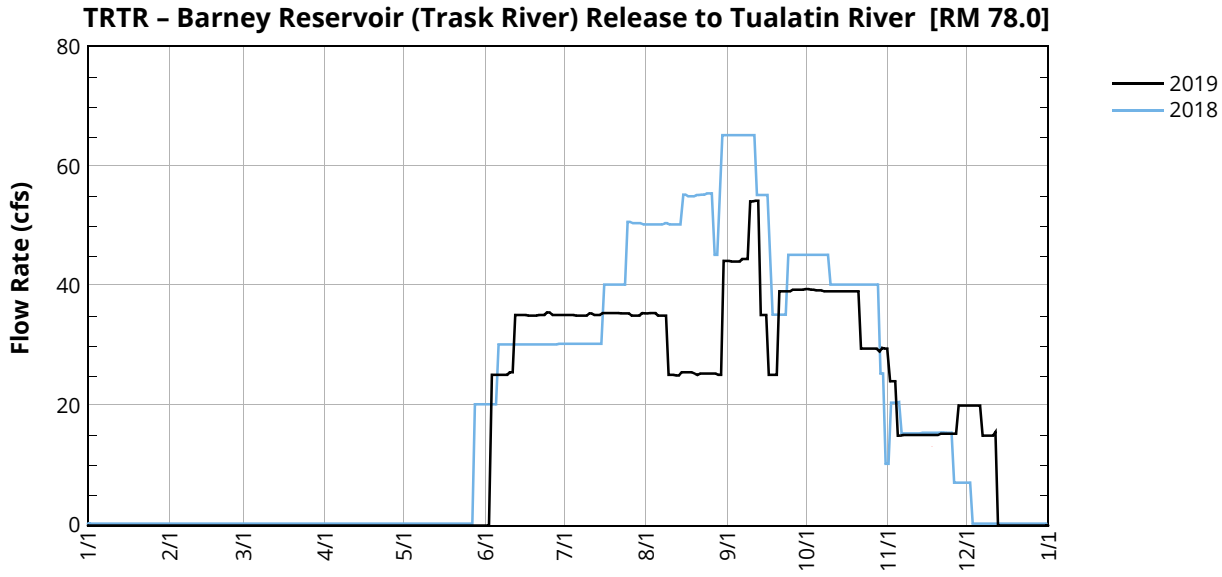
Note: Releases to the North Fork Trask River in the July–August period are often constant. Because the data vary little, the quartile boxes and whiskers are sometimes small or zero. Blue dashes are used to identify the median value.

TRTR — Barney Reservoir (Trask River) Release to Tualatin River [RM 78.0]

Data source: Barney Reservoir Joint Ownership Commission

2019 — INSTANTANEOUS MEASURED FLOW (cfs) — TRTR

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1				0.0	0.0		35.1				24.0	
2	0.0				0.0			35.4	44.0	39.3		20.0
3				0.0		25.1	35.1					
4	0.0		0.0	0.0						39.2	15.0	20.0
5		0.0				25.1	35.0	35.0	44.0			
6		0.0	0.0		0.0				44.4		15.1	15.0
7	0.0		0.0			25.1		35.0		39.0		
8		0.0	0.0	0.0	0.0		35.0				15.1	
9	0.0				0.0			25.1	54.0	39.0		15.0
10				0.0		25.5	35.3					
11	0.0	0.0	0.0	0.0					54.1	39.0	15.1	15.6
12						35.1	35.1	25.0				0.0
13			0.0		0.0				35.1		15.1	
14	0.0	0.0				35.1		25.5		39.0		
15		0.0	0.0	0.0	0.0		35.4				15.1	
16	0.0							25.5	25.1	39.0		0.0
17	0.0			0.0	0.0	35.0	35.4					
18			0.0						25.1	39.0	15.1	0.0
19		0.0		0.0		35.0	35.4	25.3				0.0
20		0.0	0.0		0.0			25.1	39.0		15.3	
21	0.0					35.1		25.3		29.5		
22		0.0	0.0	0.0	0.0		35.3				15.3	
23	0.0							25.3	39.0	29.5		0.0
24				0.0	0.0	35.5	35.3					
25	0.0	0.0	0.0	0.0					39.3		15.3	
26		0.0				35.1	35.0	25.3				0.0
27		0.0	0.0		0.0				39.3		20.0	0.0
28	0.0	0.0	0.0			35.1		25.1		29.0		
29		—		0.0	0.0					29.6	20.0	
30	0.0	—					35.4	44.1	39.4	29.5		0.0
31	0.0	—		—	0.0	—	35.3		—	29.5	—	



SUMMARY

- July–September are the peak months for water releases from Barney Reservoir to the Tualatin River.
- Releases in 2019 began June 3 and continued through December 11, the latest date on record.
- The capacity of Barney Reservoir increased when the dam was raised in 1999. Water releases before the dam raise were smaller. Since the dam raise, releases have varied year-to-year, but have no overall trend. Releases in 2019 were lower and more constant than in the past few years.

MEDIAN OF INSTANTANEOUS FLOW — TRTR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1991	0	0	0	0	0	6	6	6	6	6	0	0
1992	0	0	0	0	0	0	1	8	8	8	0	0
1993	0	0	0	0	0	6	14	19	19	3	2	2
1994	0	0	0	0	0	2	12	18	18	2	0	0
1995	0	0	0	0	2	16	8	5	5	5	5	0
1996	0	0	0	10	0	0	10	20	30	7	0	0
1997	0	0	0	0	0	0	3	10	5	0	0	0
1998	0	0	0	0	0	0	60	68	5	0	0	0
1999	0	0	0	0	0	10	20	20	30	35	0	0
2000	0	0	0	0	0	20	39	39	57	57	39	0
2001	0	0	0	0	0	5	20	20	15	19	0	0
2002	0	0	0	0	0	24	36	48	54	39	0	0
2003	0	0	0	0	0	26	40	66	44	12	0	0
2004	0	0	0	0	0	23	38	34	24	14	0	0
2005	0	0	0	0	0	0	22	36	50	31	0	0
2006	0	0	0	0	0	21	20	20	40	49	0	0
2007	0	0	0	0	0	12	20	20	39	19	0	0
2008	0	0	0	0	0	0	18	24	30	24	0	0
2009	0	0	0	0	0	0	20	24	34	20	0	0
2010	0	0	0	0	0	0	26	34	40	30	0	0
2011	0	0	0	20	50	49	49	60	49	10	0	0
2012	0	0	0	0	0	0	30	40	30	18	0	0
2013	0	0	0	0	15	20	20	32	38	14	0	0
2014	0	0	0	0	0	15	30	30	44	30	0	0
2015	0	0	0	0	25	30	40	40	50	30	0	0
2016	0	0	0	0	20	30	30	35	49	19	0	0
2017	0	0	0	0	0	0	40	40	56	20	0	0
2018	0	0	0	0	0	30	40	50	55	40	15	0
2019	0	0	0	0	0	35	35	25	39	39	15	0
median	0	0	0	0	0	8	21	31	36	19	0	0

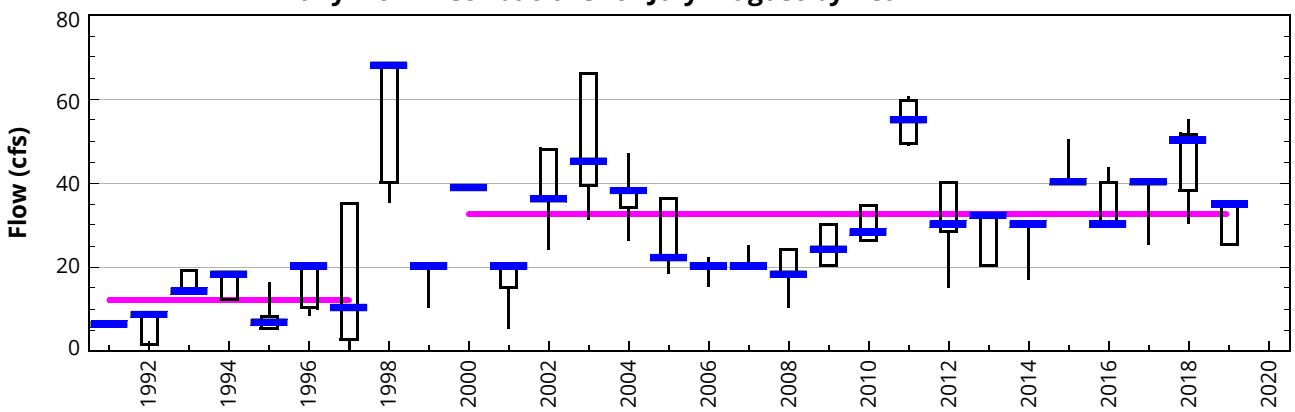
KEY

Q in cfs
- 0 < Q ≤ 5
- 5 < Q ≤ 14
- 14 < Q ≤ 39
- 39 < Q ≤ 49
- Q > 49

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Only days with water releases were used to calculate percentiles

Daily Flow Distributions for July–August by Year — TRTR



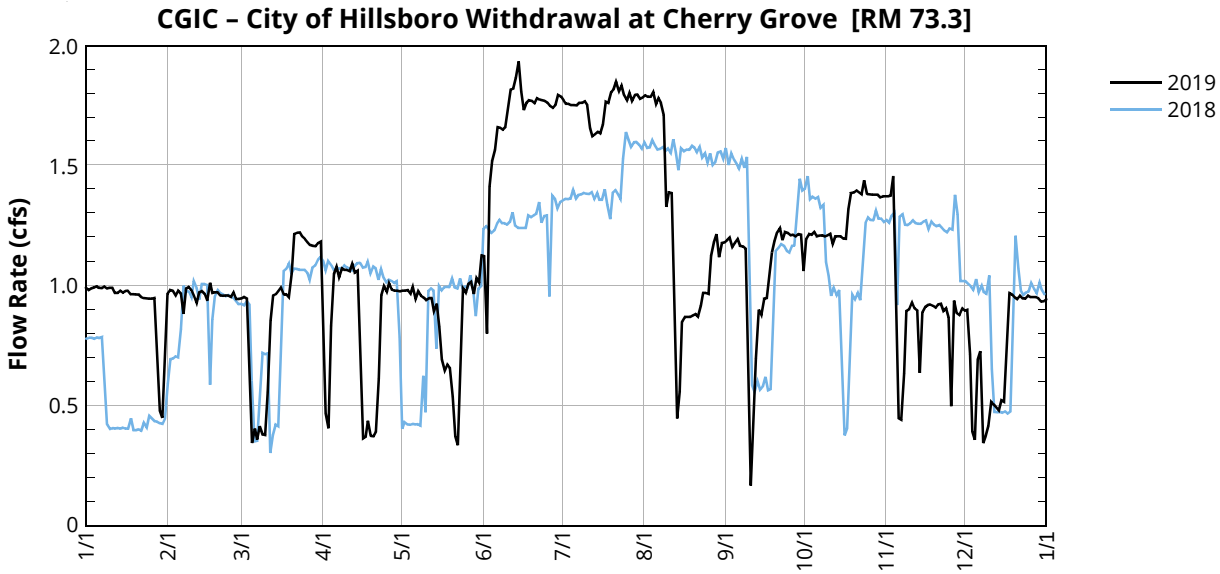
Note: Blue dashes are used to identify median values because quartile boxes and whiskers are sometimes small.

CGIC — City of Hillsboro Withdrawal at Cherry Grove [RM 73.3]

Data source: City of Hillsboro

2019 — MEAN WITHDRAWAL (cfs) — CGIC

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.97	0.95	0.78	0.98	1.12	1.77	1.79	1.19	1.19	1.37	0.90
2	0.98	0.98	0.95	0.47	0.98	0.80	1.76	1.79	1.20	1.21	1.38	0.71
3	0.99	0.98	0.95	0.41	0.98	1.41	1.76	1.79	1.16	1.21	1.46	0.39
4	0.99	0.96	0.71	0.83	0.97	1.52	1.75	1.81	1.18	1.22	0.94	0.36
5	1.00	0.98	0.34	1.05	0.99	1.57	1.75	1.76	1.19	1.20	0.45	0.69
6	0.99	0.97	0.40	1.08	0.95	1.66	1.75	1.78	1.17	1.21	0.44	0.73
7	0.99	0.88	0.36	1.04	0.97	1.66	1.76	1.76	1.16	1.21	0.63	0.34
8	0.99	0.99	0.41	1.07	0.96	1.65	1.76	1.71	1.15	1.21	0.89	0.37
9	0.99	0.99	0.38	1.06	0.95	1.66	1.77	1.33	0.58	1.21	0.90	0.41
10	0.99	0.98	0.38	1.06	0.94	1.73	1.75	1.39	0.17	1.22	0.93	0.52
11	0.99	0.96	0.56	1.06	0.95	1.82	1.66	1.38	0.43	1.17	0.91	0.50
12	0.97	0.93	0.85	1.09	0.95	1.82	1.62	0.83	0.69	1.20	0.90	0.50
13	0.97	0.97	0.96	1.06	0.89	1.87	1.63	0.45	0.90	1.21	0.64	0.48
14	0.98	0.98	0.97	1.06	0.93	1.93	1.64	0.56	0.88	1.20	0.89	0.52
15	0.97	0.97	0.98	0.79	0.83	1.81	1.63	0.85	0.95	1.20	0.91	0.52
16	0.98	0.94	0.99	0.36	0.69	1.73	1.67	0.87	0.95	1.19	0.92	0.72
17	0.98	1.01	0.96	0.37	0.65	1.76	1.77	0.87	1.04	1.32	0.92	0.97
18	0.96	0.97	0.96	0.44	0.67	1.77	1.76	0.87	1.14	1.38	0.92	0.96
19	0.96	0.97	0.95	0.37	0.66	1.77	1.81	0.88	1.19	1.39	0.91	0.95
20	0.96	0.97	1.05	0.37	0.54	1.76	1.82	0.88	1.22	1.40	0.92	0.94
21	0.96	0.96	1.22	0.39	0.37	1.78	1.85	0.87	1.24	1.39	0.92	0.96
22	0.95	0.96	1.22	0.61	0.33	1.77	1.81	0.92	1.19	1.38	0.89	0.95
23	0.95	0.96	1.22	0.96	0.72	1.77	1.84	0.97	1.22	1.44	0.91	0.95
24	0.95	0.96	1.21	1.00	0.99	1.77	1.79	0.97	1.22	1.38	0.87	0.96
25	0.95	0.95	1.19	0.97	0.97	1.76	1.77	0.97	1.21	1.38	0.50	0.95
26	0.95	0.97	1.18	1.01	1.01	1.75	1.80	1.12	1.21	1.38	0.94	0.95
27	0.95	0.94	1.17	0.98	1.02	1.74	1.77	1.18	1.21	1.38	0.89	0.95
28	0.72	0.94	1.17	0.98	0.97	1.75	1.79	1.21	1.21	1.38	0.88	0.95
29	0.48	—	1.16	0.98	1.03	1.79	1.80	1.12	1.21	1.37	0.91	0.93
30	0.45	—	1.18	0.97	1.01	1.79	1.78	1.18	1.06	1.37	0.90	0.93
31	0.75	—	1.18	—	1.12	—	1.78	1.18	—	1.37	—	0.94



CGIC — City of Hillsboro Withdrawal at Cherry Grove [RM 73.3]

Data source: City of Hillsboro

Summary

- Withdrawals at Cherry Grove in 2019 were similar to those than in 2018.
- June and July had the highest withdrawal rates in 2019. Rates were lower in August, although not as low as they were win 2016–2017.
- The median withdrawal rate for July-August for the period of record was 1.50 cfs.
- Withdrawal rates at Cherry Grove are operational decisions by Joint Water Commission.

MEDIAN OF DAILY MEAN WITHDRAWAL — CGIC

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	0.91	1.14	1.17	1.28	1.35	1.59	1.42	1.74	1.47	1.35	1.24	1.34
2012	1.00	1.30	1.26	1.34	1.33	1.37	1.60	1.47	1.27	0.98	0.86	0.97
2013	1.12	1.15	1.10	1.12	1.48	1.45	1.45	1.73	1.09	1.00	1.11	0.93
2014	0.84	0.80	0.32	0.49	0.00	0.37	1.22	0.89	0.82	0.74	0.32	0.88
2015	0.99	1.11	1.29	0.88	1.34	1.21	1.49	1.34	1.26	0.82	0.55	0.54
2016	0.54	0.59	0.58	0.83	0.74	0.57	1.14	0.50	0.94	0.60	0.82	0.72
2017	0.69	0.40	0.39	0.37	0.36	0.65	0.66	0.59	0.56	0.57	0.57	0.57
2018	0.42	0.95	0.93	1.07	0.98	1.26	1.38	1.56	1.16	1.26	1.25	0.97
2019	0.97	0.97	0.96	0.98	0.95	1.76	1.77	1.12	1.17	1.22	0.91	0.90
median	0.91	0.97	0.96	0.98	0.98	1.26	1.42	1.34	1.16	0.98	0.86	0.90

Key

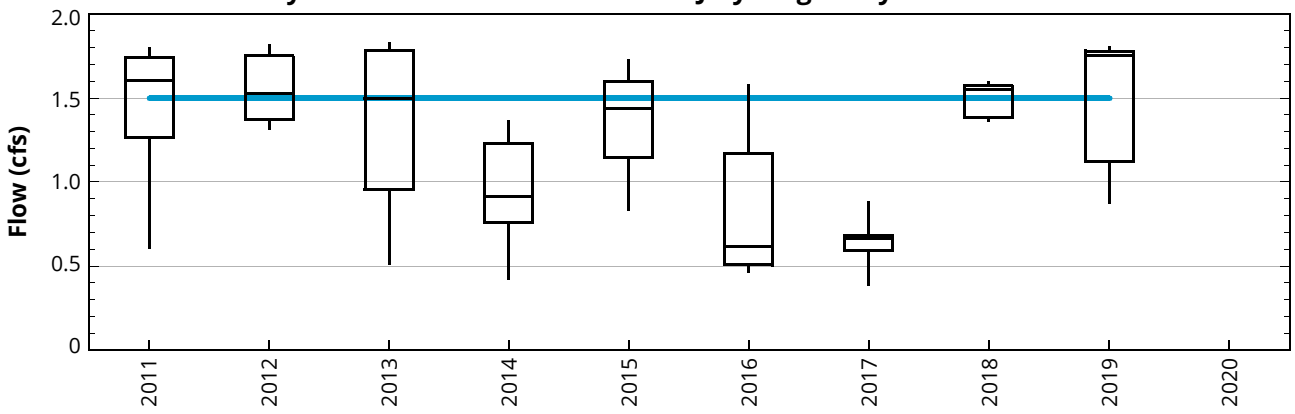
Q in cfs

- 0 < Q ≤ 0.42
- 0.42 < Q ≤ 0.60
- 0.60 < Q ≤ 1.28
- 1.28 < Q ≤ 1.50
- Q > 1.50

Q as percentile

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Daily Withdrawal Distributions for July–August by Year — CGIC

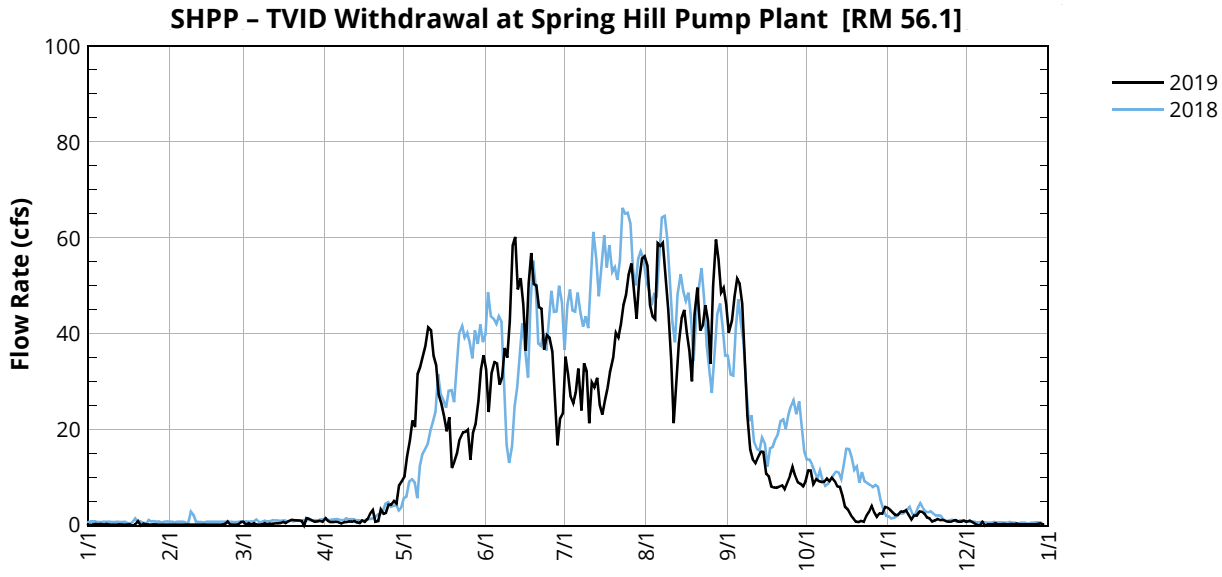


SHPP – TVID Withdrawal at Spring Hill Pump Plant [RM 56.1]

Data source: US Geological Survey, Oregon Water Science Center

2019 — MEAN WITHDRAWAL (cfs) — SHPP

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.22	0.22	0.79	1.49	10.3	32.6	35.2	54.1	40.2	11.5	3.24	1.09
2	0.14	0.22	0.22	1.03	14.4	23.7	31.5	45.9	42.7	11.5	2.74	0.81
3	0.22	0.22	0.54	0.68	17.8	31.7	26.8	43.6	47.7	8.66	2.20	0.43
4	0.35	0.22	0.22	0.71	21.9	34.1	25.5	43.0	51.4	9.69	2.17	0.16
5	0.27	0.22	0.49	0.76	20.5	33.8	27.7	58.8	50.3	9.23	2.93	0.00
6	0.30	0.22	0.22	0.71	31.6	29.4	32.7	58.2	46.3	9.03	2.88	0.74
7	0.14	0.22	0.22	0.43	33.1	30.9	24.0	58.9	32.8	9.08	3.16	0.00
8	0.30	0.22	0.22	0.71	35.2	37.0	33.8	50.9	23.0	9.76	2.23	0.24
9	0.22	0.22	0.49	0.71	37.3	35.0	32.2	44.9	15.8	9.20	1.25	0.24
10	0.22	0.22	0.27	0.87	41.2	42.6	21.3	34.6	13.8	10.0	2.04	0.24
11	0.22	0.22	0.41	0.76	40.7	58.3	29.8	21.3	13.0	9.25	2.04	0.53
12	0.22	0.22	0.30	1.03	35.3	60.1	28.8	30.5	14.3	8.12	2.93	0.24
13	0.27	0.22	0.43	0.65	33.4	49.2	30.8	38.0	15.4	8.04	2.88	0.24
14	0.22	0.22	0.43	0.49	27.3	51.5	25.1	43.2	15.3	6.22	2.47	0.30
15	0.22	0.22	0.54	1.09	25.5	46.2	23.1	44.9	10.7	3.93	1.66	0.24
16	0.22	0.22	0.76	0.81	22.7	36.4	26.0	40.2	10.3	3.36	1.52	0.24
17	0.27	0.22	0.49	1.33	19.7	50.5	28.5	36.4	8.09	2.17	0.90	0.30
18	0.00	0.22	0.95	2.47	22.6	56.8	32.0	30.0	7.90	1.49	1.06	0.24
19	0.24	0.22	1.22	3.23	12.0	50.3	35.0	44.0	7.84	0.81	1.36	0.41
20	0.94	0.22	1.14	0.76	13.4	50.1	40.1	49.6	8.09	0.71	1.14	0.24
21	0.03	0.22	1.09	0.95	15.1	45.5	39.1	40.7	8.41	1.03	1.19	0.24
22	0.38	0.35	1.09	3.32	18.0	45.2	41.9	41.8	7.59	0.81	1.03	0.24
23	0.24	0.90	1.03	2.43	19.4	36.7	45.9	45.9	8.91	2.01	0.76	0.24
24	0.22	0.22	0.00	2.69	19.5	39.7	48.1	42.7	10.4	2.96	0.84	0.24
25	0.22	0.22	1.53	4.32	20.0	39.1	52.2	33.7	12.2	4.10	1.06	0.24
26	0.27	0.22	1.41	4.34	13.7	36.2	54.6	49.8	10.4	2.74	1.14	0.24
27	0.22	0.22	1.09	5.12	19.3	26.6	48.8	59.6	9.07	1.85	0.81	0.30
28	0.22	0.73	0.76	4.65	21.1	16.7	43.1	55.4	8.72	2.50	0.76	0.47
29	0.22	—	0.90	8.44	26.0	22.3	51.0	48.6	8.15	2.47	1.09	0.24
30	0.22	—	1.00	9.37	32.6	23.5	55.7	49.6	9.32	3.92	0.81	0.24
31	0.22	—	0.81	—	35.5	—	56.1	46.0	—	3.73	—	0.24



SHPP – TVID Withdrawal at Spring Hill Pump Plant [RM 56.1]

Data source: US Geological Survey, Oregon Water Science Center

Summary

- TVID withdraws water at SHPP for irrigation. Peak season is usually July–August.
- Although the 2019 season was similar to others, withdrawal rates were lower July–September, probably due to the cooler, cloudier summer weather in 2019.
- Historically, withdrawal rates in the winter were zero, but are now low volumes used to supply nurseries.

MEDIAN OF DAILY MEAN WITHDRAWAL — SHPP

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	0	0	0	0	1.1	10.5	49.0	45.0	25.5	12.0	0.1	0
1992	0	0	0	0	18.0	40.0	50.0	49.0	18.0	4.8	0	0
1993	0	0	0	0.6	1.8	4.4	28.0	43.0	28.5	8.8	0.8	0
1994	0	0	0	0	13.0	21.5	58.0	50.0	24.0	6.8	0.2	0
1995	0	0	0	0	6.0	13.2	44.5	46.2	20.1	3.1	0	0
1996	0	0	0	0	0	25.2	62.0	54.0	9.1	2.1	0	0
1997	0	0	0	1.8	10.0	11.5	51.0	56.0	11.5	3.0	0.3	0
1998	0	0	0	1.5	1.9	14.5	49.0	52.0	28.5	4.2	0.6	0.3
1999	0	0	0.1	2.1	6.6	27.5	56.0	47.0	35.0	10.0	0.4	0.3
2000	0.3	0.3	0.3	4.8	5.9	20.5	49.0	45.0	21.5	0.0	0	0
2001	0	0	0	0	9.6	29.5	42.0	36.0	24.5	3.5	0.8	0
2002	0	0	0	0	15.0	37.0	50.0	51.0	30.0	8.6	1.7	0.3
2003	0.5	0	0	0.9	3.3	52.3	64.4	45.3	24.7	3.3	0	0
2004	0	0	0	0	13.2	41.8	57.9	46.3	4.1	3.1	1.1	0.2
2005	0.3	0.3	1.8	1.3	1.7	15.2	43.7	59.3	30.7	5.1	0.8	0.3
2006	0.2	0.3	0.6	1.6	17.7	24.3	56.7	55.7	29.9	10.7	1.0	0.3
2007	0.3	0.3	0.5	2.3	18.8	45.7	51.3	42.7	29.7	3.4	2.2	0.3
2008	0.3	0.4	0.9	1.9	17.0	32.0	54.0	39.0	32.5	5.1	2.7	0.3
2009	0.3	0.3	0.9	2.9	3.9	39.1	62.0	43.5	23.3	3.7	1.7	1.0
2010	1.0	1.1	1.4	2.5	3.4	3.1	53.0	56.0	20.5	3.6	1.3	0.3
2011	0.32	0.34	0.71	1.25	2.75	17.1	40.6	51.1	27.2	4.74	2.82	0.41
2012	0.40	0.40	0.45	1.55	6.20	16.5	42.0	53.0	37.5	6.00	1.40	0.41
2013							54.0	48.0	19.5	0	0	0
2014	0	0.23	0.43	1.45	11.0	39.0	53.0	54.0	38.0	5.10	0.73	0.22
2015	0.23	0.23	0.81	2.10	36.0	59.5	63.0	52.0	25.0	12.0	0.99	0.22
2016	0.22	0.23	0.51	4.82	25.6	43.1	51.5	56.8	24.1	1.98	1.03	0
2017	0.22	0.22	0.53	0.92	3.85	27.9	56.2	49.6	21.1	6.37	0.71	0.45
2018	0.45	0.45	0.71	0.98	25.8	41.9	53.0	47.0	21.7	9.40	1.73	0.22
2019	0.22	0.22	0.54	1.03	21.9	36.9	32.7	44.9	11.5	3.93	1.44	0.24
median	0.21	0.22	0.37	1.27	8.10	27.7	51.5	49.0	24.5	4.74	0.75	0.22

Key

Q in cfs

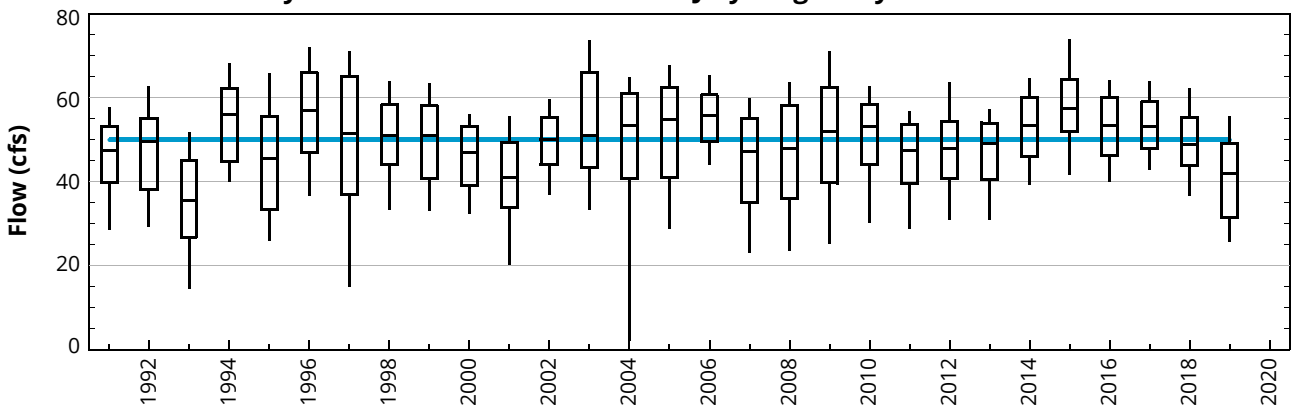
- Q=0
- 0 < Q ≤ 0.30
- 0.30 < Q ≤ 0.90
- 0.90 < Q ≤ 35.3
- 35.3 < Q ≤ 53.0
- Q > 53.0

Q as percentile*

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Only days with withdrawals >0 were used to calculate percentiles

Daily Withdrawal Distributions for July–August by Year — SHPP

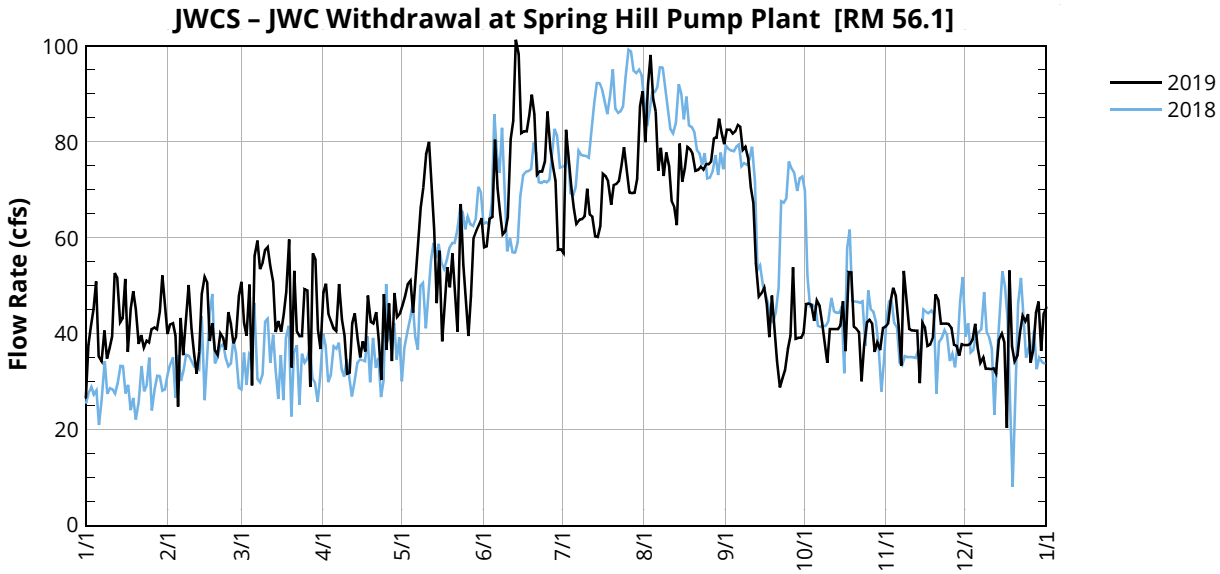


JWCS – JWC Withdrawal at Spring Hill Pump Plant [RM 56.1]

Data source: Joint Water Commission

2019 — MEAN WITHDRAWAL (cfs) — JWCS

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	26.6	39.9	50.7	48.5	45.8	57.9	56.6	79.7	82.3	46.0	42.1	37.5
2	37.6	41.9	42.1	50.3	47.6	58.1	82.3	91.8	82.3	46.2	46.7	37.8
3	41.6	42.1	39.5	43.9	50.3	63.8	76.8	97.9	81.5	46.0	49.4	38.7
4	45.0	39.5	50.1	42.5	51.0	64.2	70.7	88.8	82.0	42.6	47.7	42.0
5	50.7	24.7	29.1	41.0	44.4	80.3	66.1	86.1	83.3	46.8	41.5	37.0
6	35.2	43.2	56.1	40.5	51.5	70.2	62.8	73.8	82.9	45.7	33.3	33.9
7	34.2	35.5	59.3	50.2	59.4	64.9	63.6	78.6	78.1	42.1	53.0	35.0
8	40.6	42.9	53.4	42.8	66.2	60.6	63.8	72.7	78.7	37.9	47.1	32.6
9	34.8	50.1	54.7	39.6	70.3	61.2	64.4	77.6	76.4	33.9	40.9	32.6
10	36.9	41.0	57.3	31.6	77.3	64.1	70.1	74.7	70.4	40.8	40.6	32.5
11	39.4	35.8	58.0	31.8	79.8	80.4	64.7	67.4	67.1	40.8	40.6	32.8
12	52.5	31.7	54.0	42.0	70.0	84.2	64.2	66.2	54.6	40.8	40.5	31.5
13	51.5	36.1	50.7	44.1	61.7	101.0	60.2	62.5	47.7	40.9	29.6	38.7
14	42.3	48.2	40.3	38.8	46.3	98.1	60.0	79.5	48.4	41.7	42.1	40.0
15	43.2	51.7	42.5	35.0	57.1	81.7	62.3	71.5	49.6	46.6	41.1	38.1
16	51.3	50.5	40.4	38.3	38.3	82.0	73.1	74.3	46.0	36.2	37.4	20.3
17	36.1	38.5	43.9	36.2	45.3	82.0	72.6	78.7	39.1	52.7	37.7	53.1
18	45.0	42.1	48.7	47.8	53.8	85.3	71.6	78.3	47.8	52.6	39.2	37.3
19	48.7	36.4	59.5	42.4	49.5	89.6	66.7	77.3	41.3	41.4	48.1	34.2
20	45.1	35.5	32.9	42.1	56.7	85.6	70.8	73.8	34.2	40.9	46.8	35.4
21	37.8	39.9	53.0	44.4	49.2	73.0	71.1	74.0	28.7	40.3	42.0	40.2
22	39.6	38.9	40.3	38.6	40.4	73.7	71.7	74.7	30.6	30.0	42.0	43.6
23	37.1	36.6	39.4	30.3	66.9	73.6	74.9	74.1	32.3	37.5	42.0	42.5
24	38.5	44.4	39.5	48.2	54.4	75.7	78.7	75.2	36.7	42.3	41.9	44.0
25	38.1	41.9	49.2	36.5	46.8	86.1	74.1	75.2	39.5	42.8	41.1	33.9
26	40.8	37.9	48.9	46.2	39.5	78.4	69.3	75.7	53.7	42.1	37.6	36.5
27	41.1	39.3	28.8	34.2	47.9	74.8	69.1	80.6	38.9	36.1	37.4	44.3
28	40.8	47.7	56.7	48.4	59.9	71.8	69.3	80.7	39.0	38.0	35.3	46.6
29	44.5	—	55.4	43.4	61.5	57.3	72.1	84.7	39.0	36.6	37.7	36.3
30	52.0	—	40.7	44.1	62.7	57.4	87.3	81.6	40.1	41.1	37.6	44.2
31	45.9	—	36.7	—	64.0	—	90.3	79.3	—	41.4	—	45.4



JWCS – JWC Withdrawal at Spring Hill Pump Plant [RM 56.1]

Data source: Joint Water Commission

Summary

- JWC withdraws water at SHPP for municipal use. Peak season is July–August.
- Withdrawals in 2019 July–August were similar to those in recent years. September withdrawals were much lower, probably because September was cloudy, cool and rainy.
- Withdrawal rates in July–August increased from 1991 to the early-2000s. Withdrawal rates also increased for other months. Since 2003, no trend is evident. The average July-August withdrawal is 72.1 cfs.
- Hagg Lake did not fill in 2001, prompting strong conservation measures and lower withdrawals.

MEDIAN OF DAILY MEAN WITHDRAWAL — JWCS

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	19.5	19.2	18.6	19.3	16.8	21.0	33.1	33.6	28.6	22.9	19.6	15.9
1992	17.9	17.9	18.0	19.8	28.3	37.1	32.7	34.6	27.7	22.2	17.8	16.5
1993	17.0	16.0	16.6	16.1	20.4	24.8	25.4	32.9	32.3	19.1	17.1	18.4
1994	17.7	15.7	15.6	16.4	24.3	27.6	42.8	40.6	33.1	23.9	16.0	20.7
1995	20.9	20.9	22.5	20.8	24.4	30.2	37.8	35.4	32.9	24.0	24.2	23.4
1996	23.0	29.6	27.6	27.8	25.5	34.5	46.4	42.6	27.3	23.5	24.8	25.1
1997	23.9	23.4	28.5	25.7	43.2	39.5	48.1	44.7	33.3	25.7	24.6	26.7
1998	28.2	29.3	29.2	30.3	31.9	42.2	56.9	55.0	52.7	33.9	32.2	33.1
1999	32.6	29.8	31.2	30.1	38.4	45.8	56.1	57.6	54.1	40.8	34.5	42.0
2000	34.7	33.1	32.8	36.0	41.7	59.0	67.6	69.2	53.2	44.0	42.4	42.7
2001	43.1	42.9	45.1	38.8	36.7	33.0	38.2	42.9	38.8	28.8	35.5	37.0
2002	38.2	38.9	42.2	43.5	44.0	52.8	60.2	62.9	55.1	47.8	44.4	45.7
2003	47.1	47.6	48.5	50.1	53.4	65.9	79.1	73.0	58.0	49.5	46.8	49.2
2004	52.5	37.8	51.7	56.6	61.6	67.5	80.1	78.8	57.9	52.9	47.9	46.0
2005	48.4	49.2	53.7	53.6	49.8	58.9	75.3	83.9	77.6	49.3	47.4	46.4
2006	50.0	50.8	49.2	53.8	57.4	61.0	79.4	79.4	70.2	52.5	48.8	40.8
2007	44.7	43.6	43.9	42.2	50.7	56.9	62.6	65.1	64.9	38.8	43.9	46.8
2008	48.3	47.0	43.7	38.2	43.7	46.9	68.2	63.4	60.3	42.0	36.4	42.4
2009	44.0	43.7	42.2	40.0	43.2	56.1	72.6	65.7	53.9	38.8	32.4	38.0
2010	41.5	42.6	39.3	33.7	33.8	36.1	64.3	67.0	43.3	38.9	32.2	33.0
2011	35.4	38.0	35.4	34.9	32.1	41.1	50.2	61.8	61.4	36.5	30.6	31.4
2012	32.2	33.2	35.7	37.0	42.4	41.7	57.5	67.5	65.8	39.4	32.6	35.2
2013	37.6	37.3	33.0	29.7	45.5	44.2	62.6	72.0	45.8	44.4	42.8	34.4
2014	38.2	39.5	39.7	38.1	45.0	55.2	67.1	72.7	66.2	45.9	39.9	46.6
2015	46.9	38.6	37.3	45.3	53.8	71.9	85.5	78.2	56.2	42.2	39.5	36.3
2016	38.6	40.5	40.4	44.8	54.1	68.4	66.7	76.9	56.8	39.2	39.6	38.5
2017	40.7	37.6	38.7	40.2	43.7	57.4	73.0	77.3	66.2	36.9	34.6	28.8
2018	27.9	33.9	33.7	34.3	55.5	71.8	86.7	83.2	72.4	44.8	38.4	38.9
2019	40.8	39.9	48.9	42.2	53.8	74.2	70.1	77.3	48.1	41.4	41.1	37.5
median	37.9	37.7	36.5	36.5	43.2	46.4	62.6	65.4	54.6	39.1	35.1	36.7

Key

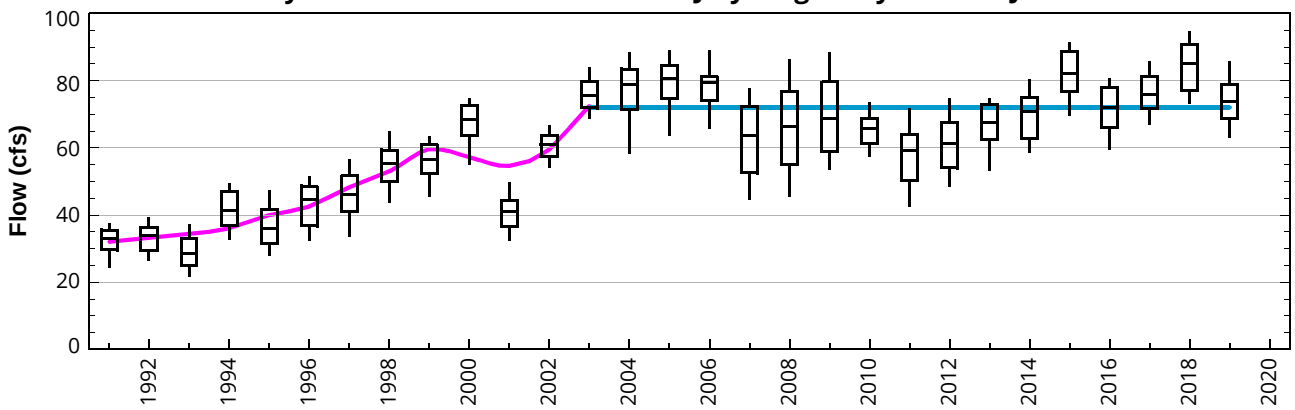
Q in cfs

- 0 < Q ≤ 22.1
- 22.1 < Q ≤ 31.0
- 31.0 < Q ≤ 51.9
- 51.9 < Q ≤ 67.6
- Q > 67.6

Q as percentile

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Daily Withdrawal Distributions for July–August by Year — JWCS



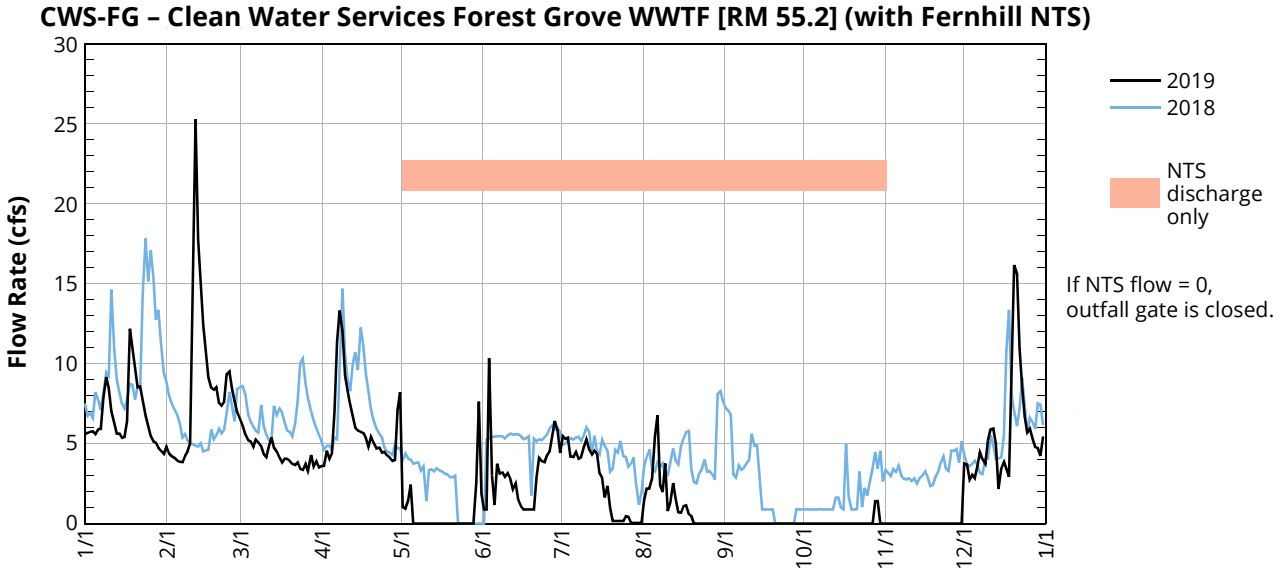
CWS-FG – Clean Water Services Forest Grove WWTF Discharge [RM 55.2] with Fernhill NTS

Data source: Clean Water Services

2019 — MEAN DISCHARGE (cfs) — CWS-FG

DAY	Jan	Feb	Mar	Apr	May*	Jun*	Jul*	Aug*	Sep*	Oct*	Nov	Dec
1	5.60	4.81	6.13	3.60	1.02	0.88	5.46	1.44	closed	closed	0.00	3.73
2	5.68	4.38	5.52	4.56	0.93	0.88	5.31	2.17	closed	closed	0.00	3.68
3	5.74	4.21	5.23	4.07	1.44	10.3	5.38	2.17	closed	closed	0.00	2.77
4	5.75	4.12	5.12	4.42	2.44	3.02	4.19	2.82	closed	closed	0.00	3.05
5	5.58	3.94	4.78	6.98	closed	1.16	4.15	5.46	closed	closed	0.00	2.83
6	5.89	3.85	5.26	11.4	closed	3.74	4.47	6.78	closed	closed	0.00	3.54
7	5.91	3.84	5.07	13.3	closed	3.12	4.05	2.44	closed	closed	0.00	4.46
8	7.84	4.24	4.84	12.0	closed	3.20	4.13	1.98	closed	closed	0.00	4.02
9	9.16	4.52	4.33	9.27	closed	2.91	4.78	3.76	closed	closed	0.00	3.71
10	8.42	5.01	4.15	8.29	closed	3.16	5.26	0.77	closed	closed	0.00	5.17
11	7.01	18.2	4.83	7.44	closed	2.80	4.59	1.31	closed	closed	0.00	5.86
12	6.25	25.3	5.38	6.68	closed	2.15	4.32	2.54	closed	closed	0.00	5.93
13	5.63	17.8	4.73	5.99	closed	2.54	4.56	1.50	closed	closed	0.00	4.97
14	5.63	14.9	4.47	5.82	closed	1.47	4.38	0.68	closed	closed	0.00	2.15
15	5.35	12.4	4.12	5.74	closed	1.08	3.12	0.67	closed	closed	0.00	3.47
16	5.41	10.8	3.82	5.66	closed	0.88	2.83	1.08	closed	closed	0.00	3.87
17	6.39	9.13	4.07	5.34	closed	0.88	1.64	1.16	closed	closed	0.00	3.40
18	12.2	8.48	4.04	4.80	closed	0.88	2.37	0.57	closed	closed	0.00	2.91
19	11.0	8.35	3.91	5.41	closed	0.88	0.97	0.46	closed	closed	0.00	8.08
20	9.82	8.52	3.73	5.03	closed	0.88	0.15	closed	closed	closed	0.00	16.2
21	8.52	7.55	3.65	4.69	closed	2.88	0.15	closed	closed	closed	0.00	15.6
22	8.55	7.38	3.82	4.72	closed	4.12	0.15	closed	closed	closed	0.00	11.0
23	7.67	7.58	3.42	4.44	closed	3.88	0.15	closed	closed	closed	0.00	8.55
24	6.73	9.31	3.36	4.49	closed	3.84	0.15	closed	closed	closed	0.00	6.70
25	6.08	9.50	3.73	4.25	closed	4.27	0.46	closed	closed	closed	0.00	5.71
26	5.45	8.40	3.30	4.13	closed	4.52	0.42	closed	closed	closed	0.00	5.93
27	5.12	7.63	4.27	3.91	closed	5.45	0.03	closed	closed	closed	0.00	5.28
28	5.06	6.96	3.59	3.96	closed	6.42	0.03	closed	closed	1.39	0.00	4.78
29	4.70	—	3.88	7.12	2.58	5.79	0.03	closed	closed	1.39	0.00	4.70
30	4.55	—	3.51	8.21	7.61	4.42	0.03	closed	closed	closed	0.00	4.22
31	4.35	—	3.60	—	1.87	—	0.05	closed	—	closed	—	5.37

*Boxed area denotes discharge only from Fernhill NTS. Effluent from the Forest Grove WWTF was not discharged directly to the Tualatin River at that time. It was either routed to the NTS or transferred to the Rock Creek WWTF depending on operational needs.



CWS-FG – Clean Water Services Forest Grove WWTF Discharge [RM 55.2] with Fernhill NTS

Data source: Clean Water Services

Summary

- Beginning in 1995, the Forest Grove WWTF discontinued discharges to the Tualatin River during the low-flow season (May/June – October/November, depending on river flow). Effluent was transferred to the Rock Creek WWTF during the entire low-flow season until 2017.
- In 2017, the Forest Grove Natural Treatment System (NTS) at Fernhill Wetlands began trial operation during the low-flow season. Since then, the Forest Grove WWTF either discharges into the NTS or transfers effluent to the Rock Creek WWTF during the low-flow season. The choice of destination is an operational decision and may change day-to-day.
- In 2019, the NTS discharged throughout June and July and intermittently in May and August. The NTS did not discharge in September and October.
- Plans are for the Forest Grove WWTF to discharge exclusively to the NTS during the low-flow season.

MEDIAN OF DAILY MEAN DISCHARGE — CWS-FG

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	7.8	9.8	8.8	8.2	6.3	5.0	4.1	3.0	3.1	2.6	4.8	6.4
1992	7.1	7.7	5.4	5.7	3.9	2.9	2.6	2.4	2.5	2.9	4.3	7.8
1993	7.8	6.2	7.7	7.7	5.7	4.2	2.9	2.7	2.6	2.7	2.8	4.8
1994	6.4	5.8	5.2	3.1	2.2	1.2	1.1	1.0	1.0	1.4	2.8	5.6
1995	4.7	5.3	5.7	5.4	3.9	0	0	0	0	0	5.0	9.1
1996	8.5	9.8	4.9	5.4	5.0	0	0	0	0	0	2.9	10.0
1997	9.0	4.5	8.3	3.4	0	0	0	0	0	0	0	5.4
1998	10.7	8.9	6.6	1.9	0	2.0	0	0	0	0	0	10.5
1999	8.4	16.4	9.7	3.7	0	0	0	0	0	0	5.2	7.8
2000	9.5	6.9	6.1	0	0	0	0	0	0	0	0	4.0
2001	3.6	3.8	2.8	2.7	0	0	0	0	0	0	0	8.7
2002	7.3	5.5	4.6	0	0	0	0	0	0	0	0	0
2003	7.8	6.8	8.2	0	0	0	0	0	0	0	0	6.0
2004	7.3	7.7	5.0	0	0	0	0	0	0	0	0	0
2005	4.7	3.4	3.3	5.8	0	0	0	0	0	0	0	8.3
2006	12.8	6.0	6.4	5.6	0	0	0	0	0	0	8.1	10.9
2007	6.6	6.9	6.3	4.9	0	0	0	0	0	0	0	8.4
2008	8.8	5.1	5.6	4.6	3.2	0	0	0	0	0	3.5	4.2
2009	5.7	3.9	5.6	0	0	0	0	0	0	0	5.4	4.7
2010	9.2	7.1	5.9	5.3	0	0	0	0	0	0	0	11.1
2011	7.5	6.5	10.1	11.3	9.7	6.1	0	0	0	0	1.3	3.7
2012	8.3	6.4	10.2	6.3	5.6	0	0	0	0	0	5.8	12.3
2013	4.6	4.3	5.0	4.2	0	0	0	0	0	0	3.5	3.4
2014	4.2	8.1	8.3	6.1	4.0	0	0	0	0	0	4.1	8.8
2015	5.6	7.1	6.1	4.4	0	0	0	0	0	0	3.5	15.4
2016	11.0	8.5	10.0	4.4	0	0	0	0	0	0	0	9.3
2017	8.0	13.8	11.0	7.0	4.5	2.9	3.9	0	0	0	8.0	5.9
2018	8.7	5.7	6.3	5.7	3.1	5.4	4.6	3.7	0.9	0.9	3.2	5.5
2019	5.9	7.6	4.1	5.4	0	3.0	2.8	0.7	0	0	0	4.7
median	7.8	6.7	6.1	4.9	0	0	0	0	0	0	2.8	6.4

Key

Q in cfs
- 0 < Q ≤ 2.7
- 2.7 < Q ≤ 3.9
- 3.9 < Q ≤ 8.0
- 8.0 < Q ≤ 11.1
- Q > 11.1

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Only days with discharges were used to calculate percentiles

NTS discharge

No July-August boxplots graph produced because direct discharge to the Tualatin River from the Forest Grove WWTF does not occur in July-August.
Since 2017, the FG-WWTF may discharge through the Fernhill NT during this time.

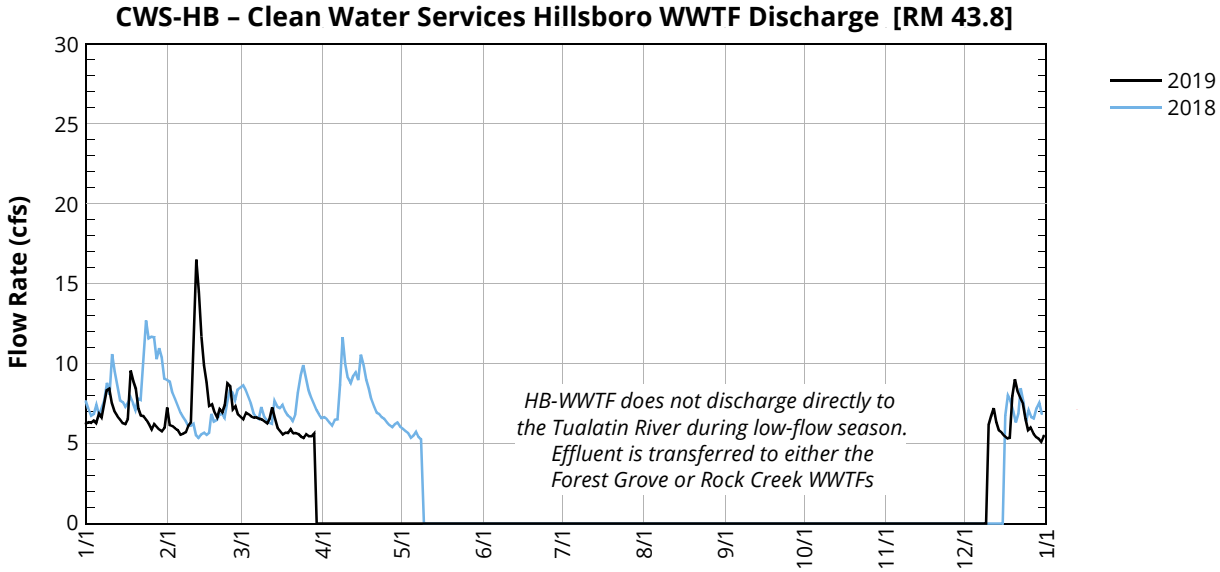
CWS-HB – Clean Water Services Hillsboro WWTF Discharge [RM 43.8]

Data source: Clean Water Services

2019 — MEAN DISCHARGE (cfs) — CWS-HB

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6.3	7.3	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	6.3	6.1	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	6.3	6.1	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	6.4	6.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	6.3	5.9	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	6.9	5.6	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	6.6	5.6	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	7.5	5.7	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	8.3	6.1	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	8.4	6.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2
11	7.5	11.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
12	7.0	16.5	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2
13	6.7	14.5	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
14	6.5	11.7	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
15	6.3	9.9	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7
16	6.2	8.8	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
17	6.5	7.3	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
18	9.6	7.5	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
19	8.9	6.9	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
20	8.4	6.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
21	7.2	7.2	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
22	6.7	6.9	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8
23	6.7	7.4	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
24	6.5	8.8	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5
25	6.2	8.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
26	5.9	7.1	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
27	6.2	7.3	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6
28	6.0	6.8	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
29	5.9	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
30	5.7	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
31	6.0	—	0.0	—	0.0	—	0.0	0.0	—	0.0	—	5.5

During the low-flow season the Hillsboro WWTF does not discharge directly to the Tualatin River. Effluent is transferred to either the Forest Grove or Rock Creek WWTFs depending on operational needs.



CWS-HB – Clean Water Services Hillsboro WWTF Discharge [RM 43.8]

Data source: Clean Water Services

Summary

- Beginning in 1995, the Hillsboro WWTF discontinued discharges to the Tualatin River during the low-flow season (May/June – October/November, depending on river flow). Effluent was transferred to the Rock Creek WWTF during the entire low-flow season until 2017.
- During the low flow season in 2018 and 2019, effluent was transferred from the Hillsboro WWTF to either the Forest Grove or Rock Creek WWTFs. Once at the Forest Grove WWTF, it was either discharged into the Natural Treatment System (NTS) at Fernhill Wetlands or transferred to the Rock Creek WWTF.

MEDIAN OF DAILY MEAN DISCHARGE — CWS-HB

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	4.2	4.8	4.3	4.5	3.8	3.5	3.1	3.8	3.7	4.4	5.0	6.6
1992	6.8	7.7	6.2	6.4	5.4	5.0	4.6	4.5	4.6	4.5	5.1	7.4
1993	7.3	6.0	6.9	7.7	6.4	6.1	4.7	4.4	4.6	3.9	4.2	5.7
1994	7.2	6.5	5.4	4.1	3.3	3.3	1.9	2.0	2.1	2.2	5.1	10.3
1995	8.3	7.6	7.4	5.6	4.5	0	0	0	0	0	5.2	9.2
1996	11.2	12.6	6.0	6.8	6.3	0	0	0	0	0	5.2	15.5
1997	9.9	6.8	9.9	5.1	4.4	0	0	0	0	0	2.4	6.2
1998	11.7	9.5	7.6	5.9	7.1	5.4	0	0	0	0	5.7	12.7
1999	11.3	15.5	9.6	7.1	0	0	0	0	0	0	6.9	8.7
2000	9.8	7.9	7.8	5.8	0	0	0	0	0	0	0	5.6
2001	5.8	5.8	5.6	5.4	0	0	0	0	0	0	0	10.9
2002	10.5	7.5	7.5	7.2	0	0	0	0	0	0	0	7.5
2003	9.4	10.3	10.5	9.3	0	0	0	0	0	0	0	7.9
2004	10.1	9.5	7.6	6.7	0	0	0	0	0	0	0	0
2005	7.1	6.9	0	6.9	7.8	0	0	0	0	0	7.2	8.7
2006	16.3	7.6	7.5	6.7	0	0	0	0	0	0	8.6	10.6
2007	7.2	7.1	6.2	5.5	0	0	0	0	0	0	0	10.6
2008	10.5	6.8	7.1	6.3	0	0	0	0	0	0	4.6	5.0
2009	6.4	5.1	6.0	3.8	4.9	0	0	0	0	0	6.0	5.8
2010	11.2	8.0	6.5	7.0	5.3	5.6	0	0	0	0	0	6.0
2011	8.7	6.9	10.4	0	0	0	0	0	0	0	0	4.9
2012	7.9	7.2	11.7	0	0	0	0	0	0	0	6.0	13.4
2013	5.8	5.5	5.8	0	0	0	0	0	0	0	4.7	4.4
2014	4.8	8.6	8.2	6.4	4.0	0	0	0	0	0	4.4	7.7
2015	5.8	7.1	6.8	5.6	0	0	0	0	0	0	0	17.1
2016	12.3	8.8	10.1	5.6	0	0	0	0	0	0	6.9	9.5
2017	8.6	15.3	11.7	8.1	5.9	0	0	0	0	0	6.9	5.8
2018	7.8	6.8	7.3	6.9	0	0	0	0	0	0	0	0
2019	6.5	7.1	5.8	0	0	0	0	0	0	0	0	5.5
median	8.4	7.3	7.3	5.9	0	0	0	0	0	0	4.6	7.5

Key

Q in cfs

- Q ≤ 4.3
- 4.3 < Q ≤ 5.2
- 5.2 < Q ≤ 8.8
- 8.8 < Q ≤ 12.4
- Q > 12.4

Q as percentile

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Only days with discharges were used to calculate percentiles

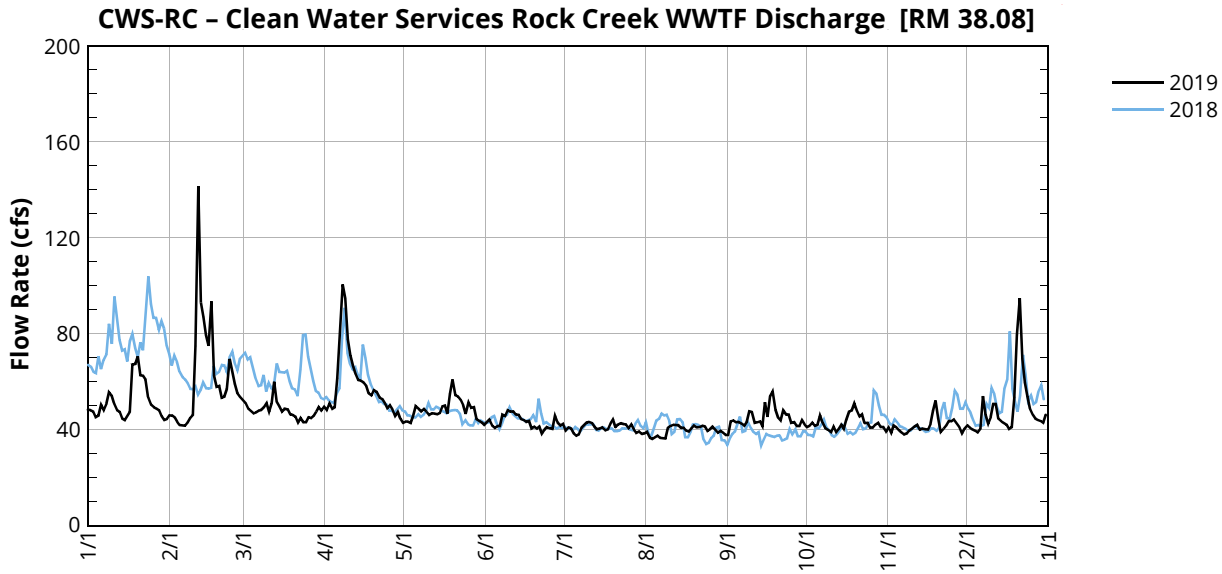
No July-August boxplots graph produced because direct discharge to the Tualatin River from the Hillsboro WWTF does not occur in July-August.

CWS-RC – Clean Water Services Rock Creek WWTF Discharge [RM 38.08]

Data source: Clean Water Services

2019 — MEAN DISCHARGE (cfs) — CWS-RC

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	48.3	45.9	51.2	48.3	43.3	43.1	39.6	39.1	37.8	41.1	41.0	41.7
2	48.1	45.9	48.7	50.8	43.3	44.1	40.9	36.6	43.5	41.6	38.6	40.8
3	47.5	45.0	47.7	48.7	42.9	41.5	40.6	36.1	43.9	43.0	41.7	40.0
4	45.1	43.1	46.8	49.4	45.7	40.7	38.4	36.7	43.1	41.6	41.1	39.6
5	45.8	41.8	47.2	61.3	49.7	41.4	37.5	37.4	43.3	41.9	39.8	38.8
6	50.2	41.6	47.8	82.5	48.7	41.4	38.0	36.5	42.4	45.8	38.8	40.4
7	48.0	41.6	48.1	100.4	47.5	46.3	40.6	36.3	41.6	42.7	38.0	54.0
8	50.8	43.0	49.2	94.7	48.6	45.8	41.6	36.2	43.2	40.6	38.4	46.3
9	55.6	44.8	51.1	77.6	47.4	48.1	42.9	40.7	47.5	39.9	39.6	42.4
10	54.3	46.2	47.4	70.9	46.1	47.3	43.3	41.5	47.3	38.9	40.4	45.1
11	50.7	74.8	51.0	66.6	46.7	47.5	42.9	41.9	42.7	41.3	41.3	50.6
12	48.0	141.5	60.0	63.1	46.6	46.2	41.2	41.9	43.1	38.9	41.9	50.5
13	47.4	93.0	51.5	60.6	46.4	46.1	40.1	41.8	43.5	40.3	40.0	44.5
14	44.7	86.9	49.6	60.3	46.9	44.3	40.3	40.7	41.3	42.0	40.4	43.5
15	43.9	79.3	47.4	59.7	49.7	44.0	41.0	40.8	51.4	40.3	40.1	42.8
16	45.7	74.9	48.7	58.3	50.1	43.1	39.6	39.5	45.2	44.1	39.9	42.1
17	47.4	93.3	48.4	55.0	46.7	43.6	40.0	39.1	53.9	47.5	42.3	40.3
18	67.0	62.5	46.3	54.3	54.9	40.6	42.5	40.5	55.9	47.8	47.8	41.1
19	67.3	57.8	46.1	56.5	60.9	41.2	44.2	41.6	48.3	50.9	52.1	53.4
20	70.6	58.2	45.5	55.8	54.4	40.4	41.0	40.9	44.9	47.8	44.7	79.4
21	62.7	53.2	42.9	53.3	53.8	41.3	42.1	41.0	43.9	45.5	39.0	94.8
22	62.3	53.7	44.8	52.7	52.4	38.4	42.5	41.5	47.9	46.4	40.4	69.6
23	60.7	56.9	43.1	51.1	50.1	39.9	42.2	41.3	46.2	42.6	41.6	59.6
24	53.4	69.3	43.1	49.0	46.5	41.0	42.0	39.4	46.2	42.9	43.6	53.7
25	50.3	64.2	45.1	50.1	51.3	40.5	40.7	40.1	42.7	40.8	43.4	48.5
26	49.3	59.1	44.7	48.4	49.0	40.3	42.0	41.2	43.1	40.8	44.3	46.3
27	48.8	55.1	45.7	45.7	49.4	45.7	40.2	40.1	41.4	42.0	42.7	44.6
28	48.0	53.7	47.4	47.4	44.4	43.0	38.7	38.8	41.4	42.7	41.3	44.0
29	45.6	—	49.5	44.5	43.7	41.6	39.1	39.4	44.0	41.1	38.4	43.6
30	43.9	—	47.9	42.7	43.0	42.3	38.1	38.7	42.2	41.0	40.5	42.9
31	44.3	—	49.5	—	41.9	—	38.4	37.8	—	39.1	—	46.2



Summary

- Discharges from the Rock Creek WWTF in 2019 from January–March were somewhat lower than those in recent years. The decrease is likely related to lower rainfall at that time.
- Discharges in July–August steadily increased from1991 to the early-2000s. Discharges also increased for other months during this time period.
- From 2003–2019 discharges show no trend. The average discharge in July-August 2003–2019 was 43.8 cfs.

MEDIAN OF DAILY MEAN DISCHARGE — CWS-RC

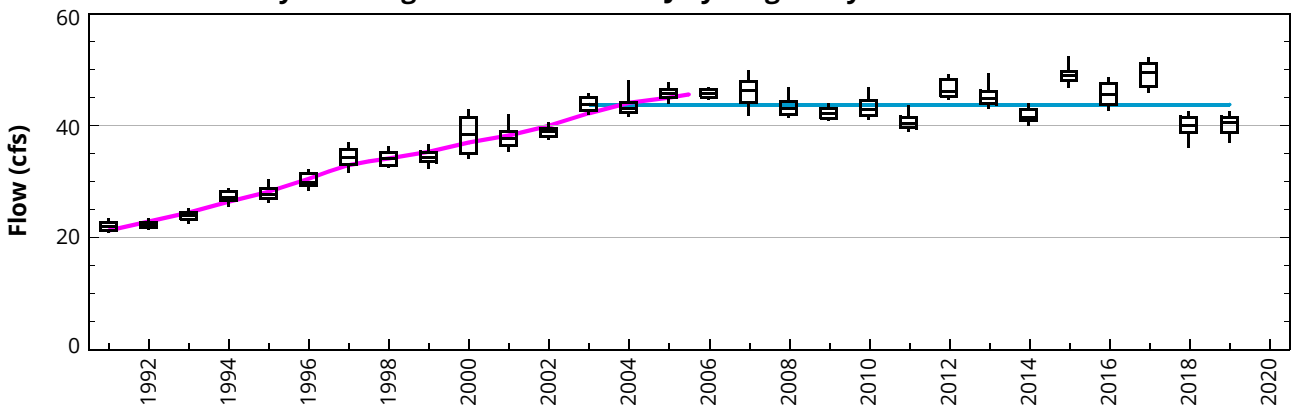
	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	26.9	32.7	33.8	30.0	28.5	23.9	21.3	22.3	21.3	21.4	28.3	30.0
1992	31.7	36.4	28.6	29.5	24.6	22.9	22.3	21.8	21.6	22.3	25.4	35.3
1993	38.1	31.4	36.9	40.4	28.7	27.4	24.2	23.4	22.2	22.2	21.1	27.1
1994	32.4	29.0	33.0	30.5	28.7	27.7	26.9	27.4	26.4	25.2	37.7	48.9
1995	55.3	51.0	52.8	37.0	33.0	28.7	28.2	27.3	27.2	28.6	34.0	71.3
1996	56.8	68.0	37.6	41.6	40.3	32.9	31.2	29.3	28.6	30.0	36.8	97.3
1997	63.0	38.2	60.8	34.8	34.7	36.8	34.8	33.5	33.8	38.7	48.3	39.6
1998	67.9	56.2	47.7	37.7	42.0	38.6	34.2	33.2	35.2	35.6	40.2	75.5
1999	73.0	89.3	55.9	39.5	39.2	38.0	33.9	34.4	32.1	30.5	44.6	51.2
2000	63.5	59.0	58.5	43.7	48.6	44.3	41.5	35.0	38.4	40.9	34.2	39.6
2001	38.2	39.5	39.4	39.4	38.3	36.7	37.5	37.7	38.9	41.5	47.8	71.3
2002	72.1	56.6	52.3	44.4	42.4	40.8	39.0	38.5	39.6	38.8	40.8	50.3
2003	59.3	57.8	63.4	63.4	47.3	45.6	43.9	43.8	40.5	40.7	39.6	51.5
2004	67.2	58.2	42.8	40.5	41.4	44.7	42.8	43.3	44.5	46.6	48.1	46.9
2005	45.3	41.8	38.4	49.3	57.3	48.3	46.0	45.6	45.8	48.4	50.1	58.0
2006	100.9	51.2	50.9	48.0	45.8	45.5	46.0	45.6	41.8	41.9	65.7	137.7
2007	55.6	55.8	52.0	48.4	48.0	44.2	46.1	46.4	42.3	47.4	47.1	73.8
2008	72.0	53.1	51.9	46.0	42.8	43.1	42.4	43.5	43.9	42.8	43.1	42.6
2009	49.8	41.3	47.0	46.2	49.6	46.5	41.7	42.7	43.0	44.5	50.6	46.2
2010	68.6	56.2	52.7	54.0	51.4	57.3	44.4	41.9	43.8	42.5	56.7	87.5
2011	62.0	51.3	73.4	59.8	45.5	41.0	41.2	39.6	39.9	42.3	45.6	37.9
2012	50.9	49.1	67.7	57.3	53.6	51.5	48.2	45.2	45.2	49.4	53.2	79.8
2013	48.0	45.1	43.4	46.8	47.2	49.0	44.2	45.7	50.5	49.9	45.7	43.4
2014	43.2	64.3	62.9	53.7	46.3	45.7	42.6	41.1	41.2	46.3	47.8	58.4
2015	48.8	58.4	59.1	52.2	51.9	50.3	49.0	48.7	51.2	51.8	59.4	100.4
2016	83.8	70.2	72.6	50.1	52.2	48.7	47.0	44.9	48.4	70.3	68.9	70.9
2017	67.0	99.3	82.4	65.9	53.5	52.0	47.0	50.7	51.5	55.6	69.8	64.6
2018	75.3	63.4	60.6	54.0	45.8	43.1	39.9	40.1	37.5	39.9	40.9	50.9
2019	48.3	56.0	47.7	54.6	47.4	42.7	40.7	40.1	43.5	41.9	40.7	44.5
median	56.8	53.1	52.0	46.0	45.5	44.2	41.7	41.1	40.5	41.9	45.7	51.5

Key

Q in cfs
- 0 < Q ≤ 28.8
- 28 8< Q ≤ 38.3
- 38.3 < Q ≤ 52.7
- 52.7 < Q ≤ 69.7
- Q > 69.7

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Daily Discharge Distributions for July–August by Year — CWS-RC

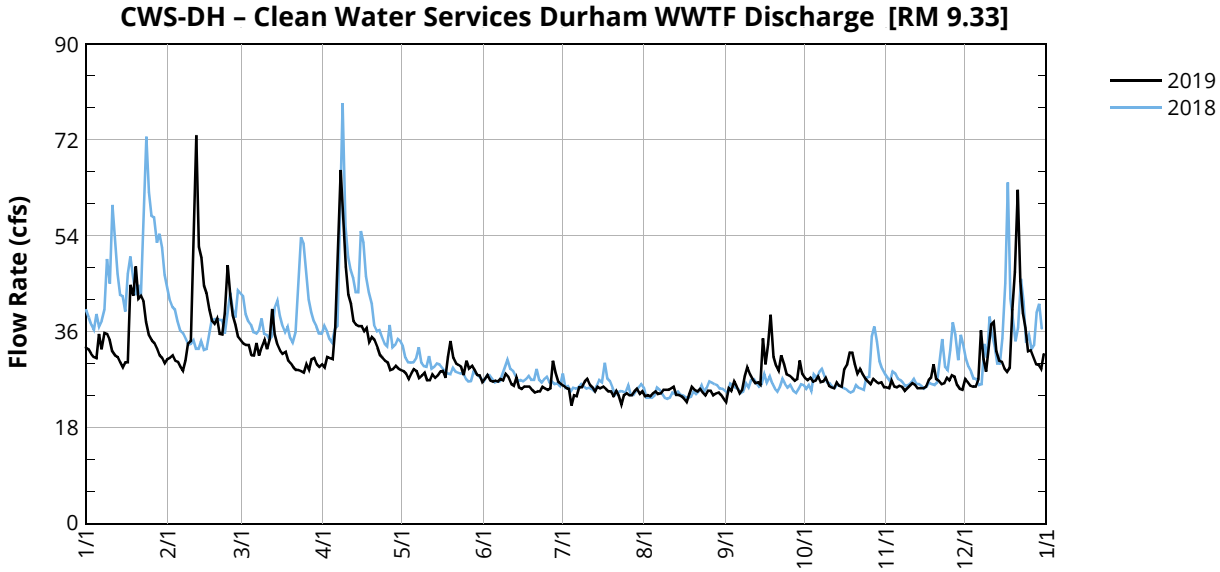


CWS-DH – Clean Water Services Durham WWTF Discharge [RM 9.33]

Data source: Clean Water Services

2019 — MEAN DISCHARGE (cfs) — CWS-DH

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	33.0	30.8	33.7	29.2	28.6	27.1	25.8	23.8	22.7	27.2	25.5	27.1
2	32.6	31.1	33.4	31.2	28.2	27.8	25.4	24.1	25.4	26.9	25.4	26.5
3	31.9	31.6	33.4	30.9	27.1	26.8	25.2	23.8	24.9	27.4	26.8	25.8
4	31.2	30.5	31.6	30.8	28.2	26.6	22.1	24.4	26.6	26.6	25.7	25.7
5	30.9	30.3	31.4	36.8	28.9	26.8	24.0	24.8	25.7	26.8	25.5	25.7
6	35.6	29.4	33.9	51.8	28.6	26.6	23.8	24.3	24.4	27.5	25.8	27.1
7	32.6	28.6	31.4	66.2	27.2	27.1	25.5	24.4	25.1	26.5	25.7	36.2
8	35.7	30.5	33.1	57.7	27.7	26.9	25.5	25.1	27.5	26.6	24.9	30.8
9	35.6	33.7	34.5	48.1	28.3	28.2	26.6	25.1	29.2	27.4	25.4	28.5
10	34.5	34.2	32.6	42.9	26.9	27.5	27.1	25.1	28.0	25.8	25.8	33.1
11	32.3	52.0	34.5	41.2	26.9	26.1	26.0	25.4	27.1	25.5	26.3	37.3
12	31.6	72.7	40.2	37.9	28.0	25.8	25.5	25.7	26.3	25.4	26.0	37.7
13	31.2	51.8	35.4	37.3	27.4	27.4	24.8	24.1	26.5	26.5	25.4	32.3
14	30.2	49.8	33.6	37.0	27.7	25.5	25.7	24.1	26.0	25.8	25.4	30.5
15	29.2	44.6	32.5	37.0	28.5	25.2	25.4	23.8	34.7	25.7	25.4	30.3
16	30.2	43.2	31.9	36.0	28.6	25.7	25.7	23.4	29.9	28.9	25.7	29.1
17	30.2	40.1	32.2	36.7	27.4	25.7	25.2	22.7	33.6	29.9	26.9	28.5
18	44.7	38.1	30.6	34.0	31.2	25.7	24.8	24.3	39.1	32.0	27.4	29.2
19	42.7	37.4	30.0	35.0	34.2	25.1	24.8	25.7	31.2	32.0	29.9	40.1
20	48.3	38.5	29.2	34.5	30.9	24.6	23.8	25.1	29.5	29.9	27.1	47.2
21	42.1	35.6	28.8	33.0	30.0	24.8	24.9	24.8	28.6	28.2	26.8	62.5
22	42.7	35.4	28.8	31.6	29.7	24.8	24.0	25.2	31.6	28.9	26.1	45.5
23	41.6	39.4	28.6	31.1	29.4	25.7	22.3	24.6	29.9	28.0	26.3	39.4
24	37.7	48.4	28.3	30.5	27.8	25.4	24.1	24.0	28.0	27.1	27.4	36.7
25	35.3	42.9	29.9	30.2	30.5	25.1	24.4	24.9	27.7	26.6	26.9	32.3
26	34.3	39.0	28.8	28.8	29.1	25.4	24.0	24.9	27.2	26.1	27.8	32.5
27	33.9	37.3	30.8	28.9	29.5	30.5	24.0	24.0	26.8	27.1	27.5	31.2
28	32.8	35.1	31.1	29.5	28.8	28.3	24.8	24.4	27.1	26.6	26.0	29.9
29	31.6	—	29.9	29.1	27.8	26.5	25.2	24.6	30.6	26.3	25.2	29.7
30	31.1	—	29.4	28.8	27.7	26.1	24.3	24.1	28.0	26.5	25.1	28.9
31	30.0	—	29.9	—	26.5	—	24.8	23.4	—	25.5	—	31.7



CWS-DH – Clean Water Services Durham WWTF Discharge [RM 9.33]

Data source: Clean Water Services

Summary

- Discharges from the Durham WWTF in 2019 were slightly lower than the median period of record discharges.
- Discharges before 1995 were lower than those after.
- Since 1995, discharges show no trend. Periods of lower and higher discharge repeatedly occur. The average discharge in July-August 1995–2019 was 25.7 cfs.

MEDIAN OF DAILY MEAN DISCHARGE — CWS-DH

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	28.9	32.8	29.4	30.7	28.2	25.4	22.3	22.0	21.5	21.5	27.0	28.1
1992	29.6	34.4	26.6	27.9	23.7	22.1	19.9	18.5	21.0	20.9	24.9	33.4
1993	33.0	26.7	30.9	39.1	31.4	24.9	24.9	24.6	23.5	24.5	21.1	27.7
1994	31.2	30.7	32.1	28.9	24.6	23.8	22.7	23.1	23.9	23.7	36.2	40.5
1995	40.3	41.7	41.3	35.6	31.5	28.2	25.9	26.1	26.0	28.8	37.4	44.4
1996	49.0	56.4	40.2	40.7	36.4	27.9	25.6	24.8	26.5	31.0	38.7	69.8
1997	60.9	36.5	51.4	34.9	30.0	30.1	26.4	25.8	28.0	30.4	34.9	33.1
1998	49.2	45.3	41.7	33.1	35.9	30.3	26.3	25.8	26.7	29.4	37.9	51.0
1999	54.7	63.1	47.4	36.9	31.1	28.5	26.7	26.8	26.2	26.8	36.7	39.8
2000	42.1	42.5	39.7	32.0	31.4	28.7	27.2	24.9	25.6	26.5	26.7	30.0
2001	28.2	28.0	28.4	28.8	25.9	25.4	24.1	24.3	24.5	25.0	30.2	42.9
2002	41.9	38.4	36.8	31.7	26.6	25.8	24.6	23.5	24.1	23.7	25.2	34.0
2003	38.2	37.1	42.5	39.3	30.9	25.5	23.5	23.8	23.6	25.2	27.2	39.0
2004	43.9	39.8	32.3	28.5	26.1	24.5	23.4	24.4	25.1	27.7	27.5	30.0
2005	30.2	27.0	25.8	33.7	34.5	28.6	24.6	23.4	23.7	28.2	34.3	40.7
2006	64.0	41.5	38.8	35.5	30.0	27.8	25.1	25.2	25.3	24.6	46.2	47.8
2007	38.7	36.1	37.0	34.3	28.6	25.8	24.4	25.5	24.1	27.4	29.8	48.6
2008	48.4	35.9	41.8	37.9	30.8	28.8	28.0	26.8	25.2	27.1	31.0	30.0
2009	37.3	33.1	36.8	34.2	33.0	29.8	28.3	28.5	29.0	29.5	38.3	35.3
2010	52.4	41.2	39.4	41.8	35.7	40.9	30.8	29.2	30.2	30.5	41.1	57.9
2011	46.4	40.2	54.3	44.9	33.7	29.9	27.2	28.0	28.2	26.3	30.6	30.2
2012	39.6	36.2	48.1	38.6	33.1	30.3	28.6	27.7	28.2	33.1	44.4	66.5
2013	39.0	36.5	35.4	35.1	31.9	32.7	28.5	25.7	29.2	28.2	30.9	29.2
2014	31.2	43.9	42.9	38.3	31.1	27.7	26.7	25.3	25.2	28.2	31.3	39.4
2015	32.2	37.3	34.5	31.7	26.9	25.4	24.0	24.3	25.7	26.0	31.3	61.4
2016	52.6	43.6	45.9	31.7	29.4	27.4	25.5	25.1	26.1	40.8	38.5	42.9
2017	40.8	64.4	52.3	41.0	34.5	30.2	26.6	26.1	27.1	28.0	39.0	36.0
2018	45.6	37.7	36.7	36.7	28.8	26.5	25.1	24.1	25.4	25.5	26.5	33.4
2019	32.8	37.4	31.4	34.3	28.3	26.1	24.8	24.4	27.6	26.8	25.9	30.8
median	40.3	37.4	38.8	34.9	30.9	27.8	25.5	25.1	25.6	27.1	31.3	39.0

Key

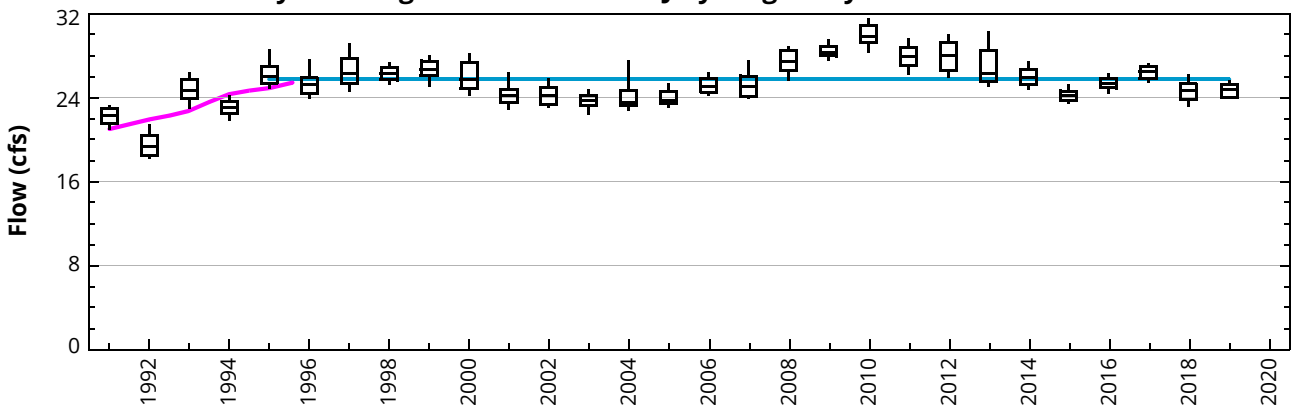
Q in cfs

- 0 < Q ≤ 24.1
- 24,1 < Q ≤ 26.1
- 26.1 < Q ≤ 29.9
- 29.9 < Q ≤ 48.1
- Q > 48.1

Q as percentile

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

Daily Discharge Distributions for July–August by Year — CWS-DH



Clean Water Services Tributary Flow Augmentation

Summary

- Since 2011, Clean Water Services has partnered with TVID to use the TVID pipeline to deliver flow augmentation water to selected tributaries that have conveniently located TVID release points. (A pilot program started at McKay Creek in 2005.)
- Typical rates of tributary flow augmentation range from 0.5 cfs to 2 cfs.
- Tributary flow augmentation usually begins sometime in July and ends sometime in October.

2019 RELEASES FOR TRIBUTARY FLOW AUGMENTATION

Site Name	River Mile	Start Date	End Date	Average Flow (cfs)	Average Daily Release (ac-ft)	Total Release (ac-ft)
McKay Creek	7.0			2.17	4.30	361
East Fork Dairy Creek	4.9	same start/end for all sites		0.68	1.34	113
West Fork Dairy Creek	5.2	7/23/2019	10/14/2019	0.79	1.57	132
Gales Creek	5.0			1.80	3.57	300

HISTORY OF TRIBUTARY FLOW RESTORATION

Year	Dates	McKay Creek #1 (RM 7.0)		EF Dairy Creek #2 (RM 4.9)		WF Dairy Creek #3 (RM 5.2)		Gales Creek #4 (RM 5.0)	
		mean cfs	total ac-ft	mean cfs	total ac-ft	mean cfs	total ac-ft	mean cfs	total ac-ft
2011	7/11 – 9/30	0.4	67	0.6	96	0.4	72	1.5	240
2012	7/20 – 10/16	2.2	388	0.7	118	0.8	146	na	177
2013	7/9 – 9/1	3.0	444	0.9	125	0.8	118	2.0	287
2014	7/11 – 10/21	1.6	319	1.0	205	0.7	151	1.9	384
2015	6/30 – 10/30	2.1	512	1.6	395	0.7	158	1.3	315
2016	7/16 – 10/13	2.0	348	1.5	274	0.7	122	1.7	303
2017	7/7 – 10/18	1.0	202	0.5	95	1.0	193	0.5	104
2018	7/18 – 10/29	1.7	355	0.8	167	0.9	188	1.7	342
2019	7/23 – 10/14	2.2	361	0.7	113	0.8	132	1.8	300

Releases at sites that have been discontinued:
McKay Creek (RM (6.5): 2011 (118 ac-ft) 2012 (140 ac-ft)
WF Dairy Creek (RM7.5): 2011 (106 ac-ft) 2012 (175 ac-ft)
Blackjack Creek: 2013(144 ac-ft) 2014 (168 ac-ft) 2015 (234 ac-ft)

APPENDIX C
SCOGGINS DAM OPERATIONS — MONTHLY REPORTS

2019 SUMMARY

- Maximum Hagg Lake storage: 53,334 ac-ft on May 6 (full pool)
- First day of allocated releases: March 3
- Last day of allocated releases: December 11
- Days with allocated releases: 231
- Maximum daily allocated release: 217 cfs on August 4–5
- Minimum Hagg Lake storage: 16,912 ac-ft on December 6 (31.7% of full pool)

RELEASE SEASON — 2019

Details of releases for each month follow in this appendix.

	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	RELEASE SEASON
Number of days of with allocated releases											
TVID	13	20	0	20	31	31	30	27	25	0	197
CWS	0	0	5	30	31	31	30	27	30	10	194
LO	0	0	0	0	20	31	30	3	0	0	84
JWC	0	0	1	30	31	31	26	29	30	10	188
Other	0	0	0	20	31	31	23	17	15	0	137
TOTAL	**13**	**20**	**5**	**30**	**31**	**31**	**30**	**30**	**30**	**11**	**231**
Allocation releases in acre-feet											
TVID	26	91.2	0	3072	4239	53591	2315	468	145	0.0	15715
CWS	0	0.0	99	982	2333	2838	1267	1041	1121	288	9969
LO	0	0.0	0	0	119	184	179	18	0	0	500
JWC	0	0.0	105	2184	1642	2678	1246	875	1105	129	9964
Other	0	0.0	0	125	210	224	101	34	30	0	724
TOTAL	**26**	**91**	**204**	**6363**	**8543**	**11284**	**5108**	**2436**	**2400**	**417**	**36,872**

Abbreviations: TVID=Tualatin Valley Irrigation District; CWS=Clean Water Services; LO=Lake Oswego Corporation; JWC=Joint Water Commission

SCOGGINS DAM RESERVOIR OPERATIONS — JANUARY 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	GASO (cfs) [10]	DLLO (cfs) [11]	GOLF (cfs) [12]	ROOD (cfs) [13]	FRMO (cfs) [14]	WSLO (cfs) [15]	PREC (in) [16]	MAX TEMP (°F) [17]	MIN TEMP (°F) [18]	TVID (cfs) [19]	CWS (cfs) [20]	LO (cfs) [21]	JWC (cfs) [22]	OTHER (cfs) [23]
1	41	93	8	142	271.44	22613	288	145	14	159	266	401	765	1520	1790	2030	0.00	46	28	0	0	0	0	0
2	33	78	6	117	271.75	22861	248	125	14	139	230	338	654	1310	1580	1860	0.00	43	29	0	0	0	0	0
3	29	69	5	103	272.03	23086	225	113	13	126	206	296	554	1100	1350	1630	0.02	42	30	0	0	0	0	0
4	33	80	7	120	272.33	23328	242	122	15	137	234	302	522	943	1170	1440	0.30	52	42	0	0	0	0	0
5	27	67	5	99	272.58	23530	202	102	12	114	215	297	519	903	1100	1300	0.01	50	37	0	0	0	0	0
6	33	84	7	124	272.88	23774	244	123	14	137	236	293	505	823	1020	1230	0.24	49	39	0	0	0	0	0
7	31	78	6	115	273.16	24002	228	115	13	128	256	342	584	934	1110	1290	0.32	42	33	0	0	0	0	0
8	41	90	7	138	273.48	24264	262	132	13	145	239	326	554	934	1130	1350	0.42	41	35	0	0	0	0	0
9	43	97	8	148	273.85	24568	304	153	14	167	277	390	673	1080	1260	1400	0.13	46	40	0	0	0	0	0
10	69	176	17	262	274.36	24989	421	212	15	227	456	511	786	1300	1500	1590	0.74	50	40	0	0	0	0	0
11	60	156	13	229	274.92	25455	466	235	16	251	397	598	991	1540	1750	1810	0.03	53	41	0	0	0	0	0
12	50	125	11	186	275.38	25840	385	194	13	207	302	527	949	1580	1830	1960	0.00	51	36	0	0	0	0	0
13	39	99	8	146	275.75	26152	312	157	13	170	251	428	822	1470	1730	1950	0.00	53	34	0	0	0	0	0
14	32	80	6	118	276.03	26413	261	132	13	145	221	361	701	1280	1530	1780	0.00	52	32	0	0	0	0	0
15	29	71	6	106	276.32	26634	221	111	13	124	200	312	586	1080	1320	1550	0.00	47	31	0	0	0	0	0
16	26	60	5	91	276.55	26830	196	99	13	112	183	279	na	924	1140	1360	0.00	42	34	0	0	0	0	0
17	26	57	4	87	276.80	27043	213	107	13	120	180	270	463	830	1020	1240	0.23	44	35	0	0	0	0	0
18	44	95	8	147	277.16	27351	308	155	13	168	255	348	569	841	1020	1200	0.56	50	39	0	0	0	0	0
19	131	318	31	480	278.13	28188	837	422	13	435	653	659	1120	1640	1750	1910	1.32	51	40	0	0	0	0	0
20	90	200	22	312	278.98	28929	741	374	13	387	490	782	1380	2180	2480	2630	0.13	52	42	0	0	0	0	0
21	66	151	13	230	279.58	29456	527	266	13	279	375	706	1430	2320	2670	3110	0.15	45	34	0	0	0	0	0
22	55	117	10	182	280.05	29872	416	210	13	223	295	587	1250	2260	2630	3050	0.00	46	35	0	0	0	0	0
23	83	151	13	247	280.60	30361	489	247	13	260	467	586	1060	2190	2550	3070	0.45	54	41	0	0	0	0	0
24	66	130	12	208	281.11	30817	456	230	13	243	375	602	1040	2060	2410	2830	0.00	54	39	0	0	0	0	0
25	55	111	9	175	281.53	31195	378	191	14	205	305	531	925	1890	2220	2610	0.00	50	32	0	0	0	0	0
26	48	96	8	152	281.88	31511	316	159	14	173	266	449	805	1680	1980	2350	0.00	49	32	0	0	0	0	0
27	41	84	7	132	282.20	31801	290	146	14	160	238	389	701	1430	1710	2070	0.00	46	35	0	0	0	0	0
28	36	73	5	114	282.47	32046	245	124	14	138	216	340	605	1230	1480	1790	0.00	41	36	0	0	0	0	0
29	31	66	5	102	282.72	32274	228	115	14	129	199	304	527	1060	1300	1570	0.00	54	34	0	0	0	0	0
30	29	60	4	93	282.93	32466	192	97	14	111	184	274	458	918	1140	1380	0.00	54	29	0	0	0	0	0
31	26	55	4	85	283.11	32631	165	83	14	97	171	248	415	797	1010	1230	0.00	53	29	0	0	0	0	0
TOTALS																	5.05 inches							
cfs	1443	3267	280	4990	—	—	5196	420	5616	8838	13076	22913	42047	49680	57570	MAX:	54	42	0	0	0	0	0	
ac-ft	2862	6480	555	9898	—	—	10306	833	11139	17530	25936	45448	83400	98540	114190	MIN:	41	28	0	0	0	0	0	

Reservoir Storage Status on Jan-31

Comparison to fill curve:	-3.80	ft
	-3553	ac-ft
Percent of full reservoir:	61.2%	

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Jan-31

	SECO	SDMO
precip to date:	29.5″	43.8″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Jan-31

	ALLOCATION (ac-ft) USED	REMAINING
TVID	0	
CWS	0	12,615
LO	0	500
JWC	0	13,500
Other	0	

SCOGGINS DAM RESERVOIR OPERATIONS — FEBRUARY 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	25	52	4	81	283.31	32814	183	92	14	106	161	228	381	716	909	1120	0.03	52	29	0	0	0	0	0
2	24	49	4	77	283.49	32980	166	84	14	98	163	232	389	695	876	1060	0.20	47	41	0	0	0	0	0
3	22	46	4	72	283.65	33127	147	74	14	88	149	209	359	677	861	1040	0.04	52	37	0	0	0	0	0
4	22	44	3	69	283.80	33265	138	70	14	84	147	201	335	606	792	1010	0.07	43	32	0	0	0	0	0
5	20	40	3	63	283.94	33394	129	65	14	79	136	183	307	666	737	936	0.00	38	27	0	0	0	0	0
6	19	37	3	59	284.06	33505	111	56	16	72	128	170	265	617	689	869	0.00	38	23	0	0	0	0	0
7	18	35	3	56	284.17	33607	102	51	16	67	123	160	257	544	620	799	0.00	39	23	0	0	0	0	0
8	18	34	3	55	284.27	33700	93	47	16	63	119	154	243	509	580	732	0.00	39	26	0	0	0	0	0
9	19	36	3	58	284.44	33858	158	80	16	96	133	172	246	497	564	816	0.45	38	30	0	0	0	0	0
10	17	35	3	55	284.56	33969	111	56	16	72	118	162	272	574	634	787	0.29	34	22	0	0	0	0	0
11	23	44	3	70	284.71	34109	140	71	16	87	148	190	288	553	624	912	0.54	37	24	0	0	0	0	0
12	286	582	44	912	286.01	35328	1219	615	27	642	na	792	1180	1520	1490	1570	3.92	44	35	0	0	0	0	0
13	142	238	25	405	287.68	36916	1588	801	19	820	633	1590	2550	3340	3870	4180	0.73	39	34	0	0	0	0	0
14	110	187	20	317	288.53	37735	819	413	18	431	517	1070	2750	3600	4240	4740	0.13	44	36	0	0	0	0	0
15	101	172	18	291	289.26	38444	709	357	18	375	476	892	2480	4070	4720	5080	0.29	42	37	0	0	0	0	0
16	104	184	19	307	289.96	39128	684	345	18	363	462	828	2160	4180	4940	5350	0.29	45	36	0	0	0	0	0
17	88	153	14	255	290.56	39718	590	297	18	315	386	738	1860	4060	4920	5500	0.02	43	31	0	0	0	0	0
18	72	125	11	208	291.04	40198	480	242	17	259	318	633	1580	3810	4690	5380	0.00	41	27	0	0	0	0	0
19	62	109	9	180	291.45	40600	402	203	18	221	280	547	1300	3510	4340	5090	0.00	42	30	0	0	0	0	0
20	65	113	10	188	291.85	40998	398	201	18	219	297	507	1100	3230	3940	4710	0.33	44	34	0	0	0	0	0
21	57	100	8	165	292.23	41379	381	192	18	210	271	483	1040	2970	3540	4230	0.06	45	28	0	0	0	0	0
22	51	90	8	149	292.54	41690	311	157	18	175	243	415	889	2690	3130	3740	0.00	47	28	0	0	0	0	0
23	50	88	7	145	292.87	42022	332	167	19	186	243	397	819	2450	2840	3370	0.16	41	32	0	0	0	0	0
24	55	96	8	159	293.21	42366	344	173	19	192	258	392	752	2230	2570	3260	0.46	44	35	0	0	0	0	0
25	55	96	8	159	293.56	42721	355	179	19	198	249	399	764	2150	2480	2960	0.13	42	32	0	0	0	0	0
26	47	84	7	138	293.85	43016	295	149	19	168	229	381	747	2010	2310	2720	0.09	35	28	0	0	0	0	0
27	45	76	6	127	294.12	43292	276	139	19	158	216	350	677	1850	2120	2510	0.02	38	27	0	0	0	0	0
28	39	68	5	112	294.36	43537	245	124	19	143	200	323	618	1670	1910	2270	0.05	35	28	0	0	0	0	0
TOTALS																								
cfs	1656	3013	263	4932	—	—	5498	487	5985	6803	12798	26608	55994	65936	76741		**MAX:**	52	41	0	0	0	0	0
ac-ft	3285	5976	522	9783	—	—	10906	966	11872	13494	25385	52777	111064	130784	152216		**MIN:**	34	22	0	0	0	0	0

Reservoir Storage Status on Feb-28		
Comparison to fill curve:	-3.84	ft
	-4012	ac-ft
Percent of full reservoir:	81.6%	

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Feb-28		
	SECO	SDMO
precip to date:	38.8″	56.5″
snow depth:	15″	34″
water content:	4.8″	12.2″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Feb-28		
	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	0	
CWS	0	12,615
LO	0	500
JWC	0	13,500
Other	0	

SCOGGINS DAM RESERVOIR OPERATIONS — MARCH 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	GASO (cfs) [10]	DLLO (cfs) [11]	GOLF (cfs) [12]	ROOD (cfs) [13]	FRMO (cfs) [14]	WSLO (cfs) [15]	PREC (in) [16]	MAX TEMP (°F) [17]	MIN TEMP (°F) [18]	TVID (cfs) [19]	CWS (cfs) [20]	LO (cfs) [21]	JWC (cfs) [22]	OTHER (cfs) [23]
1	37	66	5	108	294.60	43783	246	124	19	143	188	305	556	1470	1690	2040	0.10	38	34	0	0	0	0	0
2	34	63	5	102	294.81	43999	216	109	18	127	179	286	517	1320	1510	1800	0.00	50	29	0	0	0	0	0
3	31	58	4	93	294.99	44184	185	93	19	112	169	265	480	1190	1360	1620	0.00	50	31	1	0	0	0	0
4	28	55	4	87	295.18	44380	196	99	18	117	160	244	429	1080	1230	1480	0.00	42	24	0	0	0	0	0
5	27	52	4	83	295.34	44546	166	84	18	102	154	264	422	977	1110	1340	0.00	43	24	0	0	0	0	0
6	26	51	4	81	295.50	44711	165	83	18	101	150	273	414	942	1060	1250	0.00	43	27	1	0	0	0	0
7	26	49	4	79	295.68	44898	187	94	18	112	146	273	398	913	1030	1230	0.28	37	34	0	0	0	0	0
8	25	46	3	74	295.85	45074	176	89	18	107	146	278	409	895	1000	1190	0.19	45	30	0	0	0	0	0
9	24	45	3	72	295.99	45220	146	74	19	93	143	278	405	898	1010	1360	0.10	41	32	1	0	0	0	0
10	23	42	3	68	296.12	45355	135	68	18	86	137	265	375	858	979	1320	0.00	48	27	0	0	0	0	0
11	22	42	3	67	296.24	45480	125	63	19	82	132	254	350	783	888	1230	0.00	52	26	0	0	0	0	0
12	29	55	4	88	296.41	45658	178	90	19	109	146	265	344	815	886	1340	0.31	54	27	1	0	0	0	0
13	28	55	4	87	296.56	45815	157	79	19	98	171	302	417	1000	1120	1420	0.00	49	30	0	0	0	0	0
14	28	53	4	85	296.71	45972	157	79	21	100	164	291	412	944	1070	1460	0.00	53	30	0	0	0	0	0
15	29	57	4	90	296.87	46140	168	85	22	107	165	289	403	877	996	1360	0.00	57	34	1	0	0	0	0
16	31	60	4	95	297.04	46318	178	90	19	109	174	293	411	846	954	1290	0.00	62	34	0	0	0	0	0
17	33	66	5	104	297.21	46497	179	90	19	109	188	304	429	840	938	1250	0.00	62	32	1	0	0	0	0
18	36	76	6	118	297.41	46708	211	106	19	125	219	330	449	849	944	1240	0.00	69	33	0	0	0	0	0
19	38	94	8	140	297.63	46940	232	117	19	136	252	363	482	862	951	1230	0.00	69	45	1	0	0	0	0
20	37	100	8	145	297.86	47184	244	123	19	142	264	381	526	881	966	1230	0.00	72	50	0	0	0	0	0
21	33	65	5	103	298.09	47428	244	123	19	142	269	381	511	902	995	1250	0.00	74	40	1	0	0	0	0
22	29	85	7	121	298.31	47662	234	118	19	137	246	347	506	866	959	1250	0.02	56	37	0	0	0	0	0
23	27	79	6	112	298.51	47875	213	107	19	126	228	315	469	830	926	1230	0.12	51	39	1	0	0	0	0
24	25	70	5	100	298.71	48088	213	107	19	126	211	288	429	775	871	1180	0.01	54	34	0	0	0	0	0
25	24	65	5	94	298.88	48270	182	92	19	111	196	256	378	715	803	1110	0.00	60	37	0	0	0	0	0
26	23	62	5	90	299.05	48452	182	92	19	111	187	240	352	668	747	1070	0.08	50	38	1	0	0	0	0
27	22	56	4	82	299.20	48613	161	81	19	100	178	229	340	647	727	1020	0.00	59	36	1	0	0	0	0
28	22	58	4	84	299.38	48806	193	97	17	114	184	239	338	671	742	1070	0.31	51	36	0	0	0	0	0
29	25	59	4	88	299.55	48989	183	92	16	108	196	247	322	656	748	1060	0.21	62	38	1	0	0	0	0
30	22	55	4	81	299.70	49151	162	82	15	97	179	228	329	599	700	1000	0.00	62	35	0	0	0	0	0
31	20	51	4	75	299.83	49291	140	71	15	86	169	207	308	546	647	933	0.00	67	36	1	0	0	0	0
TOTALS																	1.73 inches							
cfs	864	1890	142	2896	—	—	2901	574	3475	5690	8780	12910	27115	30557	39853	MAX:	74	50	13	0	0	0	0
ac-ft	1714	3749	282	5744	—	—	5754	1139	6893	11286	17415	25607	53783	60610	79048	MIN:	37	24	26	0	0	0	0

Reservoir Storage Status on Mar-31	
Comparison to fill curve:	-1.80 ft
	-1957 ac-ft
Percent of full reservoir:	92.4%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Mar-31	SECO	SDMO
precip to date:	41.2″	59.7″
snow depth:	0″	8″
water content:	0″	5.5″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Mar-31		
	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	26	
CWS	0	12,615
LO	0	500
JWC	0	13,500
Other	0	

SCOGGINS DAM RESERVOIR OPERATIONS — APRIL 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW		GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	20	48	4	72	299.97	49442	151	76	15	91	159	194	282	518	613	878	0.00	68	40	1	0	0	0	0
2	22	51	4	77	300.11	49594	152	77	16	93	158	193	276	482	576	836	0.27	62	47	1	0	0	0	0
3	21	51	4	76	300.27	49767	173	87	16	103	169	218	322	508	589	909	0.35	59	50	0	0	0	0	0
4	19	47	4	70	300.39	49897	130	66	15	81	154	197	282	538	634	884	0.01	57	43	0	0	0	0	0
5	27	59	4	90	300.56	50082	185	93	15	108	163	199	288	544	627	909	0.43	56	46	1	0	0	0	0
6	51	75	5	131	300.82	50365	283	143	16	159	214	290	452	850	915	1120	0.73	55	42	0	0	0	0	0
7	129	210	23	362	301.31	50900	535	270	16	286	506	483	668	1460	1670	2260	1.22	58	45	0	0	0	0	0
8	103	172	16	291	301.94	51592	692	349	16	365	499	723	1070	2190	2650	3060	0.50	54	47	1	0	0	0	0
9	88	154	13	255	302.21	51890	298	150	165	315	458	857	1180	2310	2870	3450	0.03	59	43	0	0	0	0	0
10	68	122	11	201	302.20	51879	-11	-6	248	242	370	849	1240	2240	2770	3310	0.00	55	41	0	0	0	0	0
11	72	120	10	202	302.13	51802	-77	-39	248	209	404	811	1220	2160	2640	3140	0.08	53	45	1	0	0	0	0
12	61	105	9	175	302.22	51901	99	50	151	201	400	766	1160	2050	2510	2950	0.01	54	42	0	0	0	0	0
13	55	89	7	151	302.36	52056	155	78	97	175	314	657	1030	1910	2330	2750	0.01	59	38	1	0	0	0	0
14	49	83	7	139	302.46	52166	110	55	98	153	280	591	888	1730	2100	2540	0.11	50	39	0	0	0	0	0
15	44	72	5	121	302.56	52277	111	56	98	154	249	528	795	1550	1870	2300	0.03	51	38	1	0	0	0	0
16	40	65	5	110	302.62	52343	66	33	97	130	231	480	712	1440	1710	2120	0.11	49	42	0	0	0	0	0
17	36	61	5	102	302.66	52388	45	23	97	120	210	456	642	1300	1540	1940	0.05	57	45	1	0	0	0	0
18	33	55	4	92	302.77	52510	122	62	50	112	194	368	537	1150	1360	1750	0.00	65	45	1	0	0	0	0
19	30	51	4	85	302.86	52610	100	50	50	100	178	332	489	1010	1170	1560	0.01	74	50	2	0	0	0	0
20	31	58	4	93	302.96	52721	111	56	50	106	185	332	488	1010	1140	1510	0.26	58	47	2	0	0	0	0
21	27	52	4	83	303.00	52765	44	22	51	73	165	292	428	958	1110	1460	0.00	63	39	0	0	0	0	0
22	26	49	4	79	303.05	52821	56	28	50	78	154	271	385	831	958	1340	0.00	62	39	1	0	0	0	0
23	25	47	4	76	303.12	52899	78	39	50	89	146	261	382	761	869	1210	0.00	63	44	3	0	0	0	0
24	24	44	3	71	303.11	52888	-11	-6	50	44	138	239	350	723	824	1130	0.00	65	36	2	0	0	0	0
25	23	42	3	68	303.20	52988	100	50	28	78	130	194	301	644	746	1070	0.00	66	40	2	0	0	0	0
26	22	39	3	64	303.27	53066	78	39	28	67	124	183	273	586	686	990	0.00	74	42	4	0	0	0	0
27	21	37	3	61	303.32	53122	56	28	28	56	117	173	273	537	637	921	0.00	66	40	4	0	0	0	0
28	20	37	3	60	303.35	53155	33	17	28	45	112	163	246	502	602	854	0.00	55	32	5	0	0	0	0
29	20	34	3	57	303.41	53222	67	34	28	62	108	158	231	433	563	813	0.00	64	41	4	0	0	0	0
30	19	33	3	55	303.45	53267	45	23	28	51	104	151	220	411	533	662	0.00	66	38	8	0	0	0	0
TOTALS																	4.21 inches							
cfs	1226	2162	181	3569	—	—	2005	1943	3948		6793	11609	17110	33336	39812	50626	**MAX:**	74	50	46	0	0	0	0
ac-ft	2432	4288	359	7079	—	—	3976	3854	7830		13474	23026	33938	66122	78967	100417	**MIN:**	49	32	91	0	0	0	0

Reservoir Storage Status on Apr-30	
Comparison to fill curve:	-0.01 ft
	-11.56 ac-ft
Percent of full reservoir:	99.9%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Apr-30	SECO	SDMO
precip to date:	46.8″	67.3″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Apr-30		
	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	117	
CWS	0	12,615
LO	0	500
JWC	0	13,500
Other	0	

SCOGGINS DAM RESERVOIR OPERATIONS — MAY 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	COMP INFLOW (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PREC (in) [17]	MAX TEMP (°F) [18]	MIN TEMP (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	JWC (cfs) [23]	OTHER (cfs) [24]
1	18	31	3	52	303.48	53300	33	17	28	45	102	149	216	390	471	630	0.00	68	34	0	0	0	0	0
2	18	31	3	52	303.47	53289	-11	-6	56	50	96	169	216	355	439	610	0.00	66	35	0	0	0	0	0
3	17	30	3	50	303.48	53300	11	6	44	50	92	152	188	337	418	573	0.00	65	36	0	0	0	0	0
4	17	29	3	49	303.49	53311	11	6	44	50	88	148	183	308	384	542	0.00	69	40	0	0	0	0	0
5	16	28	3	47	303.50	53323	12	6	44	50	84	142	172	296	369	517	0.00	73	43	0	0	0	0	0
6	15	26	3	44	303.51	53334	11	6	44	50	79	135	164	295	365	507	0.00	76	45	0	0	0	0	0
7	15	25	3	43	303.48	53300	-34	-17	51	34	78	149	156	258	325	482	0.00	81	41	0	0	0	0	0
8	14	24	3	41	303.45	53267	-33	-17	51	34	62	134	123	231	299	441	0.00	78	43	0	0	0	0	0
9	14	24	3	41	303.45	53267	0	0	40	40	59	119	101	216	272	410	0.00	77	48	0	0	0	0	0
10	13	24	3	40	303.45	53267	0	0	40	40	56	115	96	180	233	380	0.00	83	45	0	0	0	0	0
11	13	22	3	38	303.44	53256	-11	-6	40	34	53	109	72	150	204	344	0.00	86	46	0	0	0	0	0
12	13	21	2	36	303.40	53211	-45	-23	40	17	51	107	74	130	175	314	0.00	82	44	0	0	0	0	0
13	12	20	2	34	303.38	53200	-11	-6	40	34	51	105	85	141	178	303	0.00	73	43	0	0	0	0	0
14	12	20	2	34	303.35	53155	-45	-23	51	28	50	115	96	141	180	303	0.08	69	49	0	10	0	0	0
15	12	21	2	35	303.33	53133	-22	-11	51	40	52	117	92	193	239	325	0.12	59	43	0	10	0	0	0
16	13	23	3	39	303.32	53122	-11	-6	44	38	58	117	111	225	271	388	0.31	60	50	0	10	0	0	0
17	12	20	2	34	303.33	53133	11	6	36	42	51	103	99	260	323	418	0.03	59	48	0	0	0	0	0
18	11	20	2	33	303.33	53133	0	0	36	36	47	94	106	212	274	427	0.05	61	50	0	0	0	0	0
19	15	32	3	50	303.41	53222	89	45	37	82	76	128	115	306	348	615	0.69	67	50	0	0	0	0	0
20	13	23	3	39	303.38	53189	-33	-17	67	50	62	148	179	440	524	630	0.06	60	45	0	0	0	0	0
21	16	34	3	53	303.44	53256	67	34	38	72	84	137	141	348	439	662	0.39	63	48	0	0	0	0	0
22	12	24	3	39	303.40	53211	-45	-23	71	48	62	156	210	353	412	568	0.00	65	44	0	0	0	0	0
23	11	21	2	34	303.39	53200	-11	-6	48	42	52	120	122	322	418	573	0.00	73	46	0	0	0	0	0
24	11	21	2	34	303.39	53200	0	0	40	40	49	112	114	229	303	507	0.00	79	50	0	0	0	0	0
25	9	20	2	31	303.35	53155	-45	-23	41	18	48	108	109	195	255	427	0.00	61	50	0	0	0	0	0
26	10	22	3	35	303.35	53155	0	0	40	40	54	115	132	261	313	464	0.26	56	45	0	0	0	0	0
27	9	20	2	31	303.33	53133	-22	-11	41	30	44	105	117	262	338	473	0.01	73	52	0	0	0	0	0
28	9	19	2	30	303.31	53110	-23	-12	41	29	42	98	95	205	278	459	0.00	71	51	0	0	0	0	0
29	8	18	2	28	303.31	53110	0	0	31	31	41	85	75	163	217	401	0.00	69	47	0	0	0	0	0
30	8	18	2	28	303.21	52999	-111	-56	67	11	39	165	132	132	179	344	0.00	77	47	0	10	0	53	0
31	8	15	1	24	303.17	52954	-45	-23	42	19	36	90	61	168	215	314	0.00	79	49	0	10	0	0	0
TOTALS																	2.00 inches							
cfs	394	726	78	1198	—	—	-158		1384	1226	1898	3846	3952	7702	9658	14351	**MAX:**	86	52	0	50	0	53	0
ac-ft	781	1440	155	2376	—	—	-313		2745	2432	3765	7629	7839	15277	19157	28465	**MIN:**	56	34	0	99	0	105	0

Reservoir Storage Status on May-31	
Comparison to fill curve:	-0.33 ft
	-369 ac-ft
Percent of full reservoir:	99.3%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on May-31	SECO	SDMO
precip to date:	49.4″	70.5″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on May-31	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	117	
CWS	99	12516
LO	0	500
JWC	105	13395
Other	0	

SCOGGINS DAM RESERVOIR OPERATIONS — JUNE 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	7	14	2	23	303.08	52854	-100	-50	78	28	33	119	82	104	149	317	0.00	83	46	0	10	0	45	0
2	7	13	2	22	302.97	52732	-122	-62	78	16	32	118	79	118	158	278	0.00	81	47	0	10	0	45	0
3	7	13	2	22	302.88	52632	-100	-50	78	28	30	115	82	146	157	278	0.00	81	44	0	10	0	45	0
4	7	12	2	21	302.72	52454	-178	-90	90	0	52	146	74	136	149	275	0.00	72	40	0	20	0	57	0
5	6	12	2	20	302.61	52332	-122	-62	90	28	52	148	79	147	201	265	0.00	77	53	0	20	0	45	0
6	7	12	2	21	302.50	52210	-122	-62	76	14	49	131	82	124	183	272	0.00	65	43	0	20	0	35	0
7	7	12	2	21	302.40	52100	-110	-55	70	15	44	120	75	126	181	258	0.00	62	45	0	20	0	30	0
8	6	12	2	20	302.31	52000	-100	-50	66	16	55	128	80	134	195	272	0.03	61	43	0	20	0	25	0
9	6	11	2	19	302.22	51901	-99	-50	66	16	53	126	72	131	194	230	0.00	67	42	0	20	0	25	0
10	6	11	2	19	302.15	51824	-77	-39	66	27	51	123	74	125	185	213	0.00	81	52	0	20	0	25	0
11	6	10	1	17	301.94	51592	-232	-117	154	37	51	194	92	114	168	221	0.00	84	66	68	20	0	45	4
12	5	10	1	16	301.68	51306	-286	-144	181	37	48	223	115	129	185	242	0.00	92	63	96	20	0	45	4
13	5	9	1	15	301.36	50955	-351	-177	198	21	57	254	126	141	198	255	0.00	95	57	99	20	0	60	4
14	5	9	1	15	301.06	50627	-328	-165	179	14	56	230	105	146	210	262	0.00	84	46	91	15	0	55	3
15	5	9	1	15	300.82	50365	-262	-132	145	13	58	193	87	129	193	268	0.00	73	45	81	10	0	35	3
16	5	9	1	15	300.61	50136	-229	-115	144	29	58	192	97	119	171	252	0.00	79	47	81	10	0	35	3
17	5	8	1	14	300.39	49897	-239	-120	144	24	57	190	98	132	185	246	0.00	81	49	82	10	0	35	3
18	5	8	1	14	300.16	49648	-249	-126	144	18	60	189	76	107	173	246	0.00	81	53	77	10	0	40	3
19	5	8	1	14	299.88	49345	-303	-153	157	4	57	201	87	98	150	224	0.00	70	45	85	10	0	45	3
20	5	8	1	14	299.60	49043	-302	-152	168	16	58	214	87	109	155	213	0.00	66	48	86	20	0	45	3
21	5	8	1	14	299.36	48785	-258	-130	152	22	56	198	102	117	170	221	0.00	65	52	85	20	0	30	3
22	5	8	1	14	299.11	48516	-269	-136	147	11	57	192	99	121	174	230	0.00	70	45	80	20	0	30	3
23	5	8	1	14	298.89	48281	-235	-118	147	29	58	196	104	119	174	233	0.00	73	46	80	20	0	30	3
24	5	8	1	14	298.65	48024	-257	-130	147	17	60	198	111	131	185	230	0.00	68	43	80	20	0	30	3
25	5	8	1	14	298.40	47757	-267	-135	155	20	57	206	100	128	184	236	0.03	71	50	73	20	0	45	3
26	5	8	1	14	298.20	47545	-212	-107	137	30	60	186	98	127	178	236	0.02	68	47	70	15	0	35	3
27	5	7	1	13	297.99	47322	-223	-112	126	14	57	172	94	133	190	252	0.00	71	50	65	15	0	30	3
28	5	9	1	15	297.83	47152	-170	-86	117	31	62	173	107	260	336	517	0.16	63	49	59	10	0	30	3
29	5	8	1	14	297.68	46993	-159	-80	104	24	58	157	108	211	318	436	0.00	71	47	55	20	0	12	3
30	4	8	1	13	297.52	46824	-169	-85	104	19	55	152	96	158	236	360	0.00	78	50	56	20	0	12	3
TOTALS																	0.24 inches							
cfs	166	290	40	496	—	—	-3091	3708	617	1591	5184	2768	4020	5685	8038	**MAX:**	95	66	1549	495	0	1101	63
ac-ft	329	575	79	984	—	—	-6130	7355	1225	3156	10282	5490	7974	11276	15943	**MIN:**	61	40	3072	982	0	2184	125

Reservoir Storage Status on Jun-30

Comparison to fill curve:	-5.98 ft
	-6499 ac-ft
Percent of full reservoir:	87.8%

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Jun-30

	SECO	SDMO
precip to date:	49.6″	70.9″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Jun-30

	ALLOCATION (ac-ft) USED	REMAINING
TVID	3189	
CWS	1081	11534
LO	0	500
JWC	2289	11211
Other	125	

SCOGGINS DAM RESERVOIR OPERATIONS — JULY 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	GASO (cfs) [10]	DLLO (cfs) [11]	GOLF (cfs) [12]	ROOD (cfs) [13]	FRMO (cfs) [14]	WSLO (cfs) [15]	PREC (in) [16]	MAX TEMP (°F) [17]	MIN TEMP (°F) [18]	TVID (cfs) [19]	CWS (cfs) [20]	LO (cfs) [21]	JWC (cfs) [22]	OTHER (cfs) [23]
1	4	7	1	12	297.36	46655	-169	-85	104	19	54	151	89	135	198	299	0.00	82	53	57	20	0	12	3
2	4	7	1	12	297.12	46402	-253	-128	147	19	54	193	100	205	263	268	0.00	76	57	69	25	0	38	3
3	4	7	1	12	296.90	46171	-231	-116	137	21	55	182	99	150	224	314	0.00	67	48	64	25	0	33	3
4	4	7	1	12	296.69	45951	-220	-111	137	26	55	182	110	135	195	282	0.00	71	50	64	30	0	28	3
5	4	7	1	12	296.47	45721	-230	-116	137	21	53	178	101	140	208	265	0.00	80	52	64	30	0	28	3
6	4	7	1	12	296.27	45512	-209	-105	122	17	52	164	94	126	194	262	0.00	75	57	57	30	0	20	3
7	4	7	1	12	296.07	45303	-209	-105	121	16	54	163	96	109	181	249	0.00	67	46	56	30	0	20	3
8	4	6	1	11	295.87	45095	-208	-105	120	15	52	162	93	123	179	242	0.00	74	50	56	30	0	20	3
9	4	6	1	11	295.69	44908	-187	-94	121	27	52	161	86	112	181	242	0.00	76	56	57	30	0	20	3
10	6	10	2	18	295.51	44722	-186	-94	132	38	61	181	102	131	192	265	0.37	71	61	51	35	0	25	3
11	4	8	1	13	295.32	44525	-197	-99	122	23	57	170	115	167	244	282	0.00	73	58	51	35	0	20	3
12	4	7	1	12	295.14	44339	-186	-94	126	32	52	169	92	140	227	303	0.00	77	56	53	35	3	20	3
13	4	6	1	11	294.91	44102	-237	-119	133	14	50	172	108	119	198	285	0.00	81	59	66	35	3	15	3
14	3	6	1	10	294.71	43896	-206	-104	133	29	50	170	97	112	193	258	0.00	79	52	67	35	3	15	3
15	4	6	1	11	294.50	43681	-215	-108	133	25	49	170	105	113	184	252	0.04	83	61	66	35	3	15	3
16	4	7	1	12	294.28	43455	-226	-114	133	19	53	173	98	110	188	249	0.02	73	60	52	35	3	28	3
17	3	6	1	10	294.05	43220	-235	-118	132	14	50	170	92	103	177	242	0.00	78	55	53	35	3	28	3
18	4	6	1	11	293.81	42975	-245	-124	142	18	51	182	96	96	169	236	0.01	72	57	57	40	3	28	3
19	3	6	1	10	293.55	42711	-264	-133	153	20	49	190	98	98	174	227	0.01	73	46	68	45	3	23	4
20	3	5	1	9	293.25	42407	-304	-153	164	11	49	206	98	105	180	201	0.00	72	47	75	45	3	28	4
21	3	5	1	9	292.97	42123	-284	-143	164	21	46	202	96	102	179	201	0.00	85	51	75	45	3	28	4
22	3	5	1	9	292.69	41841	-282	-142	164	22	45	200	95	103	179	199	0.00	90	52	75	45	3	28	4
23	3	5	1	9	292.38	41529	-312	-157	171	14	44	206	93	96	171	190	0.00	85	51	77	45	3	33	4
24	3	5	1	9	292.04	41188	-341	-172	180	8	44	215	96	91	163	185	0.00	75	48	81	45	3	38	4
25	3	4	1	8	291.70	40849	-339	-171	185	14	44	219	98	93	166	180	0.00	79	50	89	48	3	33	4
26	2	4	1	7	291.35	40500	-349	-176	183	7	43	222	95	91	163	182	0.00	88	54	94	48	3	27	4
27	2	4	1	7	291.01	40163	-337	-170	183	13	42	221	98	90	164	182	0.00	90	57	94	48	3	27	4
28	2	4	1	7	290.65	39807	-356	-179	182	3	43	222	103	96	168	180	0.00	77	49	93	48	3	27	4
29	2	4	1	7	290.31	39472	-335	-169	183	14	42	219	110	106	174	188	0.00	82	52	94	48	3	27	4
30	2	4	1	7	289.95	39118	-354	-178	186	8	42	226	87	94	173	190	0.00	81	53	79	48	3	45	4
31	2	4	1	7	289.56	38736	-382	-193	199	6	43	246	93	78	152	180	0.00	79	52	83	48	3	51	4
TOTALS																	0.45 inches							
cfs	105	182	32	319	—	—	-4078	4629	551	1530	5887	3033	3569	5801	7280	**MAX:**	90	61	2137	1176	60	828	106
ac-ft	208	361	63	633	—	—	-8088	9182	1093	3035	11677	6016	7079	11506	14440	**MIN:**	67	46	4239	2333	119	1642	210

Reservoir Storage Status on Jul-31	
Comparison to fill curve:	-13.94 ft
	-14587 ac-ft
Percent of full reservoir:	72.6%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Jul-31	SECO	SDMO
precip to date:	50.3	72.2
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Jul-31	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	7428	
CWS	3414	9201
LO	119	381
JWC	3931	9569
Other	335	

SCOGGINS DAM RESERVOIR OPERATIONS — AUGUST 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW		GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	2	4	1	7	289.18	38366	-370	-187	194	7	42	241	103	86	159	167	0.00	85	52	89	53	3	38	4
2	2	4	1	7	288.79	37987	-379	-191	201	10	41	250	101	99	169	165	0.00	88	62	84	53	3	50	4
3	2	6	1	9	288.35	37561	-426	-215	225	10	43	279	128	97	169	180	0.00	78	59	96	53	3	60	4
4	2	4	1	7	287.91	37137	-424	-214	224	10	41	275	137	116	188	182	0.00	86	52	97	53	3	60	4
5	2	4	1	7	287.46	36706	-431	-217	224	7	40	273	126	129	204	199	0.00	91	57	97	53	3	60	4
6	2	4	1	7	287.07	36333	-373	-188	192	4	39	236	102	106	186	207	0.00	90	55	88	53	3	33	4
7	2	4	1	7	286.64	35924	-409	-206	215	9	39	265	131	92	164	190	0.00	87	54	96	53	3	38	4
8	2	4	1	7	286.23	35535	-389	-196	205	9	43	254	129	104	179	185	0.01	77	58	94	53	3	30	4
9	2	5	1	8	285.81	35139	-396	-200	205	5	45	257	137	118	187	196	0.14	70	58	107	48	3	35	4
10	2	5	1	8	285.42	34772	-367	-185	204	19	33	252	141	124	199	207	0.19	76	56	106	48	3	35	4
11	2	5	1	8	284.99	34370	-402	-203	204	1	37	254	159	145	218	218	0.18	74	54	106	48	3	35	4
12	2	5	1	8	284.58	33988	-382	-193	204	11	34	245	162	188	261	249	0.00	73	51	106	48	3	35	4
13	2	4	1	7	284.23	33663	-325	-164	173	9	34	205	122	189	246	268	0.00	82	54	87	45	3	27	4
14	2	4	1	7	283.87	33330	-333	-168	183	15	31	215	108	145	200	242	0.00	87	55	80	42	3	47	4
15	2	4	1	7	283.50	32989	-341	-172	171	-1	33	207	104	119	173	210	0.00	86	52	80	37	3	37	4
16	2	4	1	7	283.14	32658	-331	-167	176	9	33	211	104	112	163	188	0.00	82	49	84	37	3	42	4
17	2	4	1	7	282.77	32320	-338	-170	176	6	32	206	98	111	158	180	0.00	76	55	78	37	3	48	3
18	2	4	1	7	282.40	31983	-337	-170	176	6	33	207	100	111	162	177	0.00	72	54	78	37	3	48	3
19	2	4	1	7	282.04	31656	-327	-165	176	11	31	205	103	117	165	182	0.00	78	54	78	37	3	48	3
20	2	4	1	7	281.67	31321	-335	-169	171	2	32	197	90	108	162	185	0.00	80	52	76	40	3	42	3
21	2	3	1	6	281.32	31006	-315	-159	171	12	32	197	92	95	146	177	0.00	82	52	77	40	3	42	3
22	2	4	1	7	280.96	30683	-323	-163	170	7	35	202	94	106	154	172	0.02	71	47	75	40	3	42	3
23	2	4	1	7	280.60	30361	-322	-162	174	12	35	202	98	109	154	170	0.00	76	49	74	45	3	42	3
24	2	3	1	6	280.24	30040	-321	-162	173	11	34	200	87	105	158	172	0.00	84	51	74	45	3	42	3
25	2	3	1	6	279.88	29721	-319	-161	174	13	34	201	97	99	147	172	0.00	80	50	75	45	3	42	3
26	2	3	1	6	279.50	29386	-335	-169	173	4	34	200	98	110	157	172	0.00	78	48	74	45	3	42	3
27	2	3	1	6	279.10	29034	-352	-177	197	20	33	230	99	99	150	175	0.00	85	56	87	50	3	48	3
28	2	3	1	6	278.64	28631	-403	-203	209	6	32	244	108	98	150	167	0.00	95	55	98	50	3	48	4
29	2	3	1	6	278.18	28231	-400	-202	213	11	31	248	113	111	158	160	0.00	97	62	96	50	3	54	4
30	2	3	1	6	277.73	27842	-389	-196	199	3	30	234	99	117	166	170	0.00	81	64	82	50	3	54	4
31	2	3	1	6	277.30	27471	-371	-187	185	-2	56	243	105	104	156	175	0.00	77	53	83	43	3	46	4
TOTALS																	0.54 inches							
cfs	62	121	31	214	—	—	-5679	5937	258		1122	7135	3475	3569	5408	5859	**MAX:**	97	64	2702	1431	93	1350	113
ac-ft	123	240	61	424	—	—	-11265	11776	511		2225	14152	6893	7079	10727	11621	**MIN:**	70	47	5359	2838	184	2678	224

Reservoir Storage Status on Aug-31

Comparison to fill curve: -26.20 ft
-25852 ac-ft
Percent of full reservoir: 51.5%

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Aug-31

	SECO	SDMO
precip to date:	50.9	73.0
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Aug-31

	ALLOCATION (ac-ft) USED	REMAINING
TVID	12788	
CWS	6252	6363
LO	303	197
JWC	6609	6891
Other	559	

SCOGGINS DAM RESERVOIR OPERATIONS — SEPTEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	GASO (cfs) [10]	DLLO (cfs) [11]	GOLF (cfs) [12]	ROOD (cfs) [13]	FRMO (cfs) [14]	WSLO (cfs) [15]	PREC (in) [16]	MAX TEMP (°F) [17]	MIN TEMP (°F) [18]	TVID (cfs) [19]	CWS (cfs) [20]	LO (cfs) [21]	JWC (cfs) [22]	OTHER (cfs) [23]
1	2	3	1	6	276.89	27120	-351	-177	184	7	57	246	115	117	165	172	0.00	80	54	82	43	3	46	4
2	2	3	1	6	276.47	26761	-359	-181	184	3	55	245	122	124	171	180	0.00	82	52	82	43	3	46	4
3	2	3	1	6	276.07	26422	-339	-171	182	11	52	238	108	130	182	190	0.00	82	54	80	43	3	46	4
4	2	3	1	6	275.65	26067	-355	-179	180	1	53	239	104	112	168	190	0.00	83	50	81	40	3	46	4
5	2	3	1	6	275.25	25731	-336	-169	174	5	56	236	100	112	159	182	0.00	80	54	80	35	3	46	4
6	1	2	1	4	274.86	25422	-309	-156	173	17	55	234	99	109	161	175	0.00	91	59	82	35	3	46	4
7	2	2	1	5	274.49	25097	-325	-164	164	0	56	224	105	104	155	172	0.00	67	55	81	40	3	41	4
8	2	3	1	6	274.11	24782	-315	-159	163	4	58	227	115	123	169	177	0.01	70	58	80	40	3	41	4
9	2	5	1	8	273.77	24502	-280	-141	163	22	68	244	130	180	216	221	0.45	70	58	78	40	3	46	3
10	2	5	1	8	273.57	24337	-165	-83	125	42	88	227	179	444	434	314	0.62	67	56	56	35	3	29	2
11	2	4	1	7	273.36	24165	-172	-87	88	1	79	172	111	356	440	473	0.01	69	54	37	15	3	24	2
12	2	4	1	7	273.19	24026	-139	-70	67	-3	75	143	98	204	282	414	0.01	73	50	34	10	3	12	1
13	2	3	1	6	273.03	23896	-130	-66	72	6	67	142	101	147	205	306	0.00	79	52	35	20	3	7	1
14	2	3	1	6	272.88	23774	-122	-62	60	-2	47	113	85	134	189	239	0.00	76	56	33	10	3	7	1
15	2	4	1	7	272.76	23676	-98	-49	61	12	49	115	74	107	164	221	0.28	74	58	33	10	3	7	1
16	2	8	1	11	272.63	23570	-106	-53	60	7	58	128	102	261	302	314	0.24	60	55	28	10	3	7	1
17	2	5	1	8	272.52	23481	-89	-45	47	2	41	103	92	230	292	344	0.50	66	50	25	10	3	0	1
18	4	20	2	26	272.51	23473	-8	-4	48	44	86	157	112	474	453	473	0.77	61	52	5	10	3	15	1
19	2	9	1	12	272.42	23400	-73	-37	47	10	60	125	122	670	740	765	0.01	66	48	6	10	3	15	1
20	2	6	1	9	272.33	23328	-72	-36	42	6	44	106	98	187	424	678	0.00	70	49	11	10	3	9	0
21	2	5	1	8	272.28	23247	-81	-41	43	2	57	115	92	182	271	427	0.00	70	50	17	15	3	9	0
22	2	5	1	8	272.12	23158	-89	-45	43	-2	56	114	92	161	224	299	0.04	68	55	17	15	3	0	0
23	2	6	1	9	272.02	23078	-80	-40	43	3	60	119	94	179	233	340	0.14	65	48	16	15	3	0	0
24	2	5	1	8	271.91	22989	-89	-45	42	-3	56	115	94	168	234	289	0.00	68	50	16	15	3	0	0
25	2	4	1	7	271.76	22869	-120	-61	59	-2	55	131	87	159	210	265	0.01	74	47	9	15	3	25	0
26	2	4	1	7	271.58	22724	-145	-73	71	-2	55	143	89	156	204	242	0.00	73	49	16	15	3	30	0
27	2	4	1	7	271.48	22644	-80	-40	39	-1	54	106	82	134	185	236	0.00	69	42	11	10	3	7	1
28	2	5	1	8	271.36	22549	-95	-48	41	-7	56	108	80	109	169	224	0.03	63	42	12	10	3	7	1
29	2	5	1	8	271.24	22453	-96	-48	41	-7	58	111	82	na	184	230	0.00	57	39	12	10	3	7	1
30	2	5	1	8	271.15	22381	-72	-36	41	5	60	111	82	140	197	258	0.03	49	41	12	10	3	7	1
TOTALS																	3.15 inches							
cfs	61	146	31	238	—	—	-2566	2747	181	1771	4837	3046	5713	7582	9010	**MAX:**	91	59	1167	639	90	628	51
ac-ft	121	290	61	472	—	—	-5090	5449	359	3513	9594	6042	11332	15039	17871	**MIN:**	49	39	2315	1267	179	1246	101

Reservoir Storage Status on Sep-30	
Comparison to fill curve:	-32.35 ft
	-30,942 ac-ft
Percent of full reservoir:	42.0%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2019 on Sep-30	SECO	SDMO
precip to date:	54.6″	79.7″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Sep-30	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	15102	
CWS	7519	5096
LO	482	18
JWC	7855	5645
Other	661	

SCOGGINS DAM RESERVOIR OPERATIONS — OCTOBER 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	2	5	1	8	270.96	22230	-151	-76	59	-17	58	128	85	120	184	230	0.00	58	34	13	20	3	14	1
2	2	4	1	7	270.82	22118	-112	-56	59	3	57	126	83	124	178	218	0.00	62	35	14	20	3	14	1
3	2	4	1	7	270.69	22015	-103	-52	59	7	58	126	84	119	172	213	0.01	58	37	14	20	3	14	1
4	2	6	1	9	270.57	21920	-95	-48	58	10	65	135	93	162	204	218	0.28	54	46	19	20	0	14	1
5	2	5	1	8	270.42	21800	-120	-61	58	-3	62	131	91	145	208	239	0.08	60	43	15	20	0	14	1
6	2	5	1	8	270.30	21705	-95	-48	58	10	60	128	87	133	194	242	0.01	62	42	15	20	0	15	1
7	2	4	1	7	270.15	21587	-118	-59	58	-1	58	127	93	129	184	233	0.00	71	41	16	20	0	14	1
8	2	5	1	8	270.07	21523	-64	-32	48	16	61	119	82	125	181	221	0.06	68	44	13	20	0	6	1
9	2	5	1	8	269.96	21436	-87	-44	40	-4	65	115	83	119	176	213	0.02	55	33	11	20	0	0	1
10	2	5	1	8	269.75	21270	-166	-84	55	-29	63	127	88	117	175	210	0.00	55	32	12	25	0	9	1
11	2	4	1	7	269.64	21184	-86	-43	60	17	62	132	92	117	172	204	0.00	61	35	13	30	0	9	1
12	2	4	1	7	269.50	21074	-110	-55	60	5	62	131	92	122	175	199	0.00	65	38	13	30	0	9	1
13	2	4	1	7	269.34	20948	-126	-64	59	-5	61	129	91	117	177	201	0.00	62	39	12	30	0	9	1
14	2	4	1	7	269.18	20822	-126	-64	59	-5	60	129	92	122	178	204	0.00	62	35	12	30	0	9	1
15	2	4	1	7	269.05	20720	-102	-51	60	9	60	129	90	119	175	204	0.00	63	37	9	30	0	14	1
16	2	5	1	8	268.87	20580	-140	-71	66	-5	61	138	91	119	175	201	0.08	56	40	8	30	0	19	1
17	3	13	2	18	268.78	20509	-71	-36	67	31	93	163	105	183	237	278	0.50	55	49	3	30	0	19	1
18	4	25	3	32	268.74	20478	-31	-16	70	54	148	225	159	188	348	368	0.67	57	45	2	20	0	24	0
19	6	62	5	73	268.76	20494	16	8	54	62	128	180	196	191	426	512	0.67	56	46	0	10	0	18	0
20	4	28	3	35	268.79	20517	23	12	54	66	181	265	373	286	576	589	0.13	57	42	0	10	0	12	0
21	3	20	2	25	268.75	20486	-31	-16	54	38	133	199	243	277	606	651	0.06	57	47	2	10	0	12	0
22	4	25	3	32	268.69	20439	-47	-24	32	8	109	134	167	190	454	605	0.09	65	51	0	0	0	0	0
23	3	20	2	25	268.71	20455	16	8	47	55	134	188	224	188	371	478	0.00	65	36	6	0	0	16	0
24	3	16	2	21	268.61	20377	-78	-39	46	7	105	156	168	188	368	414	0.00	62	38	4	0	0	21	0
25	3	13	2	18	268.52	20307	-70	-35	40	5	88	132	128	199	306	380	0.01	69	40	1	0	0	21	0
26	4	14	2	20	268.44	20245	-62	-31	50	19	84	139	127	166	256	325	0.05	66	35	0	10	0	21	0
27	4	12	2	18	268.33	20159	-86	-43	50	7	78	134	128	158	240	282	0.00	56	31	1	10	0	21	0
28	4	11	2	17	268.22	20074	-85	-43	50	7	73	128	121	158	235	265	0.00	56	29	2	10	0	21	0
29	4	10	1	15	268.14	20012	-62	-31	43	12	72	117	107	149	220	258	0.00	57	30	4	10	0	14	0
30	4	10	1	15	268.02	19919	-93	-47	45	-2	67	117	100	138	208	249	0.00	47	30	1	10	0	19	0
31	4	10	1	15	267.90	19826	-93	-47	45	-2	67	117	98	129	194	233	0.00	54	26	1	10	0	19	0
TOTALS																	2.72 inches							
cfs	89	362	49	500	—	—	-1288	1663	375	2533	4444	3861	4797	7953	9337	**MAX:**	71	51	236	525	9	441	17
ac-ft	177	718	97	992	—	—	-2555	3299	744	5024	8815	7658	9515	15775	18520	**MIN:**	47	26	468	1041	18	875	34

Reservoir Storage Status on Oct-31	
Comparison to fill curve:	-35.60 ft
	-33,497 ac-ft
Percent of full reservoir:	37.2%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2020 on Oct-31	SECO	SDMO
precip to date:	4.5″	7.5″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Oct-31	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	15570	
CWS	8561	4054
LO	500	0
JWC	8730	4770
Other	694	

SCOGGINS DAM RESERVOIR OPERATIONS — NOVEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOTAL INFLOW (cfs) [4]	W.S. ELEV (ft) [5]	STORAGE CONTENT (ac-ft) [6]	CHANGE STORAGE (ac-ft) [7]	RELEASE (cfs) [8]	COMP INFLOW (cfs) [9]	GASO (cfs) [10]	DLLO (cfs) [11]	GOLF (cfs) [12]	ROOD (cfs) [13]	FRMO (cfs) [14]	WSLO (cfs) [15]	PREC (in) [16]	MAX TEMP (°F) [17]	MIN TEMP (°F) [18]	TVID (cfs) [19]	CWS (cfs) [20]	LO (cfs) [21]	JWC (cfs) [22]	OTHER (cfs) [23]
1	4	10	1	15	267.80	19749	-77	-39	45	6	67	117	96	126	185	221	0.00	54	26	1	10	0	24	1
2	4	10	1	15	267.67	19649	-100	-50	58	8	56	124	103	123	187	215	0.00	62	30	3	15	0	24	1
3	4	10	1	15	267.55	19556	-93	-47	58	11	54	122	99	121	187	215	0.00	66	31	3	15	0	24	1
4	4	9	1	14	267.41	19449	-107	-54	58	4	53	121	98	123	187	218	0.00	64	37	4	15	0	24	1
5	4	9	1	14	267.26	19333	-116	-58	58	0	38	112	100	123	184	218	0.00	56	37	4	20	0	19	1
6	4	9	1	14	267.13	19234	-99	-50	58	8	26	109	92	123	184	218	0.00	48	40	4	20	0	19	1
7	4	9	1	14	266.95	19096	-138	-70	71	1	24	119	89	127	184	215	0.00	62	39	4	20	0	32	1
8	4	8	1	13	266.82	18997	-99	-50	61	11	24	106	83	114	177	218	0.00	63	33	1	20	0	26	1
9	4	8	1	13	266.68	18890	-107	-54	61	7	24	107	89	112	164	213	0.00	61	36	3	25	0	19	1
10	4	9	1	14	266.53	18776	-114	-57	61	4	24	107	90	124	172	210	0.08	50	43	2	25	0	19	1
11	4	9	1	14	266.40	18677	-99	-50	61	11	23	106	90	133	181	215	0.00	55	47	2	25	0	19	1
12	4	9	1	14	266.27	18579	-98	-49	60	11	22	105	89	131	183	221	0.01	61	40	1	25	0	19	1
13	4	9	1	14	266.14	18480	-99	-50	64	14	23	109	87	116	184	230	0.01	52	45	5	25	0	19	1
14	4	8	1	13	265.96	18344	-136	-69	64	-5	22	107	85	134	201	227	0.00	58	41	6	25	0	19	1
15	4	9	1	14	265.82	18239	-105	-53	64	11	22	107	85	118	189	242	0.10	57	43	5	25	0	19	1
16	4	10	1	15	265.68	18133	-106	-53	58	5	28	106	88	120	190	236	0.02	55	41	4	25	0	19	0
17	4	9	1	14	265.56	18043	-90	-45	58	13	24	102	85	121	193	233	0.00	51	43	5	25	0	19	0
18	4	9	1	14	265.42	17938	-105	-53	57	4	23	101	85	120	190	236	0.01	54	49	4	25	0	14	0
19	6	27	3	36	265.32	17863	-75	-38	67	29	33	117	88	166	213	299	0.54	55	48	0	25	0	25	0
20	13	16	2	31	265.22	17788	-75	-38	67	29	53	141	165	323	438	405	0.00	55	36	0	25	0	25	0
21	8	11	2	21	265.11	17706	-82	-41	58	17	39	116	113	240	351	441	0.00	56	33	2	15	0	20	0
22	8	10	1	19	264.99	17616	-90	-45	51	6	34	103	96	172	265	364	0.00	56	29	2	15	0	15	0
23	3	9	1	13	264.85	17512	-104	-52	50	-2	32	101	87	144	222	329	0.01	53	30	2	15	0	15	0
24	3	9	1	13	264.76	17445	-67	-34	51	17	30	99	85	126	199	292	0.04	50	33	2	15	0	15	0
25	3	9	1	13	264.66	17371	-74	-37	51	14	28	97	83	126	194	278	0.05	47	38	2	15	0	15	0
26	3	11	2	16	264.58	17311	-60	-30	40	10	31	87	80	129	204	272	0.05	49	36	0	15	0	10	0
27	4	13	2	19	264.52	17267	-44	-22	40	18	40	95	91	137	216	282	0.20	42	36	1	10	0	10	0
28	4	10	1	15	264.46	17223	-44	-22	34	12	40	84	85	145	226	285	0.00	46	34	0	10	0	10	0
29	3	9	1	13	264.38	17163	-60	-30	34	4	38	82	78	134	218	289	0.00	43	30	1	10	0	10	0
30	3	9	1	13	264.32	17119	-44	-22	34	12	36	80	72	118	198	272	0.00	43	22	0	10	0	10	0
TOTALS																	1.12 inches							
cfs	133	306	36	475	—	—	-1365	1652	287	1011	3189	2756	4169	6266	7809	MAX:	66	49	73	565	0	557	15
ac-ft	264	607	71	942	—	—	-2707	3277	570	2005	6325	5467	8269	12429	15489	MIN:	42	22	145	1121	0	1105	30

Reservoir Storage Status on Nov-30	
Comparison to fill curve:	-19.18 ft
	-15,870 ac-ft
Percent of full reservoir:	32.1%

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2020 on Nov-30	SECO	SDMO
precip to date:	6.7″	10.6″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Nov-30	ALLOCATION (ac-ft)	
	USED	REMAINING
TVID	15715	
CWS	9681	2934
LO	500	0
JWC	9835	3665
Other	724	

SCOGGINS DAM RESERVOIR OPERATIONS — DECEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE					TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOTAL INFLOW	W.S. ELEV	STORAGE CONTENT	CHANGE STORAGE	RELEASE	COMP INFLOW	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PREC	MAX TEMP	MIN TEMP	TVID	CWS	LO	JWC	OTHER
	(cfs) [1]	(cfs) [2]	(cfs) [3]	(cfs) [4]	(ft) [5]	(ac-ft) [6]	(ac-ft) [7]	(cfs) [8]	(cfs) [9]	(cfs) [10]	(cfs) [11]	(cfs) [12]	(cfs) [13]	(cfs) [14]	(cfs) [15]	(cfs) [16]	(in) [17]	(°F) [18]	(°F) [19]	(cfs) [20]	(cfs) [21]	(cfs) [22]	(cfs) [23]	(cfs) [24]
1	3	9	1	13	264.27	17082	-37	-19	34	15	36	80	72	110	186	258	0.09	41	26	0	10	0	10	0
2	3	9	1	13	264.23	17052	-30	-15	34	19	37	81	75	116	190	255	0.10	40	32	0	10	0	10	0
3	3	9	1	13	264.18	17016	-36	-18	30	12	35	75	70	118	202	262	0.00	51	32	0	10	0	5	0
4	3	5	1	9	264.12	16971	-45	-23	35	12	35	80	67	113	196	265	0.00	45	32	0	10	0	10	0
5	3	6	1	10	264.07	16934	-37	-19	32	13	36	77	70	108	178	252	0.00	48	39	0	15	0	5	0
6	3	5	1	9	264.04	16912	-22	-11	32	21	34	75	75	101	178	242	0.00	52	35	0	20	0	0	0
7	6	11	2	19	264.06	16924	12	6	34	40	39	83	78	141	206	303	0.65	48	38	0	20	0	5	0
8	11	20	2	33	264.12	16971	47	24	34	58	94	137	185	311	437	532	0.31	47	39	0	20	0	5	0
9	7	13	2	22	264.12	16971	0	0	34	34	71	113	152	302	435	563	0.01	50	41	0	20	0	5	0
10	6	11	2	19	264.12	16971	0	0	25	25	52	88	114	226	359	517	0.00	49	39	0	10	0	5	0
11	10	16	2	28	264.22	17045	74	37	20	57	77	102	129	338	442	563	0.66	43	42	0	0	0	5	0
12	23	54	4	81	264.44	17208	163	82	20	102	166	171	189	410	529	716	0.59	48	43	0	0	0	0	0
13	26	64	5	95	264.73	17423	215	108	20	128	230	268	443	690	767	857	0.33	54	39	0	0	0	0	0
14	16	42	3	61	264.94	17579	156	79	20	99	161	201	394	818	929	1010	0.09	46	40	0	0	0	0	0
15	12	28	3	43	265.08	17684	105	53	20	73	112	147	275	624	788	1020	0.02	43	34	0	0	0	0	0
16	9	22	3	34	265.18	17758	74	37	20	57	85	118	205	454	606	839	0.00	40	36	0	0	0	0	0
17	8	18	2	28	265.25	17811	53	27	20	47	65	99	155	363	501	683	0.00	47	32	0	0	0	0	0
18	7	16	2	25	265.31	17856	45	23	20	43	57	91	158	270	405	573	0.00	44	31	0	0	0	0	0
19	8	2	2	12	265.39	17916	60	30	20	50	59	90	147	257	376	522	0.20	42	32	0	0	0	0	0
20	109	232	25	366	266.02	18390	474	239	21	260	567	425	597	653	718	816	1.33	58	43	0	0	0	0	0
21	274	639	47	960	267.86	19795	1405	708	21	729	na	791	1440	2060	2040	1800	1.97	54	46	0	0	0	0	0
22	121	262	28	411	269.18	20822	1027	518	21	539	564	998	1890	2730	2920	3280	0.33	47	41	0	0	0	0	0
23	64	146	13	223	269.86	21357	535	270	21	291	337	796	1930	2790	3050	3490	0.17	47	37	0	0	0	0	0
24	39	96	8	143	270.30	21705	348	175	21	196	236	587	1510	2750	3000	3370	0.00	41	35	0	0	0	0	0
25	30	73	6	109	270.63	21967	262	132	21	153	197	424	1110	2620	2870	3240	0.16	39	36	0	0	0	0	0
26	23	56	4	83	270.88	22166	199	100	21	121	165	328	726	2310	2570	2990	0.00	42	31	0	0	0	0	0
27	20	47	4	71	271.09	22333	167	84	21	105	148	269	556	1750	2000	2500	0.06	44	32	0	0	0	0	0
28	18	40	3	61	271.27	22477	144	73	21	94	132	231	443	1220	1430	1850	0.03	41	37	0	0	0	0	0
29	16	36	3	55	271.42	22597	120	61	21	82	120	201	375	924	1110	1400	0.02	44	40	0	0	0	0	0
30	16	31	3	50	271.58	22724	127	64	21	85	116	187	341	775	942	1160	0.06	45	38	0	0	0	0	0
31	14	28	3	45	271.70	22821	97	49	21	70	108	171	297	657	826	1010	0.00	48	39	0	0	0	0	0
TOTALS																	7.18 inches							
cfs	911	2046	187	3144	—	—	2875	756	3631	4171	7584	14268	27109	31386	37138	**MAX:**	58	46	0	145	0	65	0
ac-ft	1807	4058	371	6236	—	—	5702	1500	7202	8273	15043	28301	53771	62254	73663	**MIN:**	39	26	0	288	0	129	0

Reservoir Storage Status on Dec-31

Comparison to fill curve: -11.80 ft
-10,168 ac-ft
Percent of full reservoir: 42.8%

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

SNOWTEL Summary for WY 2020 on Dec-31

	SECO	SDMO
precip to date:	17.1″	24.7″
snow depth:	0″	0″
water content:	0″	0″

The allocations (used & remaining) shown in this table are provisional.

Reservoir Delivery Status on Dec-31

	ALLOCATION (ac-ft) USED	REMAINING
TVID	15715	
CWS	9969	2646
LO	500	0
JWC	9964	3536
Other	724	

this page intentionally blank

APPENDIX D
BARNEY RESERVOIR OPERATIONS — MONTHLY REPORTS

2019 SUMMARY

- Maximum Barney Reservoir storage: 19,520 ac-ft on June 2 (97.6% of full pool)
- First day of allocated releases: June 3
- Last day of allocated releases: December 11
- Days with allocated releases: 192
- Maximum daily allocated release: 62 cfs on September 11–12
- Minimum Barney Reservoir storage: 7,500 ac-ft on December 6 and 11 (37.5% of full pool)

RELEASE SEASON — 2019

Details of releases for each month follow in this appendix.

	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	RELEASE SEASON
Number of days of with allocated releases									
JWC	0	28	31	31	30	31	30	11	192
CWS	0	0	0	2	23	31	3	0	59
ODFW (Trask)	0	28	31	31	30	31	30	10	191
TOTAL	**0**	**28**	**31**	**31**	**30**	**31**	**30**	**11**	**192**
Allocated releases in acre-feet									
JWC	0	1,765	2,152	1,722	1,745	1,319	893	367	9,963
CWS	0	0	0	56	639	861	54	0	1,609
ODFW (Trask)	0	361	504	504	488	504	474	94	2,929
TOTAL	**0**	**2,126**	**2,656**	**2,281**	**2,872**	**2,684**	**1,420**	**461**	**14,501**

Abbreviations: JWC=Joint Water Commission; CWS=Clean Water Services; ODFW=Oregon Department of Fish and Wildlife; Trask=Trask River

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JANUARY 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2	1608.2	8,400	167	0.00	28	34	2.5	0.0	0	0	0	0	0	0
3									0	0	0	0	0	0
4	1608.7	8,566	166	0.76	34	44	2.5	0.0	0	0	0	0	0	0
5									0	0	0	0	0	0
6									0	0	0	0	0	0
7	1609.6	8,866	300	1.43	31	42	2.5	0.0	0	0	0	0	0	0
8									0	0	0	0	0	0
9	1610.3	9,075	209	0.67	31	38	2.5	0.0	0	0	0	0	0	0
10									0	0	0	0	0	0
11	1611.2	9,300	225	0.99	43	45	2.5	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13									0	0	0	0	0	0
14	1611.9	9,475	175	0.02	32	41	2.5	0.0	0	0	0	0	0	0
15									0	0	0	0	0	0
16	1612.3	9,575	100	0.03	30	37	2.5	0.0	0	0	0	0	0	0
17	1612.5	9,625	50	0.29	32	42	2.5	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19									0	0	0	0	0	0
20									0	0	0	0	0	0
21	1614.6	10,200	575	3.32	30	44	3.2	0.0	0	0	0	0	0	0
22									0	0	0	0	0	0
23	1615.4	10,466	266	1.32	31	46	3.2	0.0	0	0	0	0	0	0
24									0	0	0	0	0	0
25	1616.0	10,666	200	0.03	32	42	3.2	0.0	0	0	0	0	0	0
26									0	0	0	0	0	0
27									0	0	0	0	0	0
28	1616.7	10,900	234	0.02	32	46	2.5	0.0	0	0	0	0	0	0
29									0	0	0	0	0	0
30	1617.0	11,000	100	0.00	31	42	2.5	0.0	0	0	0	0	0	0
31	1617.2	11,000	0	0.00	30	42	2.5	0.0	0	0	0	0	0	0
Monthly Totals			2,767	8.88						0		0		0
Year to Date Totals			2,767	8.88						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF FEBRUARY 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP						CWS		MUNICIPAL	
					min	max	TRASK	TUALATIN						
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2									0	0	0	0	0	0
3									0	0	0	0	0	0
4									0	0	0	0	0	0
5	1618.0	11,333	333	0.99	24	44	2.5	0.0	0	0	0	0	0	0
6	1618.1	11,366	33	0.00	22	29	2.5	0.0	0	0	0	0	0	0
7									0	0	0	0	0	0
8	1618.3	11,433	67	0.00	23	31	2.5	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10									0	0	0	0	0	0
11	1618.9	11,633	200	1.44	21	31	3.2	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13									0	0	0	0	0	0
14	1621.0	12,375	742	5.45	30	37	3.8	0.0	0	0	0	0	0	0
15	1621.4	12,525	150	0.45	30	32	3.8	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17									0	0	0	0	0	0
18									0	0	0	0	0	0
19	1622.7	13,013	488	1.00	25	42	3.2	0.0	0	0	0	0	0	0
20	1623.0	13,125	112	0.86	32	34	3.2	0.0	0	0	0	0	0	0
21									0	0	0	0	0	0
22	1623.4	13,275	150	0.05	26	34	3.2	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24									0	0	0	0	0	0
25	1624.1	13,538	263	1.05	26	34	3.2	0.0	0	0	0	0	0	0
26	1624.3	13,613	75	0.02	23	31	3.2	0.0	0	0	0	0	0	0
27	1624.5	13,688	75	0.14	21	28	3.2	0.0	0	0	0	0	0	0
28	1624.7	13,763	75	0.00	24	30	3.2	0.0	0	0	0	0	0	0
Monthly Totals			2763	11.45								0		0
Year to Date Totals			5,530	20.33								0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF MARCH 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2									0	0	0	0	0	0
3									0	0	0	0	0	0
4	1625.3	13,988	225	0.12	19	37	3.2	0.0	0	0	0	0	0	0
5									0	0	0	0	0	0
6	1625.5	14,063	75	0.06	21	34	3.2	0.0	0	0	0	0	0	0
7	1625.7	14,138	75	0.41	27	32	3.2	0.0	0	0	0	0	0	0
8	1625.8	14,175	37	0.12	27	33	3.2	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10									0	0	0	0	0	0
11	1626.1	14,288	113	0.00	25	37	2.5	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13	1626.5	14,438	150	0.98	32	40	3.2	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15	1626.9	14,588	150	0.00	30	38	3.2	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17									0	0	0	0	0	0
18	1627.5	14,813	225	0.00	32	47	3.2	0.0	0	0	0	0	0	0
19									0	0	0	0	0	0
20	1628.0	15,000	187	0.00	41	55	3.2	0.0	0	0	0	0	0	0
21									0	0	0	0	0	0
22	1628.7	15,263	263	0.03	32	58	3.2	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24									0	0	0	0	0	0
25	1629.3	15,489	226	0.12	31	45	2.5	0.0	0	0	0	0	0	0
26									0	0	0	0	0	0
27	1629.7	15,638	149	0.18	32	45	2.5	0.0	0	0	0	0	0	0
28	1629.9	15,713	75	0.39	34	43	2.5	0.0	0	0	0	0	0	0
29									0	0	0	0	0	0
30									0	0	0	0	0	0
31									0	0	0	0	0	0
Monthly Totals			1950	2.41						0		0		0
Year to Date Totals			7,480	22.74						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF APRIL 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP						CWS		MUNICIPAL	
					min	max	TRASK	TUALATIN						
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1630.5	15,938	225	0.20	35	43	2.50	0.0	0	0	0	0	0	0
2									0	0	0	0	0	0
3	1630.9	16,088	150	0.72	45	52	2.5	0.0	0	0	0	0	0	0
4	1631.0	16,125	37	0.03	41	45	2.5	0.0	0	0	0	0	0	0
5									0	0	0	0	0	0
6									0	0	0	0	0	0
7									0	0	0	0	0	0
8	1632.6	16,725	600	3.73	40	46	3.2	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10	1633.3	16,988	263	0.76	40	48	3.2	0.0	0	0	0	0	0	0
11	1633.9	17,213	225	1.41	40	43	3.8	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13									0	0	0	0	0	0
14									0	0	0	0	0	0
15	1635.1	17,663	450	0.68	33	45	3.2	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17	1635.5	17,813	150	0.29	36	45	3.2	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19	1635.8	17,925	112	0.02	42	58	3.2	0.0	0	0	0	0	0	0
20									0	0	0	0	0	0
21									0	0	0	0	0	0
22	1636.3	18,150	225	0.39	38	50	2.5	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24	1635.5	18,250	100	0.03	34	54	2.5	0.0	0	0	0	0	0	0
25	1636.7	18,350	100	0.00	40	56	2.5	0.0	0	0	0	0	0	0
26									0	0	0	0	0	0
27									0	0	0	0	0	0
28									0	0	0	0	0	0
29	1637.0	18,500	150	0.00	32	58	2.5	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
Monthly Totals			2787	8.26					0	0	0	0	0	0
Year to Date Totals			10,267	31.00						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF MAY 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL*	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1637.2	18,600	100	0.00	34	56	2.50	0.0	0	0	0	0	0	0
2	1637.3	18,650	50	0.00	38	43	2.5	0.0	0	0	0	0	0	0
3									0	0	0	0	0	0
4									0	0	0	0	0	0
5									0	0	0	0	0	0
6	1637.6	18,800	150	0.00	35	60	2.5	0.0	0	0	0	0	0	0
7									0	0	0	0	0	0
8	1637.7	18,850	50	0.00	42	66	2.5	0.0	0	0	0	0	0	0
9	1637.8	18,900	50	0.00	51	64	2.5	0.0	0	0	0	0	0	0
10									0	0	0	0	0	0
11									0	0	0	0	0	0
12									0	0	0	0	0	0
13	1638.0	19,000	100	0.00	42	70	2.5	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15	1638.1	19,040	40	0.32	41	58	2.5	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17	1638.3	19,120	80	0.32	43	50	2.5	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19									0	0	0	0	0	0
20	1638.5	19,200	80	0.99	42	56	2.5	0.0	0	0	0	0	0	0
21									0	0	0	0	0	0
22	1638.7	19,280	80	0.80	43	57	2.5	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24	1638.9	19,360	80	0.02	48	62	2.5	0.0	0	0	0	0	0	0
25									0	0	0	0	0	0
26									0	0	0	0	0	0
27	1639.0	19,400	40	0.36	40	58	2.5	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29	1639.1	19,440	40	0.00	44	58	2.5	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
31	1639.2	19,480	40	0.00	46	64	2.5	0.0	0	0	0	0	0	0
Monthly Totals			980	2.81						0		0		0
Year to Date Totals			11,247	33.81						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JUNE 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL*	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0.0	0	0	0	0
2									0	0.0	0	0	0	0
3	FIRST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE & TO TRASK RIVER FOR FISH USE													
	1639.3	19,520	40	0.00	46	67	3.2	25.1	3.2	6.3	0	0	25	50
4									3.2	6.3	0	0	25	50
5	1639.1	19,440	-80	0.00	40	59	3.2	25.1	3.2	6.3	0	0	25	50
6									3.2	6.3	0	0	25	50
7	1638.9	19,360	-80	0.15	38	51	3.2	25.1	3.2	6.3	0	0	25	50
8									3.2	6.3	0	0	25	50
9									3.2	6.3	0	0	25	50
10	1638.7	19,280	-80	0.14	42	66	6.4	25.5	6.4	13	0	0	25	50
11									6.4	13	0	0	25	50
12	1638.5	19,200	-80	0.00	61	76	6.4	35.1	6.4	13	0	0	35	69
13									6.4	13	0	0	35	69
14	1638.2	19,080	-120	0.00	47	78	6.4	35.1	6.4	13	0	0	35	69
15									6.4	13	0	0	35	69
16									6.4	13	0	0	35	69
17	1637.6	18,800	-280	0.00	47	66	8.2	35.0	8.2	16	0	0	35	69
18									8.2	16	0	0	35	69
19	1637.2	18,600	-200	0.00	48	66	8.2	35.0	8.2	16	0	0	35	69
20									8.2	16	0	0	35	69
21	1636.9	18,450	-150	0.00	45	56	8.2	35.1	8.2	16	0	0	35	69
22									8.2	16	0	0	35	69
23									8.2	16	0	0	35	69
24	1636.4	18,200	-250	0.00	42	59	8.2	35.5	8.2	16	0	0	36	69
25									8.2	16	0	0	36	69
26	1635.9	17,963	-237	0.12	43	58	8.2	35.1	8.2	16	0	0	35	69
27									8.2	16	0	0	35	69
28	1635.6	17,850	-113	0.17	46	56	8.2	35.1	8.2	16	0	0	35	69
29									8.2	16	0	0	35	69
30									8.2	16	0	0	35	69
Monthly Totals			-1,630	0.58						361		0		1,765
Year to Date Totals			9,617	34.39						361		0		1,765

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JULY 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL*	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1635.0	17,625	-225	0.00	46	66	8.2	35.1	8.2	16	0	0	35	69
2									8.2	16	0	0	35	69
3	1634.6	17,475	-150	0.00	48	58	8.2	35.1	8.2	16	0	0	35	69
4									8.2	16	0	0	35	69
5	1634.2	17,325	-150	0.00	48	64	8.2	35.0	8.2	16	0	0	35	69
6									8.2	16	0	0	35	69
7									8.2	16	0	0	35	69
8	1633.6	17,100	-225	0.00	48	58	8.2	35.0	8.2	16	0	0	35	69
9									8.2	16	0	0	35	69
10	1633.3	16,988	-112	0.43	58	66	8.2	35.3	8.2	16	0	0	35	69
11									8.2	16	0	0	35	69
12	1632.9	16,838	-150	0.05	54	59	8.2	35.1	8.2	16	0	0	35	69
13									8.2	16	0	0	35	69
14									8.2	16	0	0	35	69
15	1632.3	16,613	-225	0.20	49	67	8.2	35.4	8.2	16	0	0	35	69
16									8.2	16	0	0	35	69
17	1631.9	16,463	-150	0.03	54	63	8.2	35.4	8.2	16	0	0	35	69
18									8.2	16	0	0	35	69
19	1631.5	16,313	-150	0.11	48	58	8.2	35.4	8.2	16	0	0	35	69
20									8.2	16	0	0	35	69
21									8.2	16	0	0	35	69
22	1630.9	16,088	-225	0.00	54	67	8.2	35.3	8.2	16	0	0	35	69
23									8.2	16	0	0	35	69
24	1630.5	15,938	-150	0.00	47	67	8.2	35.3	8.2	16	0	0	35	69
25									8.2	16	0	0	35	69
26	1630.0	15,750	-188	0.00	50	74	8.2	35.0	8.2	16	0	0	35	69
27									8.2	16	0	0	35	69
28									8.2	16	0	0	35	69
29									8.2	16	0	0	35	69
30	1629.1	15,413	-337	0.01	52	73	8.2	35.4	8.2	16	0	0	35	69
31	1629.0	15,375	-38	0.00	51	64	8.2	35.3	8.2	16	0	0	35	69
Monthly Totals			-2,475	0.83						504		0		2,152
Year to Date Totals			7,142	35.22						865		0		3,917

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF AUGUST 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL*	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									8.2	16	0	0	35	69
2	1628.6	15,225	-150	0.17	51	70	8.2	35.4	8.2	16	0	0	35	69
3									8.2	16	0	0	35	69
4									8.2	16	0	0	35	69
5	1627.9	14,963	-262	0.05	54	72	8.2	35.0	8.2	16	0	0	35	69
6									8.2	16	0	0	35	69
7	1627.5	14,813	-150	0.00	53	74	8.2	35.0	8.2	16	0	0	35	69
8									8.2	16	0	0	35	69
9	1627.0	14,625	-188	0.03	55	65	8.2	25.1	8.2	16	0	0	28	56
10									8.2	16	0	0	25	50
11									8.2	16	0	0	25	50
12	1626.6	14,475	-150	0.86	50	59	8.2	25.0	8.2	16	0	0	25	50
13									8.2	16	0	0	25	50
14	1626.3	14,363	-112	0.00	54	70	8.2	25.5	8.2	16	0	0	25	50
15									8.2	16	0	0	25	50
16	1626.0	14,250	-113	0.00	50	65	8.2	25.5	8.2	16	0	0	25	50
17									8.2	16	0	0	25	50
18									8.2	16	0	0	25	50
19	1625.5	14,063	-187	0.00	52	65	8.2	25.3	8.2	16	0	0	25	50
20	1625.3	13,988	-75	0.00	54	65	8.2	25.1	8.2	16	0	0	25	50
21	1625.1	13,913	-75	0.01	51	66	8.2	25.3	8.2	16	0	0	25	50
22									8.2	16	0	0	25	50
23	1624.8	13,800	-113	0.21	46	60	8.2	25.3	8.2	16	0	0	25	50
24									8.2	16	0	0	25	50
25									8.2	16	0	0	25	50
26	1624.3	13,613	-187	0.00	50	62	8.2	25.3	8.2	16	0	0	25	50
27									8.2	16	0	0	25	50
28	1624.0	13,500	-113	0.00	54	76	8.2	25.1	8.2	16	0	0	25	50
29									8.2	16	0	0	25	50
30	FIRST DAY OF STORED WATER RELEASE FOR TUALATIN RIVER WATER QUALITY													
	1623.5	13,313	-187	0.00	58	76	8.2	44.1	8.2	16	14	28	30	60
31									8.2	16	14	28	30	60
Monthly Totals			-2,062	1.33						504		56		1,722
Year to Date Totals			5,080	36.55						1,369		56		5,639

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF SEPTEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP		TRASK	TUALATIN			CWS		MUNICIPAL*	
					min	max								
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									8.2	16	14	28	30	60
2	1622.8	13,050	-263	0.04	52	68	8.2	44.0	8.2	16	14	28	30	60
3									8.2	16	14	28	30	60
4									8.2	16	14	28	30	60
5	1621.9	12,713	-337	0.00	50	75	8.2	44.0	8.2	16	14	28	30	60
6	1621.6	12,600	-113	0.00	56	70	8.2	44.4	8.2	16	14	28	30	60
7									8.2	16	14	28	30	60
8									8.2	16	14	28	30	60
9	1620.9	12,338	-262	1.14	54	65	8.2	54.0	8.2	16	14	28	40	79
10									8.2	16	14	28	40	79
11	1620.2	12,075	-263	0.40	47	56	8.2	54.1	8.2	16	14	28	40	80
12									8.2	16	14	28	40	80
13	1619.6	11,866	-209	0.04	50	62	8.2	35.1	8.2	16	0	0	35	69
14									8.2	16	0	0	35	69
15									8.2	16	0	0	35	69
16	1619.0	11,666	-200	0.57	48	58	8.2	25.1	8.2	16	0	0	25	50
17									8.2	16	0	0	25	50
18	1618.8	11,600	-66	1.57	32	52	8.2	25.1	8.2	16	0	0	25	50
19									8.2	16	0	0	25	50
20	1618.5	11,500	-100	0.09	33	52	8.2	39.0	8.2	16	14	28	25	50
21									8.2	16	14	28	25	50
22									8.2	16	14	28	25	50
23	1617.9	11,300	-200	0.25	46	57	8.2	39.0	8.2	16	14	28	25	50
24									8.2	16	14	28	25	50
25	1617.3	11,100	-200	0.05	46	56	8.2	39.3	8.2	16	14	28	25	50
26									8.2	16	14	28	25	50
27	1616.7	10,900	-200	0.00	48	58	8.2	39.3	8.2	16	14	28	25	50
28									8.2	16	14	28	25	50
29									8.2	16	14	28	25	50
30	1616.0	10,666	-234	0.35	37	51	8.2	39.4	8.2	16	14	28	25	50
Monthly Totals			-2,647	4.50						488		639		1,745
Year to Date Totals			2,433	41.05						1,857		694		7,385

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF OCTOBER 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP						CWS		MUNICIPAL*	
					min	max	TRASK	TUALATIN						
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									8.2	16	14	28	25	50
2	1615.9	10,633	-33	0.00	34	46	8.2	39.3	8.2	16	14	28	25	50
3									8.2	16	14	28	25	50
4	1614.9	10,300	-333	0.46	40	44	8.2	39.2	8.2	16	14	28	25	50
5									8.2	16	14	28	25	50
6									8.2	16	14	28	25	50
7	1614.1	10,033	-267	0.04	40	51	8.2	39.0	8.2	16	14	28	25	50
8									8.2	16	14	28	25	50
9	1613.6	9,900	-133	0.64	32	57	8.2	39.0	8.2	16	14	28	25	50
10									8.2	16	14	28	25	50
11	1613.1	9,775	-125	0.02	34	46	8.2	39.0	8.2	16	14	28	25	50
12									8.2	16	14	28	25	50
13									8.2	16	14	28	25	50
14	1612.2	9,550	-225	0.00	36	50	8.2	39.0	8.2	16	14	28	25	50
15									8.2	16	14	28	25	50
16	1611.7	9,425	-125	0.37	40	47	8.2	39.0	8.2	16	14	28	25	50
17									8.2	16	14	28	25	50
18	1611.4	9,350	-75	1.90	38	45	8.2	39.0	8.2	16	14	28	25	50
19									8.2	16	14	28	25	50
20									8.2	16	14	28	25	50
21	1611.1	9,275	-75	2.02	40	45	8.2	29.5	8.2	16	14	28	15	30
22									8.2	16	14	28	15	30
23	1610.9	9,225	-50	0.89	42	53	8.2	29.5	8.2	16	14	28	15	30
24									8.2	16	14	28	15	30
25									8.2	16	14	28	15	30
26									8.2	16	14	28	15	30
27									8.2	16	14	28	15	30
28	1610.0	9,000	-225	0.07	31	56	8.2	29.0	8.2	16	14	28	15	30
29	1609.8	8,933	-67	0.00	34	44	8.2	29.6	8.2	16	14	28	15	30
30	1609.6	8,866	-67	0.00	30	38	8.2	29.5	8.2	16	14	28	15	30
31	1609.3	8,766	-100	0.00	31	38	8.2	29.5	8.2	16	14	28	15	30
Monthly Totals			-1,900	6.41						504		861		1,319
Year to Date Totals			533	47.46						2,362		1,555		8,704

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF NOVEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP						CWS		MUNICIPAL*	
					min	max	TRASK	TUALATIN						
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1609.1	8,700	-66	0.00	34	43	8.20	24.0	8.2	16	9	18	15	30
2									8.2	16	9	18	15	30
3									8.2	16	9	18	15	30
	LAST DAY OF STORED WATER RELEASE FOR TUALATIN RIVER WATER QUALITY													
4	1608.7	8,566	-134	0.00	39	51	8.2	15.0	8.2	16	0	0	15	30
5									8.2	16	0	0	15	30
6	1608.5	8,500	-66	0.00	38	50	8.2	15.1	8.2	16	0	0	15	30
7									8.2	16	0	0	15	30
8	1608.2	8,400	-100	0.00	38	50	8.2	15.1	8.2	16	0	0	15	30
9									8.2	16	0	0	15	30
10									8.2	16	0	0	15	30
11	1607.8	8,266	-134	0.12	42	50	8.2	15.1	8.2	16	0	0	15	30
12									8.2	16	0	0	15	30
13	1607.4	8,133	-133	0.07	42	52	8.2	15.1	8.2	16	0	0	15	30
14									8.2	16	0	0	15	30
15	1607.6	8,200	67	0.34	40	42	8.2	15.1	8.2	16	0	0	15	30
16									8.2	16	0	0	15	30
17									8.2	16	0	0	15	30
18	1607.3	8,100	-100	0.19	39	51	8.2	15.1	8.2	16	0	0	15	30
19									8.2	16	0	0	15	30
20	1607.2	8,066	-34	0.93	40	45	8.2	15.3	8.2	16	0	0	15	30
21									8.2	16	0	0	15	30
22	1607.0	8,000	-66	0.00	31	45	8.2	15.3	8.2	16	0	0	15	30
23									8.2	16	0	0	15	30
24									8.2	16	0	0	15	30
25	1606.7	7,900	-100	0.42	32	42	8.2	15.3	8.2	16	0	0	15	30
26									8.2	16	0	0	15	30
27	1606.6	7,866	-34	0.49	30	37	6.4	20.0	6.4	13	0	0	15	30
28									6.4	13	0	0	15	30
29	1606.3	7,766	-100	0.00	26	30	6.4	20.0	6.4	13	0	0	15	30
30									6.4	13	0	0	15	30
Monthly Totals			-1,000	2.56						474		54		893
Year to Date Totals			-467	50.02						2,835		1,609		9,596

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF DECEMBER 2019

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	WEATHER @ BARNEY			MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		ALLOCATED STORAGE RELEASED TO TUALATIN			
				RAIN	TEMP						CWS		MUNICIPAL	
					min	max	TRASK	TUALATIN						
	feet	ac-ft	ac-ft	in.	°F	°F	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									6.4	13	0	0	15	30
2	1606.0	7,666	-100	0.20	24	33	6.4	20.0	6.4	13	0	0	20	40
3									6.4	13	0	0	20	40
4	1605.7	7,566	-100	0.00	32	40	4.0	20.0	4.0	7.9	0	0	20	40
5									4.0	7.9	0	0	20	40
6	1605.5	7,500	-66	0.00	37	42	4.0	15.0	4.0	7.9	0	0	15	30
7									4.0	7.9	0	0	15	30
8									4.0	7.9	0	0	15	30
9	1605.6	7,533	33	1.12	37	42	4.0	15.0	4.0	7.9	0	0	15	30
10									4.0	7.9	0	0	15	30
	LAST DAY OF STORED WATER RELEASE TO TRASK RIVER FOR FISH USE													
11	1605.5	7,500	-33	0.62	39	40	0.5	15.6	0	0	0	0	16	31
	LAST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE													
12	1605.9	7,633	133	1.57	40	44	1.1	0.0	0	0	0	0	0	0
13									0	0	0	0	0	0
14									0	0	0	0	0	0
15									0	0	0	0	0	0
16	1606.8	7,933	300	1.03	32	41	0.5	0.0	0	0	0	0	0	0
17									0	0	0	0	0	0
18	1607.0	8,000	67	0.02	32	37	0.5	0.0	0	0	0	0	0	0
19	1607.2	8,066	66	0.65	33	38	0.5	0.0	0	0	0	0	0	0
20									0	0	0	0	0	0
21									0	0	0	0	0	0
22									0	0	0	0	0	0
23	1610.1	9,025	959	7.11	32	42	3.8	0.0	0	0	0	0	0	0
24									0	0	0	0	0	0
25									0	0	0	0	0	0
26	1611.8	9,450	425	0.28	30	36	0.5	0.0	0	0	0	0	0	0
27	1612.0	9,500	50	0.23	32	32	0.5	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29									0	0	0	0	0	0
30	1612.4	9,600	100	0.20	32	38	0.5	0.0	0	0	0	0	0	0
31									0	0	0	0	0	0
Monthly Totals			1,834	13.03						94		0		367
Year to Date Totals			1367	63.05						2,929		1,609		9,963

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which is one day later.

this page intentionally blank

APPENDIX E
MUNICIPAL WATER USE ALLOCATIONS — MONTHLY REPORTS

2019 SUMMARY

- 2019 was the longest release season in JWC history: 196 days
- First day of stored water delivery for municipal use: 105 acre-feet (34.3 MG) on May 30
- Last day of stored water delivery for municipal use: 15.0 acre-feet (4.89 MG) on December 12
- Mean daily used allocation of stored water: 102 acre-feet per day (33.1 MGD)
- Maximum daily used allocation of stored water: 119 acre-feet per day (31.0 MGD) on August 3–5

2019 MUNICIPAL WATER USE ALLOCATIONS

Details of releases for each month follow in this appendix.

	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	RELEASE SEASON*
Barney Reservoir (acre-feet)									
Hillsboro	574	949	513	841	677	540	574	949	4,300
Forest Grove	0	0	0	14	4	0	0	0	22
Beaverton	459	655	351	495	487	225	459	655	2,814
TVWD	663	548	868	405	171	128	663	548	2,827
TOTAL	**1,696**	**2,152**	**1,732**	**1,755**	**1,339**	**893**	**1,696**	**2152**	**9,963**
Hagg Lake (acre-feet)									
Hillsboro	67	954	820	1420	517	439	405	36	4621
Forest Grove**	4	519	283	300	354	130	214	26	1803
Beaverton	35	711	539	958	376	306	486	67	3410
TOTAL	**105**	**2,184**	**1,642**	**2,678**	**1,246**	**875**	**1,105**	**129**	**9,835**

*The Release Season total may not equal the sum of the Monthly Allocations because of round-off error.
Abbreviations: TVWD=Tualatin Valley Water District
**Releases from Hagg Lake allocated to Forest Grove may include water that was leased to TVWD. Details about allocation leases from Forest Grove to TVWD can be obtained from the JWC.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF MAY 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28	FIRST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE									
29	Barney Reservoir: June 4 Hagg Lake: May 30									
30	53.0	0	53	0.0	33.7	0.0	1.9	0.0	17.4	0.0
31	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monthly Summary (May)										
Mean daily cfs	53.0	0.0	53.0	0.0	33.7	0.0	1.9	0.0	17.4	0.0
Total ac-ft	105	0	105	0	67	0	4	0	35	0
Stored Water Use Summary to Date (May 30–May 31)										
Mean daily cfs	53.0	0.0	53.0	0.0	33.7	0.0	1.9	0.0	17.4	0.0
Total ac-ft	105	0	105	0	67	0	4	0	35	0

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF JUNE 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	45	0	45	0.0	18.1	0.0	10.7	0.0	16.2	0.0
2	45	0	45	0.0	17.4	0.0	11.1	0.0	16.5	0.0
3	45	0	45	0.0	17.9	0.0	11.0	0.0	16.0	0.0
4	82	25	57	4.5	36.1	0.0	1.3	2.4	19.6	18.0
5	70	25	45	3.8	26.8	0.0	0.7	2.4	17.4	18.8
6	60	25	35	8.0	20.9	0.0	0.8	5.1	13.3	11.9
7	55	25	30	8.7	16.6	0.0	0.8	6.7	12.7	9.6
8	50	25	25	7.8	13.3	0.0	0.4	6.6	11.3	10.6
9	50	25	25	8.6	13.4	0.0	0.6	7.0	10.9	9.4
10	50	25	25	7.9	12.0	0.0	2.0	7.2	11.0	9.9
11	70	25	45	3.9	23.2	0.0	5.2	2.8	16.6	18.2
12	70	25	45	4.0	22.7	0.0	5.3	3.0	17.0	17.9
13	95	35	60	7.7	32.4	0.0	8.2	4.6	19.4	22.6
14	90	35	55	9.5	30.6	0.0	8.1	5.0	16.2	20.5
15	70	35	35	9.1	16.1	0.0	6.6	7.0	12.3	18.9
16	70	35	35	9.0	15.9	0.0	6.5	7.1	12.6	19.0
17	70	35	35	13.6	10.9	0.0	15.4	10.9	8.7	10.5
18	75	35	40	13.6	12.6	0.0	17.2	10.9	10.1	10.5
19	80	35	45	15.0	16.3	0.0	17.4	10.4	11.3	9.6
20	80	35	45	15.1	16.1	0.0	17.7	10.5	11.2	9.4
21	65	35	30	15.6	10.3	0.0	11.9	11.8	7.8	7.6
22	65	35	30	12.7	8.3	0.0	13.6	12.2	8.0	10.1
23	65	35	30	13.3	8.8	0.0	13.2	12.0	7.9	9.7
24	65	35	30	13.2	8.9	0.0	13.1	11.9	8.0	9.8
25	80	35	45	13.3	14.1	0.0	18.7	11.5	12.2	10.2
26	70	35	35	13.0	10.3	0.0	15.3	11.8	9.3	10.2
27	65	35	30	15.1	9.9	0.0	12.2	11.9	7.8	8.0
28	65	35	30	18.0	14.1	0.0	6.8	11.8	9.2	5.2
29	47	35	12	13.4	3.8	0.0	4.6	13.0	3.6	8.6
30	47	35	12	12.2	3.3	0.0	5.1	13.6	3.6	9.2
Monthly Summary (June)										
Mean daily cfs	65.2	31.7	36.7	10.7	16.0	0.0	8.7	8.6	11.9	12.4
Total ac-ft	3,880	1,696	2,184	574	954	0.0	519	459	711	663
Stored Water Use Summary to Date (May 30–June 30)										
Mean daily cfs	64.8	27.6	37.2	9.3	16.6	0.0	8.5	7.5	12.1	10.8
Total ac-ft	3,985	1,696	2,289	574	1,021	0.0	523	458.9	745	663

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF JULY 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	47	35	12	12.5	3.3	0.0	5.2	13.6	3.5	8.9
2	73	35	38	18.8	19.0	0.0	9.3	9.5	9.7	6.7
3	68	35	33	16.6	14.5	0.0	8.6	11.3	9.9	7.1
4	63	35	28	16.9	12.0	0.0	6.9	12.9	9.2	5.2
5	63	35	28	17.7	12.6	0.0	6.5	12.4	8.8	5.0
6	55	35	20	18.2	9.5	0.0	4.1	12.0	6.3	4.8
7	55	35	20	18.1	9.0	0.0	5.0	12.1	6.0	4.9
8	55	35	20	18.0	9.1	0.0	4.8	12.1	6.1	4.9
9	55	35	20	15.8	7.8	0.0	5.6	13.2	6.6	6.0
10	60	35	25	16.3	10.5	0.0	6.5	12.5	8.0	6.2
11	55	35	20	16.8	9.4	0.0	3.7	12.4	6.9	5.8
12	55	35	20	18.1	8.5	0.0	5.8	12.2	5.7	4.7
13	50	35	15	17.2	5.9	0.0	4.6	13.0	4.5	4.8
14	50	35	15	17.2	6.2	0.0	4.1	12.9	4.7	4.8
15	50	35	15	14.7	6.5	0.0	2.6	13.2	5.9	7.1
16	63	35	28	17.5	16.4	0.0	2.4	9.8	9.2	7.7
17	63	35	28	16.9	16.5	0.0	1.8	9.9	9.7	8.3
18	63	35	28	16.8	14.6	0.0	3.5	11.3	9.9	6.9
19	58	35	23	14.5	11.3	0.0	3.2	10.9	8.5	9.6
20	63	35	28	13.1	14.8	0.0	3.0	9.0	10.2	12.9
21	63	35	28	13.2	14.8	0.0	3.0	9.1	10.2	12.7
22	63	35	28	13.2	14.8	0.0	3.1	9.0	10.1	12.9
23	68	35	33	14.1	17.3	0.0	4.9	8.8	10.8	12.1
24	73	35	38	13.7	20.6	0.0	4.9	8.4	12.6	12.9
25	68	35	33	12.9	16.6	0.0	4.9	9.0	11.6	13.0
26	62	35	27	12.8	13.1	0.0	4.2	9.4	9.7	12.8
27	62	35	27	14.1	14.5	0.0	3.6	8.7	8.9	12.2
28	62	35	27	14.3	14.8	0.0	3.3	8.6	8.9	12.1
29	62	35	27	13.8	14.4	0.0	3.3	8.9	9.3	12.3
30	80	35	45	13.2	25.6	0.0	5.5	7.2	13.9	14.6
31	86	35	51	11.7	29.5	0.0	5.0	6.5	16.5	16.8
Monthly Summary (July)										
Mean daily cfs	61.7	35.0	26.7	15.4	13.3	0.0	4.6	10.6	8.8	8.9
Total ac-ft	3,794	2,152	1,642	949	820	0	283	655	539	548
Stored Water Use Summary to Date (May 30–July 31)										
Mean daily cfs	63.3	33.4	32.0	13.2	15.0	0.0	6.6	9.7	10.4	10.5
Total ac-ft	7,779	3,848	3,931	1,524	1,841	0.0	806	1114	1,284	1,211

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF AUGUST 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	73	35	38	12.8	21.6	0.0	4.3	7.2	12.1	15.0
2	85	35	50	9.7	28.4	0.0	5.0	5.7	16.6	19.6
3	95	35	60	7.6	35.0	0.0	5.1	4.3	19.8	23.1
4	95	35	60	6.8	35.2	0.0	5.0	3.8	19.8	24.3
5	95	35	60	6.9	34.1	0.0	5.6	4.1	20.4	24.0
6	68	35	33	11.0	16.5	0.0	4.5	8.0	12.0	16.0
7	73	35	38	8.9	18.6	0.0	5.0	6.9	14.5	19.1
8	65	35	30	12.2	14.3	0.0	4.5	9.6	11.2	13.2
9	70	35	35	14.7	18.9	0.0	4.2	9.3	11.9	11.0
10	63	28	35	11.8	19.9	0.0	3.7	6.8	11.5	9.4
11	60	25	35	7.9	17.6	0.0	3.2	6.4	14.2	10.7
12	60	25	35	9.6	19.1	0.0	3.4	6.3	12.5	9.1
13	52	25	27	9.0	12.1	0.0	4.0	8.1	10.9	7.9
14	72	25	47	7.2	23.9	0.0	5.5	5.3	17.6	12.4
15	62	25	37	8.6	18.7	0.0	4.7	6.2	13.6	10.2
16	67	25	42	7.2	21.6	0.0	5.3	5.1	15.1	12.7
17	73	25	48	6.4	24.5	0.0	6.0	4.5	17.5	14.1
18	73	25	48	6.2	25.6	0.0	4.6	4.3	17.8	14.5
19	73	25	48	6.1	25.6	0.0	3.7	4.5	18.7	14.4
20	67	25	42	7.5	21.0	0.0	5.3	5.6	15.7	11.9
21	67	25	42	9.0	21.4	0.0	5.2	6.4	15.4	9.6
22	67	25	42	9.5	22.6	0.0	4.7	6.2	14.7	9.3
23	67	25	42	9.0	22.1	0.0	4.7	6.2	15.1	9.8
24	67	25	42	8.3	22.3	0.0	4.9	5.6	14.9	11.1
25	67	25	42	7.8	21.7	0.0	5.0	5.5	15.2	11.7
26	67	25	42	7.2	21.5	0.0	5.1	5.2	15.4	12.6
27	73	25	48	5.4	25.1	0.0	6.2	3.6	16.7	16.0
28	73	25	48	4.1	24.6	0.0	5.8	3.0	17.6	17.9
29	79	25	54	5.0	28.8	0.0	6.4	3.3	18.8	16.7
30	79	25	54	5.9	29.4	0.0	4.9	3.9	19.7	15.2
31	76	30	46	8.7	24.0	0.0	5.7	5.9	16.2	15.4
Monthly Summary (August)										
Mean daily cfs	71.7	28.2	43.5	8.3	23.1	0.0	4.9	5.7	15.6	14.1
Total ac-ft	4,409	1,732	2,678	513	1,420	0	300	351	958	868
Stored Water Use Summary to Date (May 30–August 31)										
Mean daily cfs	66.1	31.6	35.8	11.5	17.7	0.0	6.0	8.3	12.2	11.8
Total ac-ft	12,189	5,580	6,609	2,036	3,261	0.0	1,106	1,464	2,242	2,079

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF SEPTEMBER 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	76	30	46	5.5	24.5	0.0	4.6	3.8	16.9	20.7
2	76	30	46	13.1	18.1	0.0	16.3	8.4	11.6	8.5
3	76	30	46	12.7	17.4	0.0	16.8	8.7	11.9	8.6
4	76	30	46	13.0	17.7	0.0	16.4	8.7	11.9	8.3
5	76	30	46	5.2	23.3	0.0	5.2	3.9	17.5	20.8
6	76	30	46	6.5	25.3	0.0	5.0	4.0	15.7	19.5
7	71	30	41	7.2	21.8	0.0	4.8	4.8	14.4	18.0
8	71	30	41	6.7	22.3	0.0	3.8	4.5	14.9	18.8
9	76	30	46	6.0	25.2	0.0	4.3	4.0	16.9	20.0
10	69	40	29	19.2	12.2	0.0	10.4	10.1	6.4	10.7
11	64	40	24	19.5	10.1	0.0	8.2	11.0	5.7	9.5
12	52	40	12	20.5	4.9	0.0	4.6	10.7	2.5	8.9
13	47	40	7	21.9	2.0	0.0	4.0	11.4	1.0	6.8
14	42	35	7	20.4	2.5	0.0	3.3	9.9	1.2	4.7
15	42	35	7	20.1	2.9	0.0	2.6	10.4	1.5	4.5
16	42	35	7	21.6	0.0	0.0	5.5	11.1	1.5	2.3
17	25	25	0	10.4	0.0	2.1	0.0	8.4	0.0	4.1
18	40	25	15	16.8	2.3	0.0	8.6	8.2	4.1	0.0
19	40	25	15	16.8	3.7	0.0	7.1	8.2	4.3	0.0
20	34	25	9	15.7	1.3	0.0	5.2	9.3	2.5	0.0
21	34	25	9	15.2	1.7	0.0	4.9	9.8	2.4	0.0
22	25	25	0	12.3	0.0	1.3	0.0	9.5	0.0	1.9
23	25	25	0	12.3	0.0	1.5	0.0	9.4	0.0	1.8
24	25	25	0	12.5	0.0	1.9	0.0	9.0	0.0	1.6
25	50	25	25	15.7	7.5	0.0	9.4	9.3	8.1	0.0
26	55	25	30	16.5	11.4	0.0	9.3	8.5	9.2	0.0
27	32	25	7	15.3	0.0	0.0	5.1	9.1	1.9	0.7
28	32	25	7	16.1	0.0	0.0	5.2	8.5	1.8	0.4
29	32	25	7	16.2	0.0	0.0	5.1	8.6	1.9	0.2
30	32	25	7	13.2	2.6	0.0	2.7	8.6	1.7	3.2
Monthly Summary (September)										
Mean daily cfs	50.4	29.5	24.2	14.1	10.0	0.2	6.9	8.3	7.3	6.8
Total ac-ft	3,002	1,755	1,246	841	517	14	354	495	376	405
Stored Water Use Summary to Date (May 30–September 30)										
Mean daily cfs	62.3	31.1	33.3	12.2	16.0	0.1	6.2	8.3	11.1	10.5
Total ac-ft	15,190	7,335	7,855	2,877	3,778	13.5	1,459	1,960	2,618	2,484

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF OCTOBER 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	39	25	14	14.1	6.8	0.0	3.4	7.9	3.8	3.0
2	39	25	14	14.7	7.0	0.0	3.1	8.2	3.9	2.1
3	39	25	14	13.8	6.6	0.0	2.8	9.4	4.5	1.8
4	39	25	14	14.1	7.1	0.0	2.2	9.4	4.7	1.5
5	39	25	14	13.7	6.9	0.0	2.3	9.4	4.8	1.8
6	40	25	15	14.0	7.6	0.0	2.4	9.2	5.0	1.8
7	39	25	14	13.7	6.6	0.0	2.9	9.3	4.5	2.0
8	31	25	6	12.4	1.8	0.0	2.6	10.4	1.5	2.2
9	25	25	0	11.5	0.0	0.3	0.0	10.8	0.0	2.4
10	34	25	9	12.2	2.7	0.0	4.1	10.4	2.3	2.4
11	34	25	9	12.6	3.5	0.0	2.8	10.1	2.7	2.3
12	34	25	9	12.4	3.5	0.0	2.5	10.3	2.9	2.3
13	34	25	9	12.1	3.6	0.0	2.3	10.6	3.1	2.3
14	34	25	9	11.9	3.6	0.0	2.4	10.1	3.0	3.0
15	39	25	14	12.7	6.8	0.0	2.3	9.2	4.9	3.2
16	44	25	19	13.6	10.6	0.0	2.2	8.1	6.3	3.4
17	44	25	19	13.9	10.8	0.0	2.2	7.7	6.0	3.4
18	49	25	24	13.6	14.0	0.0	2.4	7.4	7.6	4.0
19	43	25	18	13.6	10.8	0.0	1.3	7.5	5.9	3.8
20	37	25	12	13.6	7.1	0.0	0.6	8.2	4.3	3.2
21	37	25	12	13.1	6.7	0.0	0.8	8.7	4.5	3.2
22	15	15	0	4.5	0.0	1.9	0.0	6.9	0.0	1.7
23	31	15	16	7.2	7.2	0.0	3.8	5.0	5.0	2.8
24	36	15	21	5.9	10.4	0.0	1.4	5.2	9.2	3.9
25	36	15	21	6.3	10.6	0.0	1.5	5.3	9.0	3.5
26	36	15	21	6.4	11.2	0.0	0.9	5.2	9.0	3.4
27	36	15	21	6.8	11.6	0.0	1.1	4.9	8.4	3.3
28	36	15	21	6.6	10.7	0.0	2.1	5.1	8.2	3.3
29	29	15	14	6.0	6.1	0.0	1.8	6.1	6.2	2.9
30	34	15	19	6.6	9.7	0.0	2.0	75.0	7.4	3.3
31	34	15	19	7.4	9.8	0.0	3.1	4.7	6.2	3.0
Monthly Summary (October)										
Mean daily cfs	36.0	21.8	15.2	11.0	7.6	0.1	2.3	7.9	5.3	2.8
Total ac-ft	2,213	1,339	875	677	439	4.4	130	487	306	171
Stored Water Use Summary to Date (May 30–October 31)										
Mean daily cfs	57.0	29.2	29.7	11.9	14.4	0.1	5.4	8.2	10.0	8.9
Total ac-ft	17,404	8,674	8,730	3,554	4,216	17.9	1,589	2,446	2,925	2,655

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF NOVEMBER 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	39	15	24	7.7	12.8	0.0	4.1	4.3	7.1	3.1
2	39	15	24	7.3	12.5	0.0	4.1	4.3	7.4	3.4
3	39	15	24	7.3	12.9	0.0	3.5	4.3	7.6	3.4
4	39	15	24	7.9	12.6	0.0	4.2	4.5	7.1	2.6
5	34	15	19	7.8	9.6	0.0	3.4	4.9	6.0	2.2
6	34	15	19	7.8	9.1	0.0	3.7	5.3	6.2	1.9
7	47	15	32	7.8	16.9	0.0	5.0	4.7	10.1	2.5
8	41	15	26	7.8	12.8	0.0	4.9	5.0	8.3	2.2
9	34	15	19	7.6	9.2	0.0	3.2	5.4	6.6	2.0
10	34	15	19	7.5	8.8	0.0	3.7	5.5	6.5	2.0
11	34	15	19	10.3	5.6	0.0	3.8	2.6	9.7	2.1
12	34	15	19	10.3	6.6	0.0	3.7	2.6	8.7	2.1
13	34	15	19	9.9	3.8	0.0	3.4	2.5	11.8	2.7
14	34	15	19	10.0	4.7	0.0	3.4	2.5	11.0	2.5
15	34	15	19	10.0	3.0	0.0	4.9	2.5	11.1	2.5
16	34	15	19	10.3	4.3	0.0	5.8	2.6	8.9	2.1
17	34	15	19	10.2	5.5	0.0	3.8	2.6	9.7	2.2
18	29	15	14	10.6	3.5	0.0	3.2	2.7	7.3	1.7
19	40	15	25	10.4	12.6	0.0	2.8	2.6	9.7	2.0
20	40	15	25	10.5	11.7	0.0	2.7	2.6	10.5	1.8
21	35	15	20	10.8	6.7	0.0	5.3	2.7	8.0	1.5
22	30	15	15	10.6	1.6	0.0	5.1	2.6	8.4	1.8
23	30	15	15	10.4	2.3	0.0	3.7	2.6	9.1	2.0
24	30	15	15	10.5	2.1	0.0	4.1	2.6	8.8	1.9
25	30	15	15	10.5	2.0	0.0	4.4	2.6	8.6	1.9
26	25	15	10	6.1	2.9	0.0	3.7	7.2	3.4	1.6
27	25	15	10	6.3	3.8	0.0	2.0	7.0	4.2	1.6
28	25	15	10	10.6	0.2	0.0	0.6	2.7	9.3	1.7
29	25	15	10	10.7	0.2	0.0	0.2	2.7	9.6	1.6
30	25	15	10	6.6	4.0	0.0	1.8	6.8	4.2	1.6
Monthly Summary (November)										
Mean daily cfs	33.6	15.0	18.6	9.1	6.8	0.0	3.6	3.8	8.2	2.1
Total ac-ft	1997	893	1105	540	405	0.0	214	225	486	128
Stored Water Use Summary to Date (May 30–November 28)										
Mean daily cfs	53.2	26.8	27.9	11.5	13.1	0.0	5.1	7.5	9.7	7.8
Total ac-ft	19,401	9,566	9,835	4,094	4,621	17.9	1,803	2,671	3,410	2,783

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF DECEMBER 2019

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney	Hagg Lake	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	25	15	10	10.6	0.1	0.0	1.4	2.6	8.5	1.8
2	25	15	10	6.5	4.0	0.0	1.8	6.8	4.2	1.7
3	25	20	5	10.1	1.8	0.0	1.6	8.4	1.5	1.6
4	30	20	10	14.4	0.0	0.0	2.1	3.6	7.9	2.0
5	25	20	5	10.6	1.8	0.0	1.9	7.5	1.3	1.9
6	20	20	0	8.9	0.0	1.7	0.0	7.6	0.0	1.7
7	20	15	5	6.4	1.7	0.0	1.5	6.8	1.8	1.8
8	20	15	5	6.6	1.8	0.0	1.3	6.6	1.8	1.7
9	20	15	5	6.0	1.9	0.0	1.0	6.6	2.1	2.4
10	20	15	5	5.9	2.2	0.0	0.3	6.6	2.5	2.4
11	20	15	5	7.5	2.7	0.0	0.3	5.5	2.0	2.0
12	15	15	0	10.4	0.0	0.2	0.0	3.4	0.0	1.0
13	LAST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE									
14	Barney Reservoir: December 12 Hagg Lake: December 11									
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Monthly Summary (November)										
Mean daily cfs	22.1	16.7	6.5	8.7	1.8	0.2	1.3	6.0	3.4	1.8
Total ac-ft	526	397	129	206	36	3.8	26	143	67	44
Stored Water Use Summary to Date (May 30–December 12)										
Mean daily cfs	49.1	25.4	25.1	10.5	12.0	0.0	4.6	7.3	8.5	7.6
Total ac-ft	17,930	9,071	8,859	3,760	4,252	21.7	1,615	2,590	2,992	2,699

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

this page intentionally blank

APPENDIX F
STREAM TEMPERATURE

SCOPE

This appendix shows data for stream temperature at selected sites in the Tualatin River and its tributaries. Most of the data were obtained by continuous monitoring at a resolution of 15 minutes to 1 hour. Resolution may have changed over time for an individual site. The data have been subject to quality assurance tests by the collecting entity.

The following data and analyses are included for each site. A more detailed explanation of the analyses and graphics begins on page F-4:

- Table of 2019 data with summary statistics by month.
- Graph of 2019 data superimposed on percentile statistics for the period of record for the site.
- Color-coded chart of the distribution of stream temperature by month for the period of record.
- Table of monthly median stream temperatures by year for the period of record.
- Graphs showing trends in stream temperature for selected summer months over the period of record.
- Graphs showing the number of days that the State of Oregon rearing and migration temperature standard was exceeded over the period of record and the period when that exceedance occurred. The spawning standard may apply at some sites, but data were not evaluated relative to that standard in this report.
- A brief discussion of the graphs and tables.

2019 HIGHLIGHTS

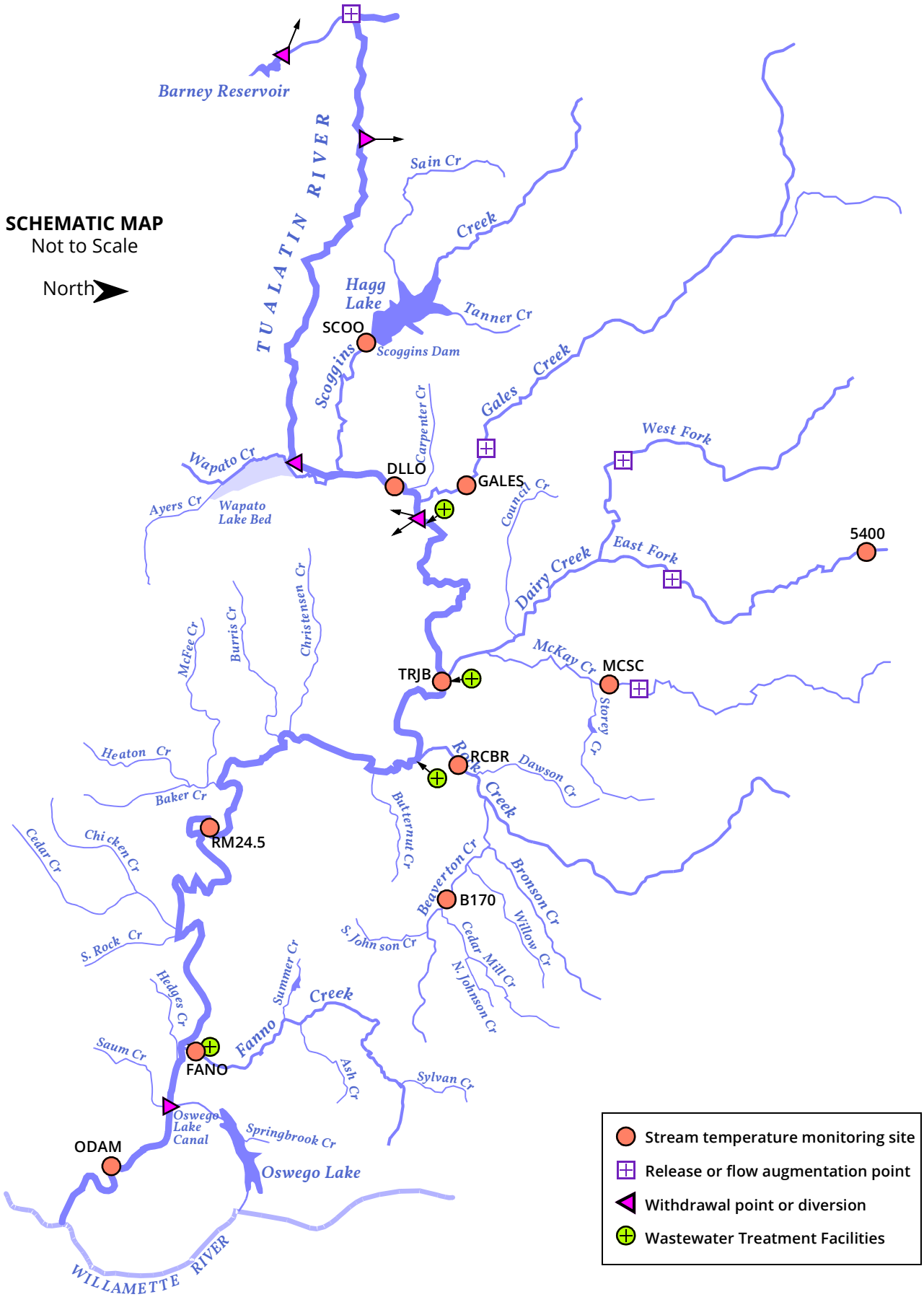
- Temperatures in 2019 were above average at most sites during periods in May, June and late-August through early-September. In many cases record highs were set for daily mean temperature during these time periods. July temperatures were close to the period of record median at most sites.
- Statistically significant increases in summer water temperatures in recent years appear to have occurred in the Tualatin River at Hwy 219 and at Oswego Dam and in Fanno Creek at Durham. The cause is unknown.

EXCEEDANCES OF OREGON REARING AND MIGRATION TEMPERATURE STANDARD

SITE	NUMBER OF DAYS		DATE RANGE OF EXCEEDANCES*		PERCENT OF YEARS WITH EXCEEDANCES
	2019	MEDIAN	2019	AVERAGE (MEAN)	
Mainstem Tualatin River and Scoggins Creek sites					
Scoggins Creek below Hagg Lake	0	9	did not occur	Sep-22 – Oct-6	44%
Tualatin River at Hwy 219 Bridge	5	13	did not occur	Jun-23 – Jul-29	73%
Tualatin River at RM 24.5	115	96	May-13 – Sep-20	Jun-7 – Sep-18	100%
Tualatin River at Oswego Dam	121	111	May-13 – Sep-22	Jun-3 – Sep-24	100%
Tributary sites					
Gales Creek at Old Hwy 47	102	87	Jun-2 – Sep-17	Jun-16– Sep-17	100%
East Fork Dairy Creek near Meacham Corner	39	36	Jun-16– Sep-8	Jul-12– Sep-1	100%
McKay Creek at Scotch Church Rd above Waible Ck	—	34	data suspended 6/11	Jul-3 – Aug-26	100%
Beaverton Creek at 170th	130	116	May-7– Sep-13	May-15 – Sep-19	100%
Rock Creek at Brookwood Ave	114	95	May-9 – Sep-17	May-28 – Sep-13	100%
Fanno Creek at Durham Road	122	107	May-8 – Sep-18	May-26 – Sep-14	100%

*Date range may include days when the standard was not exceeded (7-day average daily maximum ≤ 18 °C).

STREAM TEMPERATURE MONITORING SITES



STREAM TEMPERATURE MONITORING SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	STATION ID	PAGE
5400	East Fork Dairy Creek near Meacham Corner, OR	12.4	14205400	F-24
B170	Beaverton Creek at 170th	4.9	453004122510301	F-30
DLLO	Tualatin River near Dilley, Oregon	58.8	14203500	F-10
FANO	Fanno Creek at Durham Road near Tigard, Oregon	1.2	14206950	F-36
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	2.36	453040123065201 OWRD#: 14204530	F-21
MCSC	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	6.3	14206070	F-27
ODAM	Tualatin River at Oswego Dam near West Linn, Oregon	3.4	14207200	F-18
RCBR	Rock Creek at Brookwood Avenue, Hillsboro, Oregon	2.4	453030122560101	F-33
RM24.5	Tualatin River at RM 24.5 near Scholls, Oregon	24.5	14206694	F-15
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4.80	14202980	F-6
TRJB	Tualatin River at Hwy 219 Bridge	44.4	14206241	F-12

EXPLANATION OF FIGURES AND TABLES IN THIS APPENDIX — PAGES 1-2

Page 1–current year data and graph: A table of mean daily stream temperature for the current year is at the top of page 1. A graph at the bottom of the page shows the current year's data superimposed on shaded percentile ranges for the period of record, providing historical context. A legend, located to the right of the graph, includes the period of record for the site and definitions of lines and shading. If the period of record is too short to accurately calculate some percentiles, the appropriate shaded areas are omitted.

Page 2–Frequency chart: A Frequency Chart for the site is at the top of page 2. This graphic can be used to determine the temperature ranges for each month, the percent of the time stream temperature is within a particular range, and the importance of missing values. An example is shown below.

FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — ODAM

TEMP (°C)	0 < T < 6.0	6.0 < T ≤ 7.5	7.5 < T ≤ 9.0	9.0 < T ≤ 11	11 < T ≤ 13	13 < T ≤ 16	16 < T ≤ 18	18 < T ≤ 19	19 < T ≤ 20	20 < T ≤ 21	21 < T ≤ 22	22 < T ≤ 23	23 < T ≤ 26	Missing
JAN														
FEB														
MAR														
APR														
MAY														
JUN														
JUL														
AUG														
SEP														
OCT														
NOV														
DEC														
ALL	7.2%	10%	11%	11%	9.2%	11%	9.3%	5.7%	4.7%	5.1%	5.1%	4.3%	2.8%	3.1%

KEY	
$f \geq 3\%$	
$2\% \leq f < 3\%$	
$1\% \leq f < 2\%$	
$0.2\% \leq f < 1\%$	
$0.06\% \leq f < 0.2\%$	
$0 < f < 0.06\%$	

- *The top row* shows the ranges of stream temperatures (bins) corresponding to each column. The temperature ranges do not change from year-to-year in the Flow Report. They were determined as follows:
  - —round numbers were used for simplicity,
  - —the last bin captures the extreme high temperatures,
  - —the first half of the bins capture the low temperatures, about 5-10% of the distribution per bin,
  - —the other bins capture the higher temperatures, approximately 5% of the distribution per bin,
  - —a column for missing data is included if needed.
- *The first column* shows the months corresponding to each row.
- *The bottom row* shows the actual fraction of the distribution in the bin. Because the bins use round numbers and do not from vary year-to-year, the distribution totals will only approximate 5% and 10% as designed. The total distribution may not add to 100% due to round-off error.
- *Each cell is color coded* based on the fraction of the overall distribution of temperature in the corresponding bin and month. A Key to the color code is at the right of the chart. All sites use the same color code.
- *Information that can be obtained* from the example chart above includes:
  - —The all-time highest temperatures at this site are 23-26°C, and occurred in June, July and August.
  - —Temperature was above 18°C about 27.7% of the time.
  - —Mean daily temperature in August at this site has exceeded 18°C every day for the period of record.
  - —About 3% of the data were missing, most of which occurred in January–April, a time when temperatures would be low. Consequently, the percentages for the low temperature bins are likely too small.

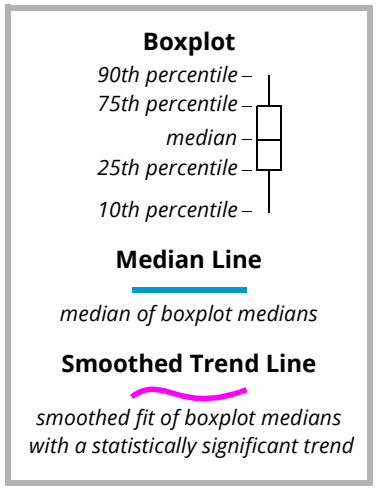
Page 2–color-coded table of monthly medians: A table of monthly medians of daily mean stream temperature by year follows the Frequency Chart on page 2. Entries in this table are color-coded by percentiles calculated from the daily mean temperature for the period of record. Two Keys are provided to the right of the table. The upper Key contains the values corresponding to the percentiles shown in the lower Key. Medians are not shown if more than 20% of the data are missing.

Explanation of Figures and Tables in this Appendix — page 3

Page 3–discussion of graphs: The left side of the page contains a discussion of findings based on the graphs for each site. The narrative is divided into three or four sections:

- *Distribution and Current year* describes stream temperatures for the current year in the context of the historical record, when the highest and lowest temperatures occur, and data shortcomings.
- *Reservoir effects* is included if stream temperature is influenced by an upstream reservoir.
- *Trends* describes any trends in stream temperature over time.
- *Oregon water temperature standard* describes the frequency and timing of exceedances of the standard.

Page 3–temperature trends: The top three graphs on the right side show changes in stream temperature over time for the warmest times of the year. Boxplots of daily mean temperature are plotted versus year for June, July/August and September. A boxplot is a graphical representation of the data distribution and is illustrated at the right.



These graphs include one or more lines that indicate trends and central tendencies of the data over time. The types of line used vary with the graph and are shown at the right,

Smoothed lines were calculated using the LOWESS method (LOcally WEighted Scatterplot Smoothing). LOWESS is a non-parametric method that fits a curve to data giving more weight to points closer to the point being fitted. LOWESS can be used to help visualize trends in data.

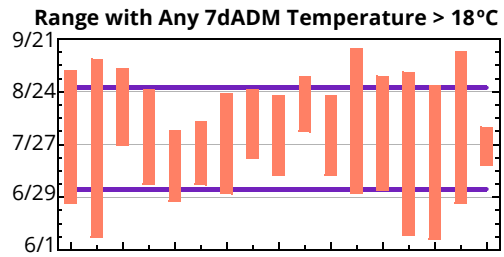
Statistically significant differences were tested using non-parametric methods (Kendall's tau). Magenta lines are used to show trends that are statistically significant. Note that a statistically significant trend may or may not indicate a meaningful environmental trend. Temperature is influenced by long-term weather patterns, such as the El Niño Southern Oscillation and the Pacific Decadal Oscillation. Especially for sites with short periods of record, an apparent trend may be statistically significant, but disappear over a longer period of record.

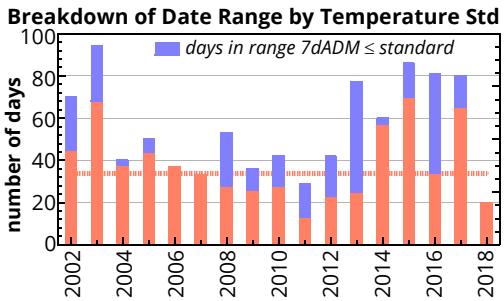
Page 3–Oregon temperature standard: The two lower graphs on page 3 assess each site with regard to the State of Oregon water-quality standard for temperature. The Oregon standard for salmonid rearing and migration applies in the Tualatin Basin. The standard is:

> The seven day average of the daily maximum temperature (7dADM) is not to exceed 18°C.

Daily maximum temperature and the 7dADM were computed for sites with data of at least hourly frequency.

Example graphs pertaining to the temperature standard are shown at the right.





The upper graph shows a bar for each year that begins on the first day of the year when the 7dADM exceeded 18°C and ends on the last day that the 7dADM exceeded 18°C. Some of the 7dADM within this date range may be less than 18°C. Purple lines, if present, show the mean date range for exceedance of the temperature standard for the period of record.

The bottom graph shows the number of days in the date range from the upper graph when the standard was exceeded (orange), and the number of days it was not (blue). Missing values, if they occurred within the date range, are shown in grey. A dotted orange line, if present, shows the median number of days that the standard is exceeded in a year.

A trend is shown in magenta as a smoothed trend line (LOWESS) if it is statistically significant.

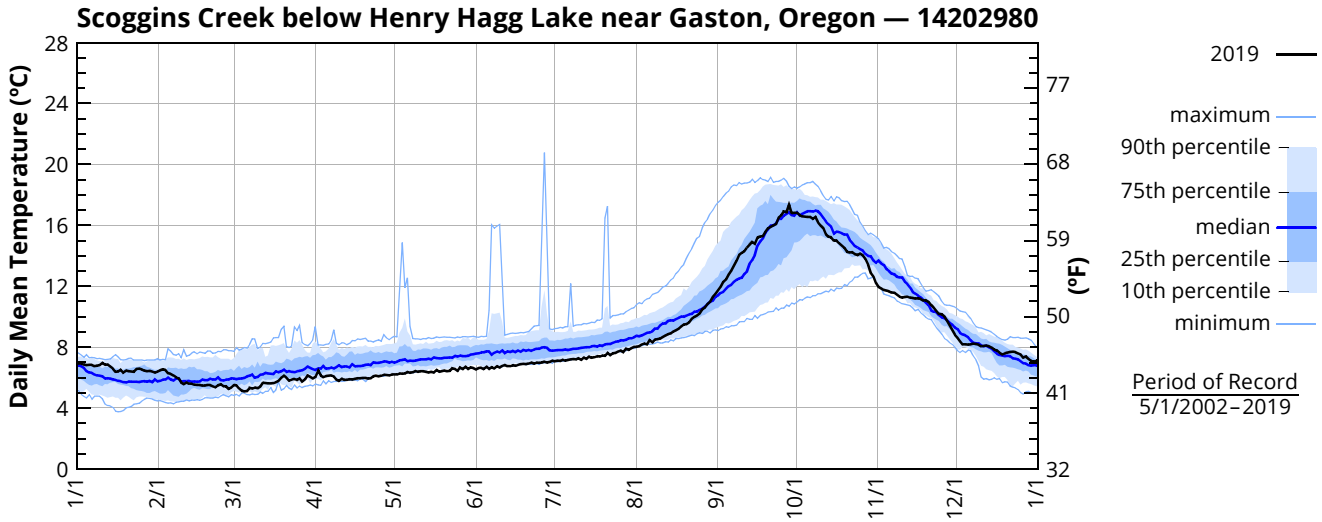
SCOO – SCOGGINS CREEK BELOW HENRY HAGG LAKE NEAR GASTON, OREGON – 14202980

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 4.80 *Latitude:* 45 28 10 *Longitude:* 123 15 61

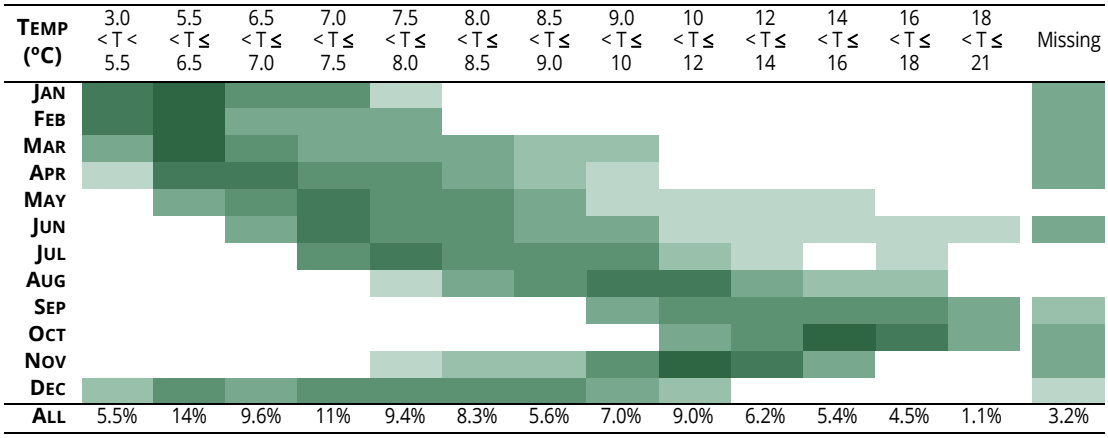
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — SCOO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	6.92	6.48	5.52	6.05	6.22	6.54	7.08	8.02	11.74	16.82	11.97	8.62
2	6.92	6.55	5.49	6.46	6.21	6.63	7.11	8.06	11.96	16.67	11.87	8.39
3	6.86	6.51	5.29	6.16	6.28	6.66	7.10	8.19	12.29	16.58	11.75	8.19
4	6.82	6.29	5.14	6.04	6.25	6.56	7.17	8.25	12.46	16.56	11.71	8.19
5	6.85	6.25	5.09	6.11	6.28	6.71	7.12	8.18	12.77	16.54	11.67	8.17
6	6.85	6.15	5.13	6.12	6.38	6.56	7.16	8.45	13.01	16.54	11.58	8.18
7	6.75	6.02	5.33	6.15	6.31	6.70	7.19	8.32	13.33	16.43	11.57	8.22
8	6.79	5.97	5.29	6.09	6.35	6.62	7.22	8.51	13.69	16.54	11.44	8.21
9	6.83	5.69	5.36	5.88	6.45	6.75	7.19	8.53	14.07	16.21	11.31	8.17
10	6.96	5.58	5.31	5.80	6.38	6.68	7.28	8.56	14.19	15.98	11.25	8.07
11	6.85	5.68	5.41	5.95	6.43	6.77	7.18	8.66	14.30	15.81	11.29	8.08
12	6.86	5.60	5.66	5.86	6.43	6.85	7.33	8.77	14.54	15.41	11.32	8.11
13	6.73	5.60	5.64	5.85	6.38	6.76	7.25	8.86	14.73	15.24	11.25	8.06
14	6.59	5.55	5.62	5.90	6.33	6.75	7.38	8.91	14.90	15.23	11.23	7.98
15	6.39	5.52	5.62	5.87	6.38	6.83	7.31	9.02	14.81	15.00	11.20	7.84
16	6.40	5.52	5.64	5.92	6.34	6.79	7.35	9.12	15.21	15.02	11.21	7.79
17	6.53	5.47	5.71	5.97	6.50	6.84	7.42	9.21	15.26	14.83	11.16	7.64
18	6.34	5.47	5.80	5.97	6.39	6.88	7.39	9.37	15.29	14.68	11.06	7.53
19	6.46	5.52	6.00	5.99	6.42	6.90	7.46	9.48	15.57	14.51	11.09	7.60
20	6.42	5.51	6.12	5.98	6.47	6.89	7.44	9.51	15.82	14.25	10.99	7.65
21	6.40	5.43	6.01	5.95	6.43	6.93	7.62	9.64	15.89	14.22	10.78	7.68
22	6.39	5.38	5.82	5.96	6.45	7.00	7.48	9.86	16.01	14.23	10.60	7.70
23	6.56	5.50	5.88	6.09	6.62	6.93	7.59	10.00	16.09	14.11	10.39	7.69
24	6.59	5.57	5.91	6.13	6.57	7.00	7.61	10.07	16.51	14.05	10.19	7.59
25	6.55	5.44	5.86	6.09	6.45	6.97	7.72	10.21	16.65	14.16	10.16	7.54
26	6.46	5.43	5.97	6.12	6.67	7.00	7.79	10.50	16.91	14.05	10.02	7.33
27	6.42	5.26	5.76	6.20	6.57	7.05	7.69	10.60	16.86	13.81	9.75	7.38
28	6.44	5.36	5.90	6.18	6.72	7.00	7.90	10.83	17.35	13.41	9.45	7.23
29	6.40	—	6.16	6.14	6.56	7.04	7.82	10.98	16.79	12.89	9.12	7.09
30	6.34	—	6.07	6.21	6.67	7.11	7.93	11.31	16.82	12.66	8.82	7.06
31	6.41	—	5.97	—	6.64	—	8.01	11.51	—	12.21	—	7.09
Mean	6.62	5.73	5.66	6.04	6.44	6.82	7.43	9.34	14.86	14.99	10.91	7.81
Max	6.96	6.55	6.16	6.46	6.72	7.11	8.01	11.51	17.35	16.82	11.97	8.62
Min	6.34	5.26	5.09	5.80	6.21	6.54	7.08	8.02	11.74	12.21	8.82	7.06

†Data after September 15, 2019 are provisional—subject to revision



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — SCOO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2002–2019

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — SCOO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002					7.1	7.4	8.0	9.5	14.6	16.2	10.6	8.0
2003	6.9	7.1	7.4	7.9	8.2	8.5	9.1	11.0	18.2	18.5	10.3	7.5
2004	4.9	5.6	6.3	6.7	7.1		7.8	10.2	14.9	16.9	11.7	8.4
2005	5.8	5.9	6.4	7.1	7.5	7.9	8.2	9.3	11.8	15.5	10.7	6.3
2006	7.1	6.8	6.3	6.7	7.2	7.5	8.0	10.2	17.0	16.3	10.9	7.5
2007	5.6	5.2	5.9	6.3	6.8	7.1	8.0	10.1	17.0	15.0	10.9	7.0
2008	5.6	4.6	5.2	5.8	6.6	6.9	7.5	9.2	14.3	15.6	11.9	7.0
2009	5.1	4.6	5.4	6.4	6.8	7.1	7.5	9.1	12.4	15.0	10.7	6.1
2010	5.7	6.3	7.0	7.8	8.2	9.0	9.1	9.9	11.4	13.1	12.0	8.2
2011	6.2	6.1	6.7	6.7	7.3	7.8	8.1	8.6	10.0	11.8	11.7	7.3
2012	6.0	5.9	6.5	7.0	7.2	7.5	7.8	8.6	10.5	14.5	11.7	8.7
2013	5.7	5.5	6.2	6.8	6.8	7.2	7.6	9.1	12.4	14.2	12.1	6.5
2014	5.6	5.0	5.9	6.7	7.2	7.8	8.5	9.8	13.3	17.2	11.1	8.6
2015	7.2	7.6	8.0	8.4	8.6	8.9	9.6	12.8	18.8	17.3	11.9	8.0
2016	6.0	6.3	7.5	7.8	8.2	8.3	8.9	11.0	18.0	14.8	12.5	7.7
2017	4.5	5.2	6.1	6.8	7.7	8.3	8.7	10.0	13.6	15.8	11.3	7.7
2018	6.8	7.1	6.9	7.4	7.8	8.1	8.8	10.2	15.6	15.9	11.7	7.6
2019	6.6	5.6	5.7	6.0	6.4	6.8	7.4	9.1	15.1	15.0	11.2	7.8
median	6.0	5.9	6.3	6.8	7.3	7.7	8.2	9.8	13.9	15.4	11.3	7.8

KEY

T in °C

$T \leq 5.4$
$5.4 < T \leq 5.9$
$5.9 < T \leq 6.2$
$6.2 < T \leq 6.5$
$6.5 < T \leq 7.1$
$7.1 < T \leq 7.4$
$7.4 < T \leq 7.9$
$7.9 < T \leq 10.4$
$10.4 < T \leq 14.4$
$14.4 < T \leq 16.4$
$T > 16.4$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

DISTRIBUTION AND 2019

- Water temperatures in 2019 were lower than most years, especially in July. September had somewhat higher temperatures than usual.
- The highest temperatures occur in September and October which is unusual because that is after the warmest period of the summer.
- The lowest temperatures occur in January and February.

RESERVOIR EFFECTS

- Hagg Lake is thermally stratified in the summer. During most of the summer, water is released from the lower, cooler, level of the reservoir. As the reservoir is drawn down, eventually the water from the upper, warmer level reaches the outlet and is released. The overall effect is to trap heat during the summer and release it at the end of summer through fall.
- Exactly when warm water reaches the outlet depends on the depth of the warm water layer and how much water has been released during the season. In a cool summer (such as 2011), the upper layer is thinner, less water is released for irrigation and municipal use, and water from the upper warm layer may not be released at all. The opposite occurs for a hot summer such as 2015. This process accounts for the wide variability in the September temperatures.
- Temperatures at this site sometimes spike for a day or so in the spring and early summer. These spikes mark the occasional times when water is released over the spillway.

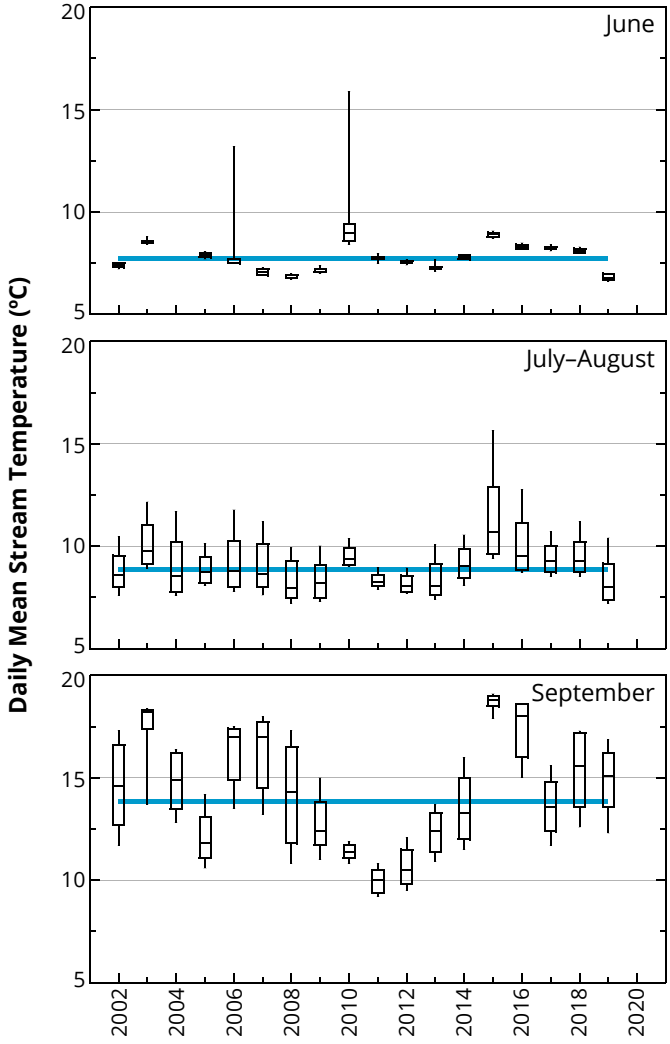
TRENDS

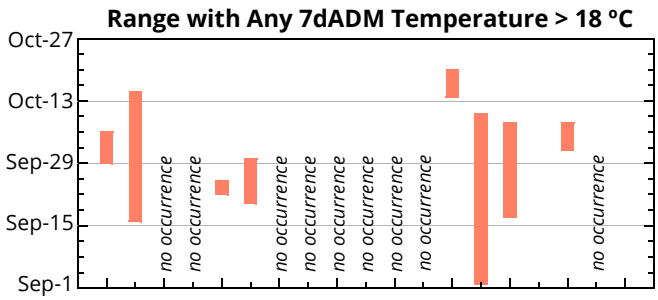
- Water temperatures in July through September do not show any trend.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

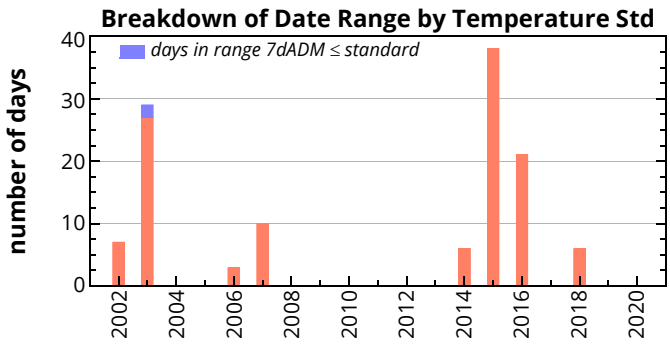
OREGON WATER TEMPERATURE STANDARD

- Exceedances of the water temperature standard occurred in about half of the years. They did not occur in 2019.

fraction of years with any exceedance	44%
median days/year exceeding standard	8
average first day of exceedance (if it occurred)	Sep-22
average last day of exceedance (if it occurred)	Oct-6







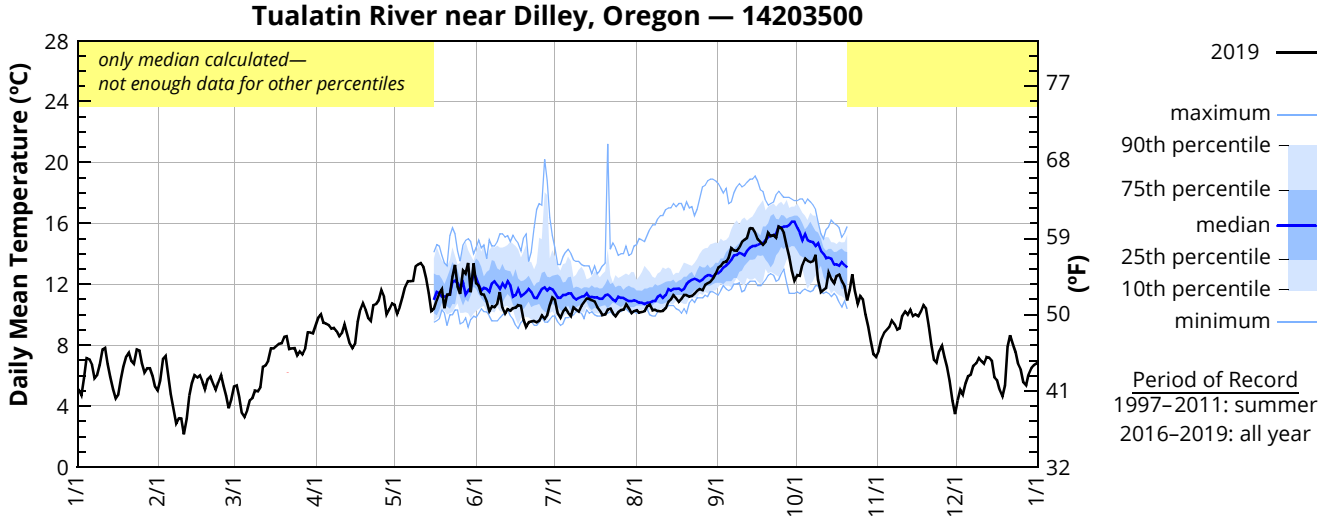
DLLO – Tualatin River near Dilley, Oregon – 14203500

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 58.8 *Latitude:* 45 28 30 *Longitude:* 123 07 23

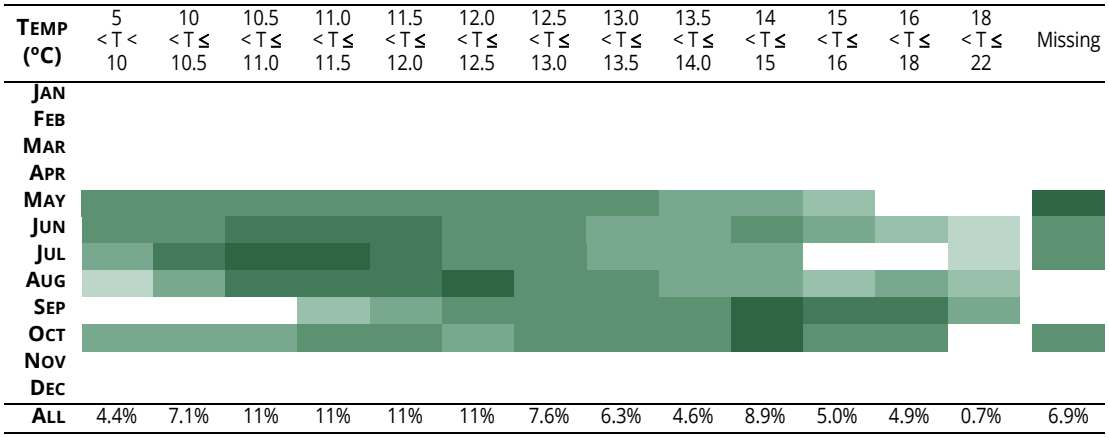
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — DLLO

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5.06	5.66	5.30	9.27	10.67	12.06	10.98	10.31	13.11	12.59	7.63	4.37
2	4.70	7.11	5.38	9.82	10.07	11.91	10.08	10.15	13.21	12.55	8.43	5.06
3	5.83	7.30	4.59	10.03	10.50	11.34	9.81	10.19	13.44	13.30	8.82	4.75
4	7.16	6.01	3.54	9.46	11.17	11.31	10.21	10.24	13.49	13.69	9.00	5.51
5	7.07	4.80	3.30	9.42	11.84	10.87	10.42	10.57	13.76	13.54	9.19	5.99
6	6.72	3.75	3.75	9.32	12.20	10.25	10.15	10.67	14.36	13.45	9.63	6.06
7	5.84	2.87	4.39	9.08	12.20	10.54	9.91	10.29	14.21	13.53	9.39	6.66
8	6.05	3.20	4.53	9.14	12.22	10.50	10.48	10.33	14.19	13.95	9.02	6.83
9	6.69	3.18	5.01	8.92	13.19	10.73	10.34	10.25	14.43	12.29	9.12	7.17
10	7.73	2.15	4.97	8.59	13.32	11.48	10.20	10.22	14.78	11.48	9.94	6.96
11	7.82	3.19	5.24	8.82	13.40	10.45	10.60	10.24	14.92	11.64	10.23	6.81
12	6.75	4.69	6.59	9.36	13.16	10.08	10.83	10.44	15.03	11.75	10.02	7.22
13	5.92	5.53	6.68	8.72	12.36	10.38	11.06	10.86	15.68	12.77	10.33	7.18
14	5.09	6.02	6.96	8.10	11.42	10.26	11.04	11.00	15.67	12.35	9.92	6.99
15	4.52	5.87	7.78	7.80	10.25	10.43	10.96	11.30	15.39	12.07	10.04	5.90
16	4.77	6.03	7.78	8.13	10.39	10.46	10.87	11.10	14.94	12.56	9.91	5.70
17	5.76	5.60	7.93	9.54	10.99	10.62	10.51	10.86	14.78	12.65	10.23	5.07
18	6.60	5.12	8.08	10.36	11.42	10.59	10.28	11.05	14.60	12.20	10.65	4.64
19	7.26	5.76	8.12	10.77	11.69	9.68	9.98	11.29	14.79	11.86	10.44	5.36
20	7.52	5.94	8.54	10.31	10.43	9.22	10.02	11.30	15.40	10.93	9.26	7.90
21	6.97	5.47	8.58	9.78	11.31	9.51	10.36	11.19	15.16	11.63	8.03	8.65
22	6.78	5.07	7.75	9.59	11.32	9.55	10.41	11.23	15.23	12.66	7.06	8.05
23	7.73	5.57	7.79	10.65	12.49	9.59	10.09	11.38	15.06	11.57	6.87	7.56
24	7.67	6.04	7.81	10.70	13.26	9.51	9.91	11.56	15.80	10.73	7.59	6.76
25	6.80	5.33	7.35	10.99	11.86	9.62	10.18	11.69	15.69	11.23	7.98	6.41
26	6.21	4.69	7.59	11.61	11.39	9.97	10.30	11.62	15.36	11.02	7.23	5.59
27	6.49	3.87	7.42	11.19	12.91	9.74	10.34	11.96	14.51	10.03	6.57	5.37
28	6.49	4.43	7.81	10.03	12.71	9.97	10.69	12.07	13.81	9.20	5.66	6.13
29	6.00	—	8.83	10.39	13.39	10.63	10.42	12.16	12.90	8.24	4.34	6.51
30	5.26	—	8.84	10.75	11.49	11.12	10.09	12.38	12.24	7.41	3.49	6.69
31	5.02	—	8.77	—	13.37	—	10.24	12.70	—	7.25	—	6.83
Mean	6.33	5.01	6.68	9.69	11.88	10.41	10.38	11.05	14.53	11.68	8.53	6.34
Max	7.82	7.30	8.84	11.61	13.40	12.06	11.06	12.70	15.80	13.95	10.65	8.65
Min	4.52	2.15	3.30	7.80	10.07	9.22	9.81	10.15	12.24	7.25	3.49	4.37

†Data after November 7, 2019 are provisional—subject to revision



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — DLLO



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1997–2011
2016–2019

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — DLLO

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997					12.9	13.2	10.6	10.8	14.1			
1998					10.4	13.8	12.0	12.5	13.7	15.3		
1999					12.0	10.8	10.5	11.5	15.9	15.0		
2000					12.2	11.5	10.7	10.8	14.8	14.5		
2001				9.2	12.0	11.6	13.2	17.0	18.1	12.9		
2002	6.3	6.0	6.8	8.8	10.6	10.8	10.9	11.3	14.6	14.3	9.1	
2003	7.4	7.1	8.6	9.5	11.1	11.6	11.5	12.3	15.6	15.1	10.1	
2004								12.0	14.4	15.1		
2005						12.4	11.1	11.3	12.2	14.0		
2006					11.0	12.3	10.3	11.3	14.7	13.6		
2007					10.9	9.8	10.4	11.6	15.7	12.1		
2008					11.2	11.3	11.3	11.3	14.4	12.9		
2009					10.8	14.0	10.4	11.1	13.4	13.3		
2010					11.2	12.3	12.6	12.1	12.7	11.5		
2011					10.0	12.2	12.4	12.4	12.3	11.6		
2012												
2013												
2014												
2015												
2016			8.8	11.6	12.9	11.5	11.5	12.7	16.4	11.7	10.5	5.9
2017	4.1	6.0	8.3	9.2	12.4	12.2	11.7	12.1	13.9	13.0	8.8	5.8
2018	7.2	6.3	7.7	9.1	11.3	11.1	11.1	11.9	14.7	13.7	8.6	6.6
2019	6.5	5.4	7.4	9.6	11.8	10.4	10.3	11.1	14.8	12.1	9.1	6.5
median	6.5	6.0	7.8	9.4	11.3	11.7	11.1	11.7	14.5	13.4	9.4	6.2

Key

T in °C

$T \leq 6.0$
$6.0 < T \leq 7.4$
$7.4 < T \leq 8.6$
$8.6 < T \leq 9.5$
$9.5 < T \leq 10.4$
$10.4 < T \leq 11.0$
$11.0 < T \leq 11.5$
$11.5 < T \leq 13.0$
$13.0 < T \leq 14.8$
$14.8 < T \leq 15.9$
$T > 15.9$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
T > 95th

Distribution and 2019

- Temperatures in 2019 were cooler during the summer than most years. No record were set.
- Because of the influence of reservoir releases, the highest average temperatures occur in September and October, after the warmest period of the summer.
- Individual days with high temperatures have occurred in June through October.
- Little data is available outside of the summer season. The lowest temperatures occur in December through February.
- No temperature data were collected in 2012–2015.

Reservoir effects

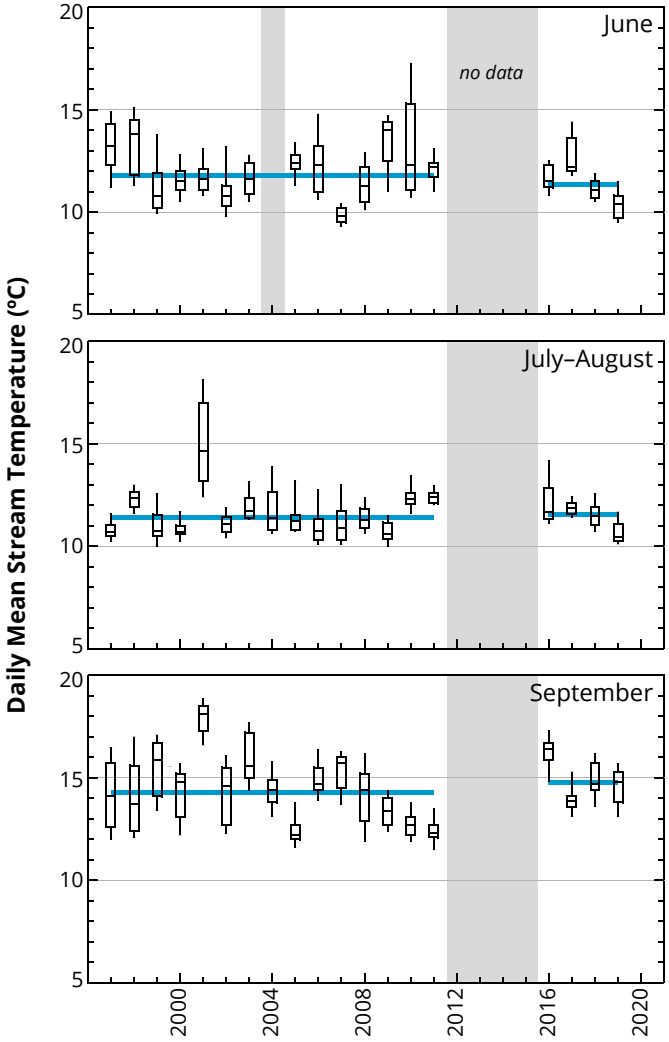
- During the summer season, a substantial fraction of the water at Dilley originates in Hagg Lake. Reservoir releases account for warm temperatures in September and October. The reservoir traps heat in the upper warm layer during the summer and releases it at the end of summer through fall.
- Hagg Lake did not fill in 2001 and less cold water was available in the lower layer of the lake. By July/August, the upper warmer lake water was being released and is responsible for the high water temperatures at Dilley in 2001.
- Reservoir release is also responsible for occasional temperatures spikes at this site. The spikes occur when warm water from the upper layer of the lake is released over the spillway.

Trends

- Water temperatures in June through September do not show any trend.

Oregon water temperature standard

- Exceedance of the water temperature standard can be assessed only for 2016–2018 because those are the only years when daily maximum temperatures were measured.
- The water temperature standard was not exceeded during 2016–2019.

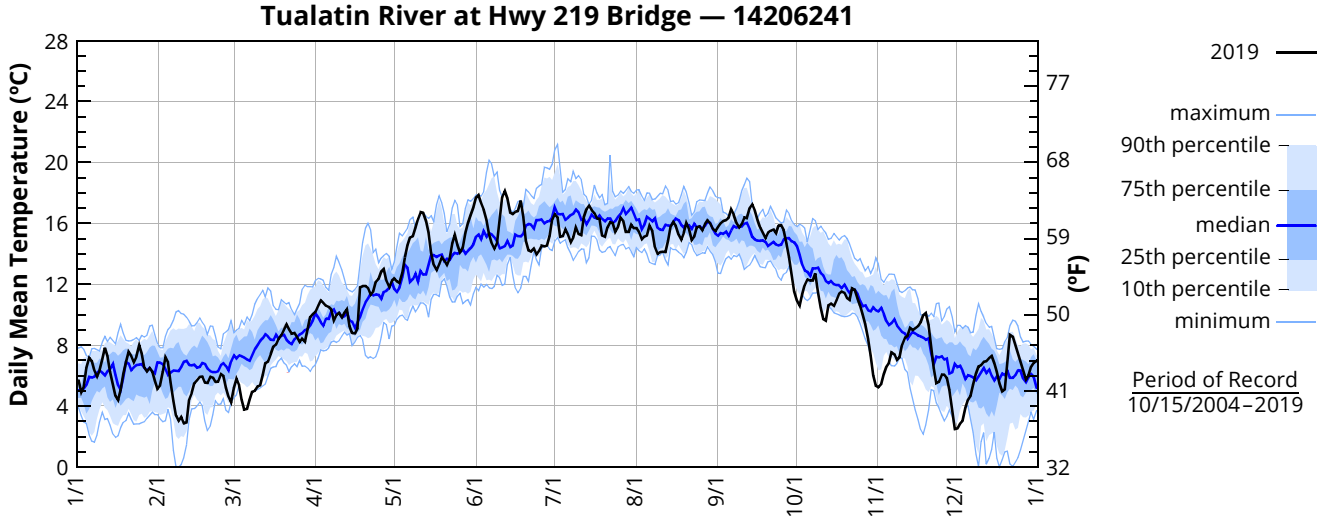


TRJB – Tualatin River at Hwy 219 Bridge – 14206241

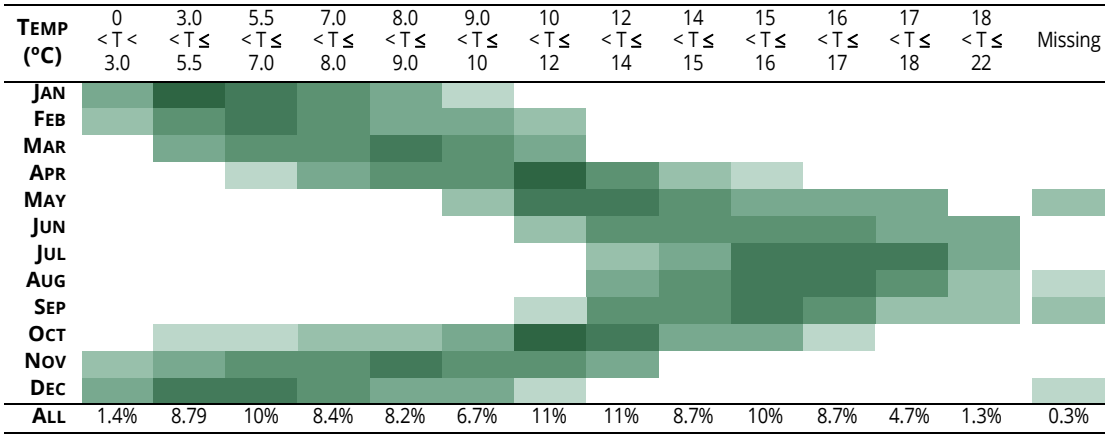
Data source: Jackson Bottom Wetlands Education Center
River mile: 44.4 *Latitude:* 45 30 01 *Longitude:* 123 59 24

2019 — DAILY MEAN WATER TEMPERATURE (°C) — TRJB

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.67	5.36	5.20	10.19	12.38	17.67	16.60	15.68	15.76	10.89	5.24	2.54
2	4.94	6.28	5.80	10.61	12.20	17.85	16.40	15.43	16.00	10.59	5.46	2.85
3	5.31	7.21	5.37	10.93	12.09	17.33	15.12	14.94	16.15	11.33	6.11	3.04
4	6.51	6.86	4.43	10.79	12.74	16.91	15.16	15.13	16.22	11.96	6.59	3.91
5	7.17	5.58	3.77	10.60	13.75	16.20	15.61	15.20	16.36	12.32	6.85	4.42
6	6.96	4.35	3.81	10.52	14.56	15.28	15.27	15.83	16.91	12.24	7.53	4.68
7	6.34	3.37	4.43	10.36	15.08	14.70	14.76	15.47	16.56	12.24	7.41	5.41
8	5.95	3.05	4.95	9.63	15.15	14.35	15.07	14.42	16.00	12.72	7.04	6.14
9	6.34	3.29	5.01	10.00	15.70	14.73	15.73	14.01	15.72	11.55	7.20	6.62
10	7.09	2.87	5.30	10.13	16.30	16.22	15.30	14.10	15.96	10.45	8.03	6.69
11	7.83	2.93	5.38	9.82	16.73	17.74	15.23	14.14	16.38	9.73	8.50	6.91
12	7.29	4.45	6.04	10.14	16.69	18.15	16.42	14.12	16.34	9.62	8.60	6.95
13	6.25	4.87	6.83	10.38	16.16	17.65	16.93	14.85	17.01	10.63	9.13	7.15
14	5.39	5.49	6.93	9.25	15.40	16.71	17.16	15.78	17.23	10.72	8.98	7.30
15	4.65	5.70	7.44	8.79	14.05	16.60	16.89	16.08	16.84	10.59	9.11	6.85
16	4.39	5.91	7.92	8.78	13.28	16.76	16.68	15.84	16.26	10.96	9.26	6.26
17	5.05	5.94	8.04	9.11	12.94	16.79	16.31	15.25	15.70	11.38	9.52	5.53
18	6.06	5.54	8.41	11.79	13.33	17.49	16.29	14.93	15.37	11.52	9.97	4.98
19	6.91	5.53	8.66	11.89	13.78	16.42	15.21	15.36	15.03	11.45	10.11	5.10
20	7.56	5.94	9.03	11.89	13.56	14.85	15.11	16.02	15.39	11.08	9.32	6.98
21	7.29	5.88	9.36	11.73	13.28	14.23	15.74	15.57	15.51	10.96	7.95	8.69
22	6.89	5.59	9.03	11.32	13.72	14.16	16.07	14.91	15.61	11.73	6.50	8.57
23	7.24	5.60	8.75	11.52	14.67	14.34	16.02	15.14	15.34	11.66	5.51	7.99
24	8.00	6.10	8.79	12.16	15.24	13.96	15.45	15.75	15.86	11.06	5.60	7.45
25	7.46	5.98	8.53	12.37	14.59	14.20	15.78	15.82	15.87	10.60	6.06	6.88
26	6.53	5.20	8.21	12.82	14.12	14.54	16.37	15.55	15.56	10.02	6.07	6.33
27	6.27	4.62	8.44	13.00	14.43	14.48	16.16	15.96	14.68	9.39	5.86	5.75
28	6.51	4.24	8.22	12.25	15.38	14.56	15.44	16.20	13.77	8.42	5.06	6.02
29	6.27	—	9.02	11.82	16.02	15.16	15.44	16.03	12.63	7.33	3.67	6.59
30	5.66	—	9.84	12.23	16.53	16.26	15.91	15.63	11.53	6.03	2.49	6.84
31	5.15	—	10.03	—	17.05	—	15.68	15.49	—	5.35	—	6.96
Mean	6.35	5.13	7.13	10.89	14.55	15.88	15.85	15.31	15.65	10.53	7.16	6.08
Max	8.00	7.21	10.03	13.00	17.05	18.15	17.16	16.20	17.23	12.72	10.11	8.69
Min	4.39	2.87	3.77	8.78	12.09	13.96	14.76	14.01	11.53	5.35	2.49	2.54



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — TRJB



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2005–2019
(Oct-Dec 2004 omitted)

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — TRJB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004										11.8	7.7	5.8
2005	5.0	5.4	9.0	10.3	13.1	14.6	17.1	15.5	13.6	13.2	7.3	5.6
2006	7.5	6.6	7.6	10.7	13.2	15.6	16.3	14.9	15.4	12.4	8.7	6.1
2007	4.7	7.2	9.0	10.0	13.5	14.3	15.8	14.9	15.4	11.6	8.3	5.9
2008	4.9	6.1	7.1	8.3	12.7	14.8	15.0	15.1	14.8	11.5	8.9	4.3
2009	4.6	4.7	7.0	10.1	12.0	16.5	16.5	14.8	14.8	12.3	8.2	3.9
2010	7.4	8.1	8.8	10.6	11.8	13.2	17.0	16.3	14.6	11.2	8.6	7.1
2011	6.7	5.6	8.0	9.1	11.2	14.1	16.1	16.3	15.0	12.1	7.8	4.7
2012	6.0	6.7	7.1	10.6	12.3	14.9	16.6	16.0	13.6	11.6	8.8	6.7
2013	4.6	6.6	8.2	11.0	13.2	15.5	16.4	16.2	15.9	10.5	9.0	4.0
2014	4.8	6.3	9.3	10.9	13.7	15.9	17.4	16.6	15.5	14.4	8.8	8.1
2015	7.2	9.1	10.4	10.9	14.2	16.9	17.1	17.3	16.1	14.5	8.9	7.4
2016	7.3	8.4	9.4	12.2	14.6	16.4	16.0	16.4	16.0	12.1	11.1	5.3
2017	3.6	6.5	9.1	10.2	13.5	16.0	17.3	16.7	15.7	11.6	8.8	5.2
2018	7.5	6.6	7.9	10.4	14.8	15.6	16.6	15.9	15.1	12.6	7.3	6.7
2019	6.3	5.5	7.9	10.7	14.6	16.2	15.7	15.5	15.9	11.0	7.1	6.6
median	6.0	6.6	8.3	10.4	13.4	15.4	16.4	15.9	15.1	12.0	8.4	6.0

Key

T in °C

$T \leq 4.4$
$4.4 < T \leq 5.4$
$5.4 < T \leq 6.3$
$6.0 < T \leq 7.0$
$7.0 < T \leq 8.1$
$8.1 < T \leq 9.4$
$9.4 < T \leq 11.1$
$11.1 < T \leq 15.0$
$15.0 < T \leq 16.5$
$16.5 < T \leq 17.1$
$T > 17.1$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

Distribution and 2019

- Temperatures in 2019 were well above average in parts of May and June. July and August had cooler than usual temperatures. New record high daily mean temperatures were set for multiple days in May, June, September and November.
- The highest average temperatures occur in July and August, but individual days with high temperatures can occur from June through September.
- The lowest average temperatures occur in December and January.

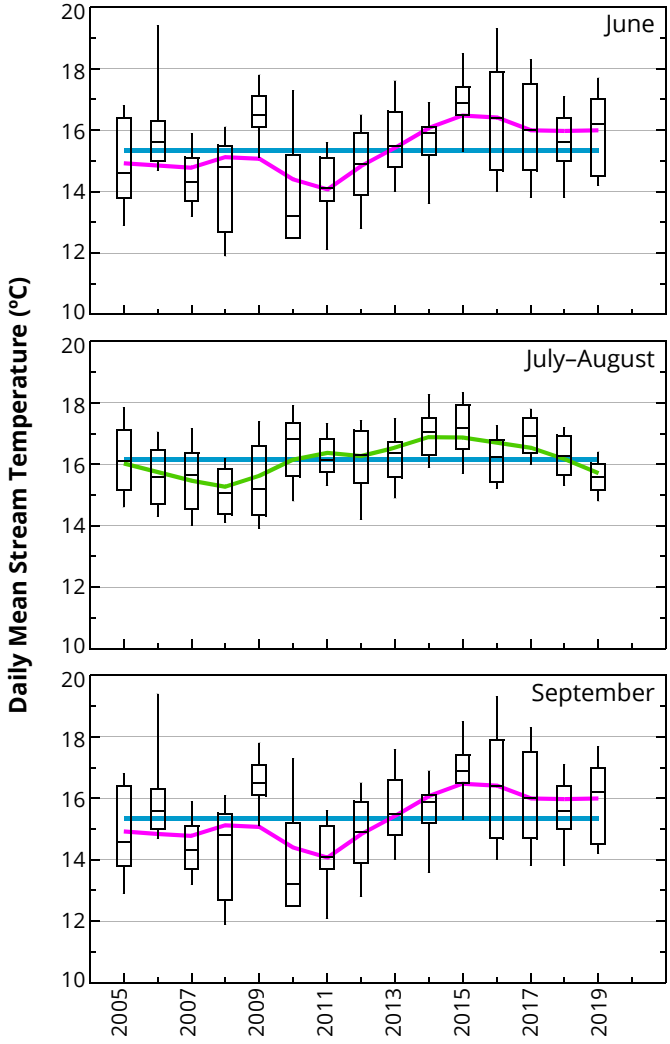
Trends

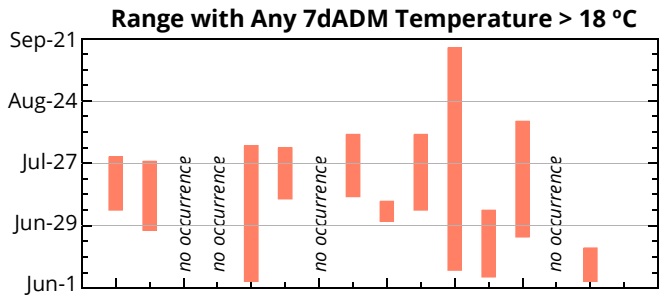
- Water temperatures showed increasing trends in June and September that were statistically significant. Because the period of record is short, the trend may be related to long-term weather patterns such as the Pacific Decadal Oscillation and the El-Niño Southern Oscillation. More years will be required to know if this trend persists.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

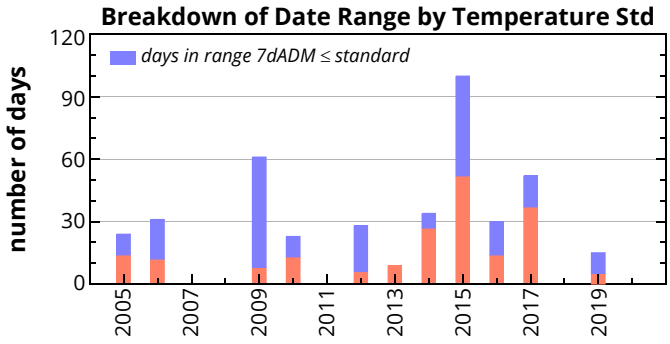
Oregon Water Temperature Standard

- Exceedances of the water temperature standard occurred in about three-quarters of the years.
- The temperature standard was exceeded for 5 days in 2019, all in June.
- Days when the 7dADM did not exceed the standard were common within the date range of exceedances.

fraction of years with any exceedance	73%
median days/year exceeding standard	13
average first day of exceedance (if it occurred)	Jun-23
average last day of exceedance (if it occurred)	Jul-29





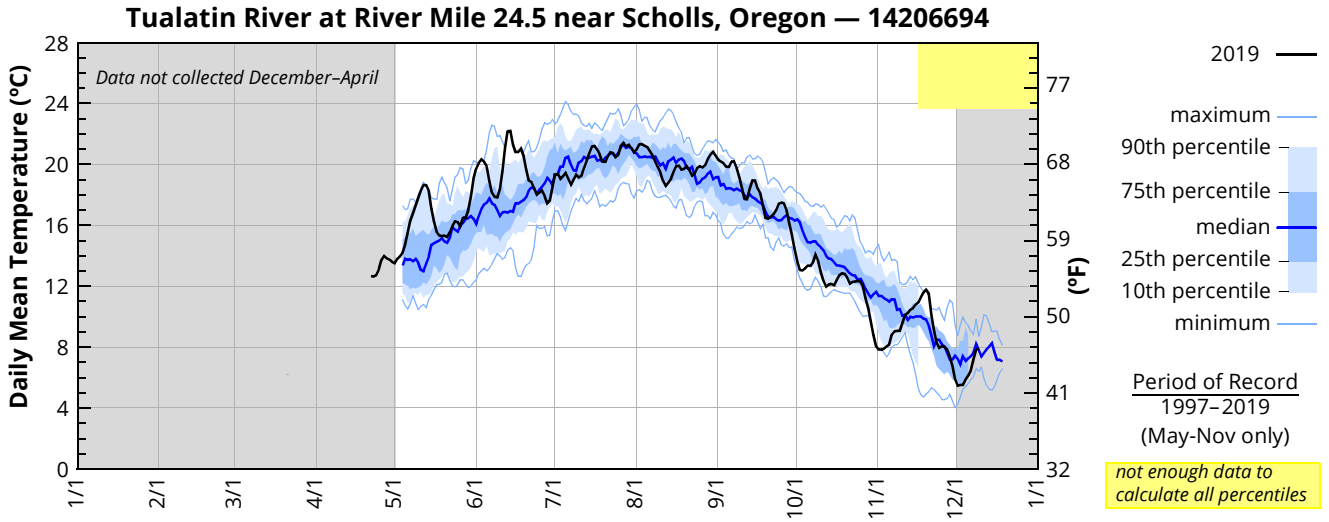


RM24.5 – Tualatin River at River Mile 24.5 nr Scholls, Oregon – 14206694

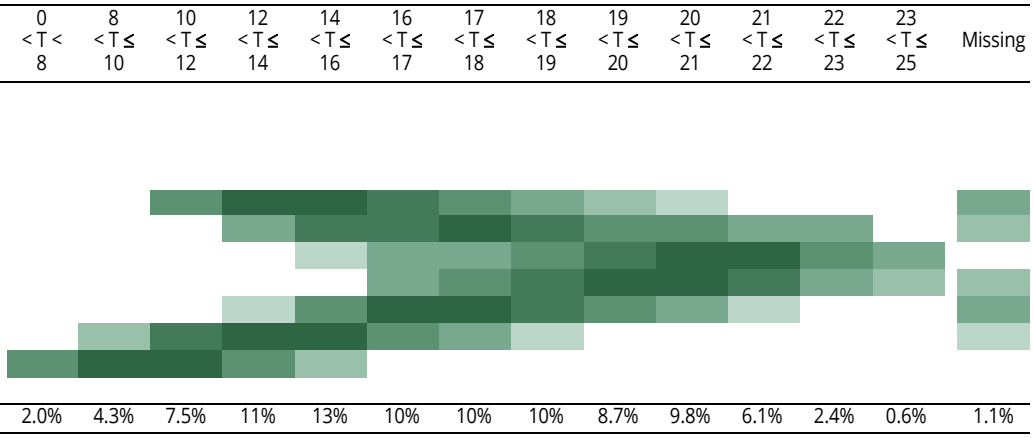
Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 24.5 *Latitude:* 45 24 06 *Longitude:* 122 53 38

2019 — DAILY MEAN WATER TEMPERATURE (°C) — RM24.5

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1					13.52	19.74	19.31	20.98	20.31	13.65	7.85	5.47
2					13.80	20.09	19.36	21.32	20.20	13.06	7.83	5.52
3					13.95	20.32	19.04	21.33	20.10	13.03	7.92	5.53
4					14.20	20.18	19.21	21.23	19.84	13.16	8.06	5.89
5					14.72	19.86	19.45	21.14	19.83	13.36	8.17	6.16
6					15.54	18.91	19.09	20.87	20.18	13.34	8.82	6.46
7					16.30	18.14	18.67	20.58	20.19	13.56	9.05	7.15
8					16.81	17.87	19.00	20.17	19.73	14.06	9.06	7.86
9					17.33	17.83	19.31	19.83	19.16	13.66	9.06	7.89
10					17.80	18.35	19.16	19.48	18.48	12.89	9.57	
11					18.28	19.53	19.26	18.93	17.72	12.35	10.11	
12					18.65	21.05	19.80	18.59	17.70	11.97	10.24	
13					18.62	22.18	20.24	18.80	18.44	12.11	10.45	
14					18.25	22.19	20.74	19.03	18.95	12.15	10.57	
15					17.11	21.31	21.17	19.50	18.94	12.08	10.80	
16					16.28	20.80	21.21	19.89	18.41	12.41	10.93	
17					15.56	20.81	20.97	19.91	18.06	12.72	11.29	
18					15.32	21.04	20.65	19.66	17.30	12.85	11.58	
19					15.29	20.57	20.18	19.69	16.49	12.80	11.77	
20					15.32	19.69	20.16	19.88	16.44	12.55	11.50	
21					15.25	18.97	20.54	19.62	16.57	12.17	10.15	
22				12.66	15.58	18.85	20.78	19.26	16.74	12.28	9.14	
23				12.63	15.97	18.41	20.75	19.41	17.00	12.31	8.29	
24				12.73	16.28	18.02	20.47	19.75	17.42	12.35	7.96	
25				13.12	16.22	18.14	20.62	19.89	17.49	12.31	8.08	
26				13.74	15.91	18.28	21.24	19.81	17.44	11.98	8.02	
27				13.98	16.51	17.92	21.41	19.94	16.95	11.23	7.86	
28				13.83	16.48	17.44	21.18	20.35	16.13	10.54	7.42	
29				13.76	16.97	17.61	21.29	20.62	15.41	9.68	6.76	
30		—		13.60	17.81	18.49	21.06	20.81	14.50	8.80	5.89	
31		—		—	19.08	—	20.78	20.56	—	8.09	—	
Mean					16.28	19.42	20.20	20.03	18.07	12.24	9.14	
Max					19.08	22.19	21.41	21.33	20.31	14.06	11.77	
Min					13.52	17.44	18.67	18.59	14.50	8.09	5.89	



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — RM24.5



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1997–2019
(May–Nov only)

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — RM24.5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997					16.0	16.9	20.1	20.0	16.8	12.0		
1998					12.9	17.2	20.4	19.4	17.2	13.4	10.4	
1999					12.4	16.2	18.8	19.2	16.9	12.8	10.5	
2000					14.6	17.6	19.8	18.0	16.2	14.0	7.1	
2001					15.1	17.6	21.1	21.0	19.1	13.7	9.9	
2002					14.5	17.9	21.1	19.7	16.9	14.0	10.0	7.0
2003					13.6	18.4	21.8	19.5	17.6	15.0	8.6	8.0
2004					15.7	18.8	21.6	20.1	17.7	15.0	9.4	
2005			9.8	10.7	14.0	16.1	20.5	20.4	16.8	14.5		
2006					14.4	17.3	20.2	19.2	17.2	13.6	9.1	
2007					15.2	17.5	20.5	18.9	17.5	13.4	9.8	6.6
2008					14.5	16.5	19.3	18.6	17.1	12.8	10.2	
2009					13.2	18.9	21.3	18.7	17.3	13.4	9.4	
2010					13.0	14.1	19.6	19.8	16.8	12.8	10.5	
2011					12.1	15.6	18.8	19.9	17.9	13.9	9.3	
2012					13.5	16.7	19.9	20.2	16.8	13.3	9.5	8.3
2013					14.8	17.6	20.7	20.2	18.6	11.9	10.1	
2014					15.2	18.2	21.3	21.1	18.4	16.1	9.6	8.1
2015					16.1	20.7	21.6	21.1	17.9	16.0	10.4	
2016					16.4	18.9	20.1	20.4	17.5	12.9	12.1	
2017					14.3	17.8	20.9	21.0	18.3	12.8	9.9	
2018					16.8	18.6	21.1	20.5	17.1	14.2	11.3	
2019					16.3	19.3	20.5	19.9	17.9	12.4	9.1	
median					14.7	17.7	20.5	20.0	17.3	16.7	9.8	

Key

T in °C

$T \leq 8.5$
$8.5 < T \leq 10.2$
$10.2 < T \leq 11.5$
$11.5 < T \leq 12.3$
$12.3 < T \leq 14.0$
$14.0 < T \leq 15.6$
$15.6 < T \leq 16.8$
$16.8 < T \leq 19.2$
$19.2 < T \leq 20.9$
$20.9 < T \leq 21.5$
$T > 21.5$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

Distribution and 2019

- Temperatures in 2019 were well above average for periods in May and June. New record high daily mean temperatures May13, June 2–4 and 13–18, September 8 and November 19–20.
- Temperatures in July and August were near the long term median or lower.
- The highest temperatures occur in July and August.
- Temperature is not routinely measured at this site during high flow which is when low temperatures would occur. Consequently, the percentiles are skewed and under-represent low temperatures.

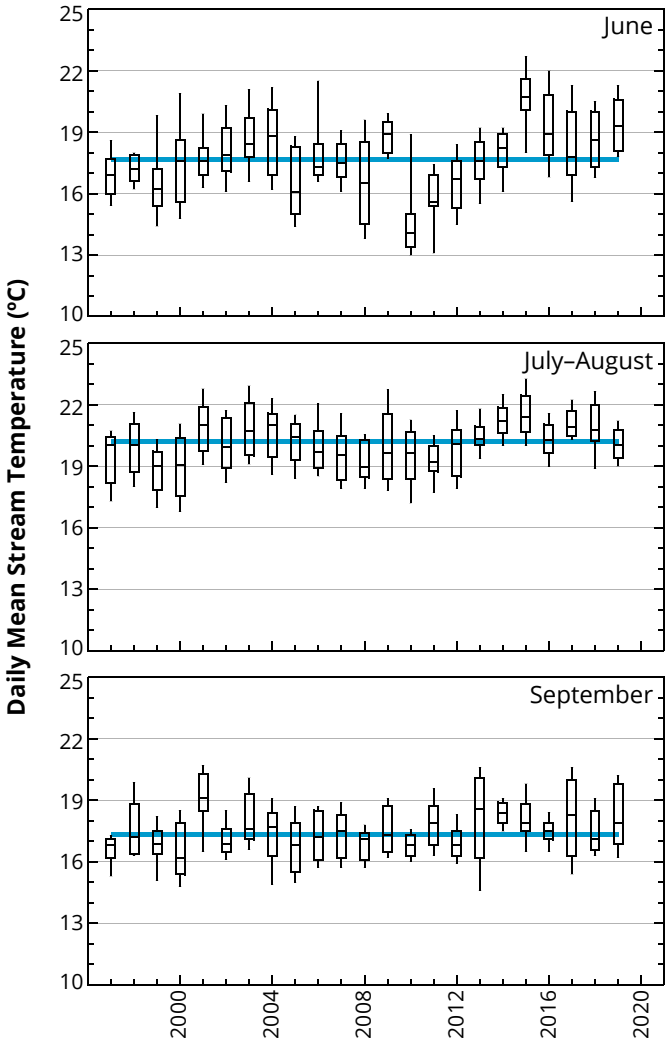
Trends

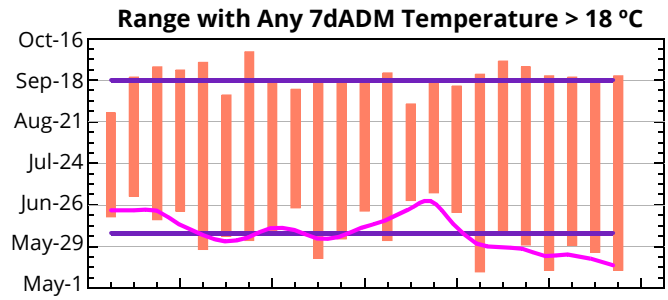
- Water temperatures in June through September do not show any statistically significant trends. The year-to-year variability is considerable and appears somewhat cyclical.
- The first day when temperature standard is exceeded has become earlier over the period of record. The trend is statistically significant.
- The number of days exceeding the temperature standard shows an overall increasing trend that is statistically significant, although considerable variability exists year-to-year.

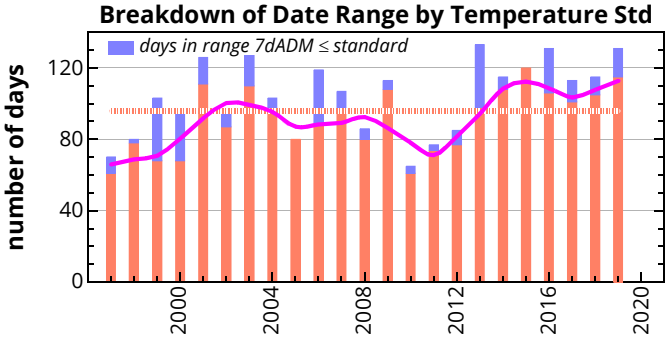
Oregon water temperature standard

- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard usually occurred within the date range of exceedances, but were a minor fraction.

fraction of years with any exceedance	100%
median days/year exceeding standard	96
average first day of exceedance (if it occurred)	Jun-7
average last day of exceedance (if it occurred)	Sep-18





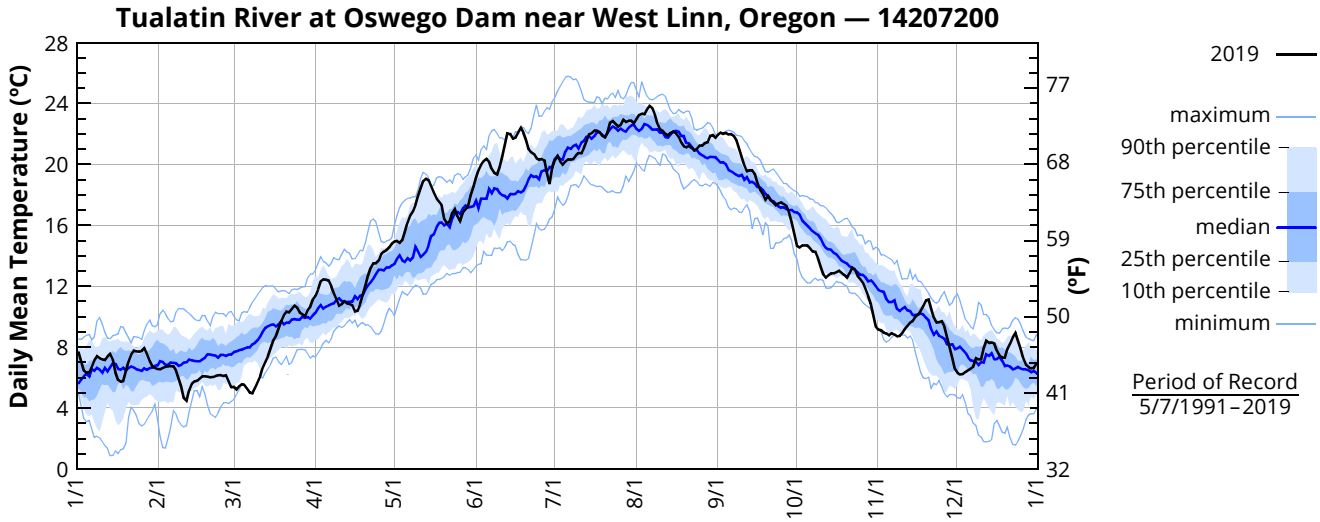


ODAM – Tualatin River at Oswego Dam near West Linn, Oregon – 14207200

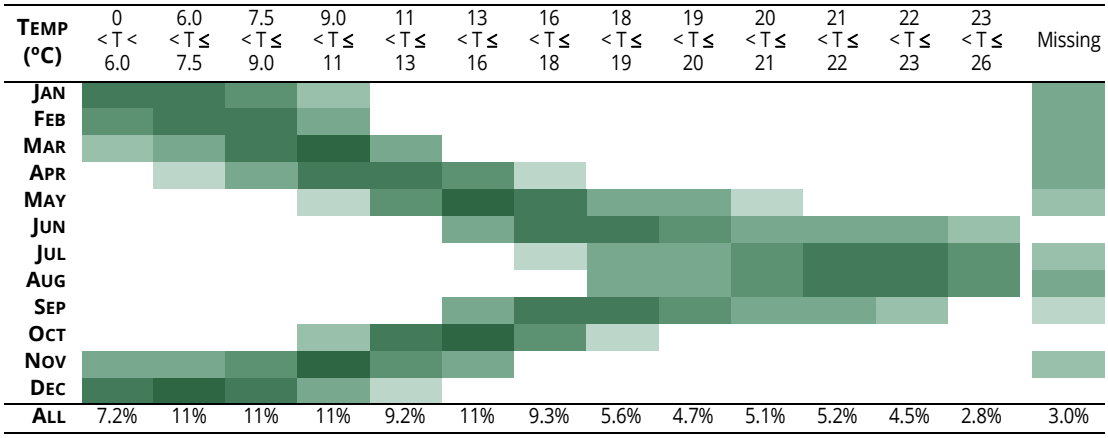
Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 3.4 *Latitude:* 45 21 24 *Longitude:* 122 41 02

2019 — DAILY MEAN WATER TEMPERATURE (°C) — ODAM

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	7.64	6.55	5.40	11.36	14.92	19.11	20.28	22.98	21.95	14.66	9.16	6.31
2	7.06	6.66	5.23	11.79	14.98	19.63	20.56	23.25	22.09	14.56	9.11	6.21
3	6.46	6.71	5.44	12.33	14.84	20.00	20.20	23.34	22.01	14.68	8.95	6.23
4	6.31	6.74	5.56	12.46	15.04	20.23	19.99	23.28	22.07	14.67	8.90	6.38
5	6.37	6.76	5.55	12.43	15.58	20.36	20.18	23.61	21.97	14.68	8.77	6.48
6	6.73	6.74	5.28	12.36	16.18	20.18	20.33	23.83	21.98	14.48	8.93	6.59
7	7.15	6.46	5.01	12.01	16.62	19.69	20.31	23.68	21.86	14.27	8.84	6.71
8	7.42	5.95	4.97	11.52	16.93	19.45	20.35	23.24	21.56	14.26	8.72	7.29
9	7.28	5.44	5.30	11.15	17.34	19.33	20.58	22.65	21.01	13.85	8.74	7.21
10	7.19	4.68	5.72	10.72	17.93	19.82	20.75	22.31	20.48	13.28	8.93	7.21
11	7.16	4.50	6.10	10.84	18.44	20.49	20.73	22.22	19.94	12.79	9.22	7.94
12	7.39	5.18	6.68	11.01	18.89	21.23	21.08	22.00	19.55	12.57	9.41	8.41
13	7.56	5.60	7.05	10.87	19.06	22.03	21.55	21.90	19.62	12.72	9.61	8.27
14	7.16	5.76	7.42	10.84	18.96	21.99	21.98	22.08	19.62	12.84	9.71	8.32
15	6.33	5.79	7.95	10.78	18.56	21.69	22.04	22.16	19.38	12.85	10.00	8.24
16	5.85	5.95	8.47	10.36	18.17	21.76	22.21	22.08	18.79	12.94	10.15	7.76
17	5.74	6.09	8.74	10.39	17.77	22.06	22.21	21.82	18.31	13.01	10.39	7.45
18	5.78	6.08	9.19	10.84	17.56	22.40	22.13	21.44	18.05	12.87	10.71	7.30
19	6.47	6.06	9.74	11.42	17.30	22.10	21.90	21.19	17.67	12.75	11.06	7.31
20	7.09	6.02	10.12	12.08	16.39	21.62	21.78	21.12	17.91	12.58	11.13	7.89
21	7.54	6.05	10.32	12.73	16.13	21.03	22.12	21.22	17.64	12.88	10.51	8.23
22	7.76	6.11	10.28	13.21	16.25	20.82	22.75	21.07	17.49	13.22	9.96	8.66
23	7.72	6.16	10.50	13.51	16.81	20.69	22.84	20.92	17.32	13.12	9.62	8.95
24	7.71	6.18	10.73	13.51	17.08	20.41	22.67	21.02	17.44	12.69	9.63	8.44
25	7.77	6.11	10.61	13.68	16.59	20.31	22.48	21.23	17.52	12.50	9.70	7.91
26	7.93	6.15	10.29	14.14	16.27	20.34	22.59	21.24	17.41	12.26	9.37	7.30
27	7.56	5.78	10.19	14.28	16.84	20.27	22.94	21.40	17.25	11.87	8.70	6.84
28	7.08	5.37	10.06	14.36	17.04	19.40	22.78	21.44	16.83	11.36	8.02	6.69
29	6.74	—	10.43	14.56	17.22	18.71	22.87	21.85	16.20	10.87	7.28	6.62
30	6.66	—	10.65	14.81	17.94	19.78	22.86	21.92	15.50	10.10	6.57	6.64
31	6.57	—	11.12	—	18.52	—	22.71	21.76	—	9.36	—	6.94
Mean	7.01	5.99	8.07	12.21	17.04	20.56	21.64	22.10	19.21	12.95	9.33	7.38
Max	7.93	6.76	11.12	14.81	19.06	22.40	22.94	23.83	22.09	14.68	11.13	8.95
Min	5.74	4.50	4.97	10.36	14.84	18.71	19.99	20.92	15.50	9.36	6.57	6.21



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — ODAM



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
1991–2019

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — ODAM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991					13.0	16.1	21.5	21.8	18.5	14.8	9.8	6.9
1992	6.4	8.5	11.2	12.5	16.6	20.8	21.4	21.1	17.5	14.1	10.5	5.6
1993	4.0	5.9	8.3	10.0	16.3	16.7	18.9	20.6	16.5	14.7	8.3	6.9
1994	7.5	5.6	9.3	11.6	16.3	17.8	21.7		18.6	13.5	7.0	7.6
1995	6.7	9.5			14.7	18.5	22.1	20.1	18.7	14.1	11.0	7.9
1996	8.0				13.6	18.1	21.2	20.8	16.9	14.5	9.6	7.1
1997		7.5	8.7	11.3	17.4	18.1	20.8	22.4	17.6	12.4	9.9	6.8
1998	7.1	8.6	9.9	11.1	13.5	18.4	21.8	22.0	19.6	14.0	10.8	7.1
1999	7.0	7.1	8.6	11.2	12.9	17.5	20.1	21.1	18.1	13.7	10.6	8.2
2000	6.0	7.5			15.2	18.1	21.1	20.6	17.6	14.4	8.2	6.7
2001	6.5	6.6	9.8	10.8	15.8	18.6	21.0	21.1	19.5	14.3	10.8	7.2
2002	6.6	6.7	7.5	11.7	15.3	19.3	22.4	21.3	18.6	14.0	9.7	7.5
2003	7.6	8.1	9.8	11.5	13.8	20.0	22.9	21.4	18.4	15.3	9.2	7.8
2004	6.0	7.3	10.6	12.5	16.5	18.7	23.0	23.1	18.6	15.6	9.5	7.8
2005	6.0	6.7			14.9	17.0	21.2	22.5	18.5	15.0	8.8	6.0
2006	7.8	7.0	8.1	11.5	15.4	18.2	22.3	21.3	18.2	14.1	9.3	6.1
2007	5.3	7.6	9.9	11.1	15.7	18.9	21.6	20.6	18.8	13.8	10.2	6.5
2008	5.3	6.6	8.4	9.5	15.3	16.6	21.7	20.8	18.6	13.6	11.3	4.9
2009	5.0	5.6	7.7	11.0	13.3	19.6	21.8	20.8	18.9	14.0	9.0	4.8
2010	7.6	8.3	9.4	11.8	13.3	14.5	21.0	21.6	17.8	14.3	10.2	7.3
2011	7.0	6.7			12.9	16.7	19.7	21.4	19.4	14.4	9.5	5.5
2012	6.3	7.2	7.5	11.5	14.5	17.2	21.3	22.2	18.4	13.8	10.1	7.5
2013	4.7	7.4	8.8	12.3	16.5	18.7	22.4	22.0	20.0	12.2	10.5	5.6
2014	5.8	6.6	9.9	12.3	15.4	18.8	22.7	23.0	19.5	16.5	9.8	8.6
2015	7.5	9.5	11.2	12.3	16.7	21.9	24.1	22.6	18.9	16.2	10.7	7.7
2016	7.5	8.7	10.0	13.7	17.2	19.6	21.5	22.3	18.4	13.8	12.1	5.7
2017	4.1	7.2	9.6	10.8	14.7	18.9	22.5	22.4	19.9	12.9	9.8	6.1
2018	7.9	7.4	8.6	10.9	17.7	18.9	23.3	23.0	18.4	13.9	10.1	7.6
2019	7.2	6.1	8.5	12.0	17.0	20.4	22.0	21.9	19.1	12.9	9.3	7.3
median	6.5	7.2	9.1	11.5	15.4	18.6	21.8	21.6	18.5	14.2	9.9	6.9

Key

T in °C

$T \leq 5.5$
$5.5 < T \leq 6.4$
$6.4 < T \leq 7.1$
$7.1 < T \leq 7.7$
$7.7 < T \leq 9.1$
$9.1 < T \leq 10.8$
$10.8 < T \leq 12.9$
$12.9 < T \leq 18.7$
$18.7 < T \leq 21.5$
$21.5 < T \leq 22.4$
$T > 22.4$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

DISTRIBUTION AND 2019

- Temperatures in 2019 were well above average in May, June and early September. New record high daily mean temperatures were set on May 15, June 13, 14 & 18, and September 1–2.
- Temperatures in July were below or near the period of record average.
- The highest temperatures occur in July and August.
- The lowest temperatures occur in December and January.

TRENDS

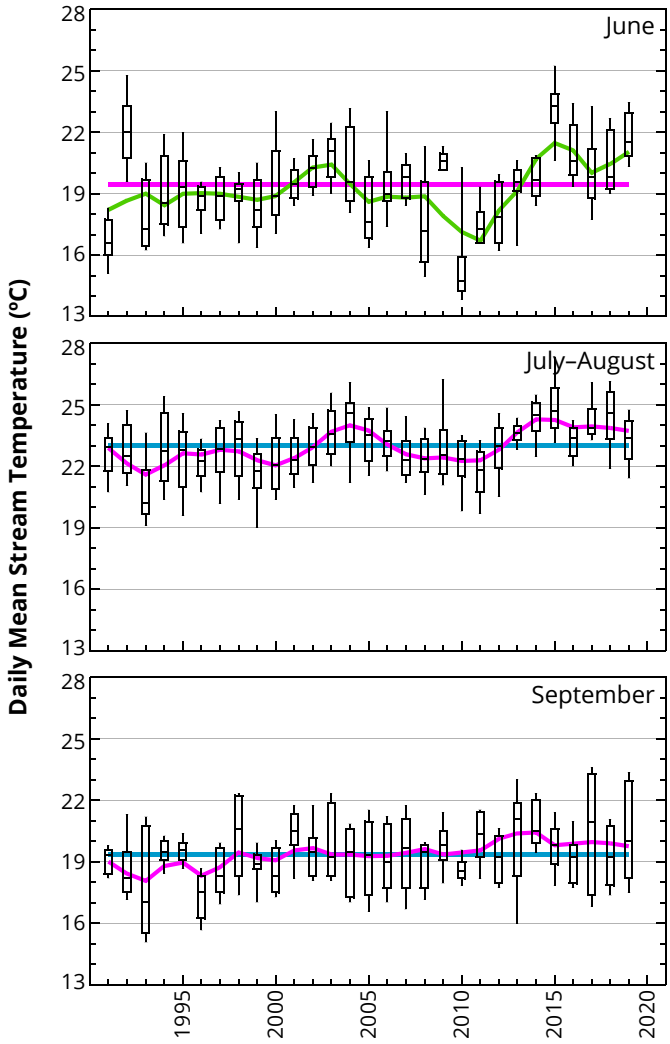
- June median water temperatures from 2013–2019 were greater than the period of record median for June. June temperatures were variable over time, but this 7-year streak is the longest.
- Water temperatures in July–August and September show an increasing trend. The trend is statistically significant even though the increase is small.
- The year-to-year variability in June and July–August is considerable and appears to be somewhat cyclical. Year-to-year variability is less in September than in the earlier summer months.
- This site illustrates the importance of a long period of record, especially when long-term patterns such as the Pacific Decadal Oscillation and the El Niño Southern Oscillation may be active.
- No trend was evident in the timing of temperature standard exceedances. The number of days with exceedances had a increasing trend that was statistically significant.

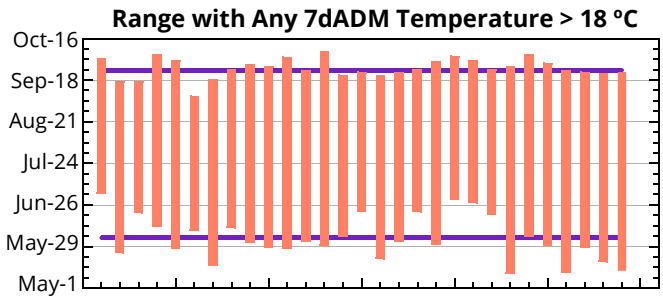
OREGON WATER TEMPERATURE STANDARD

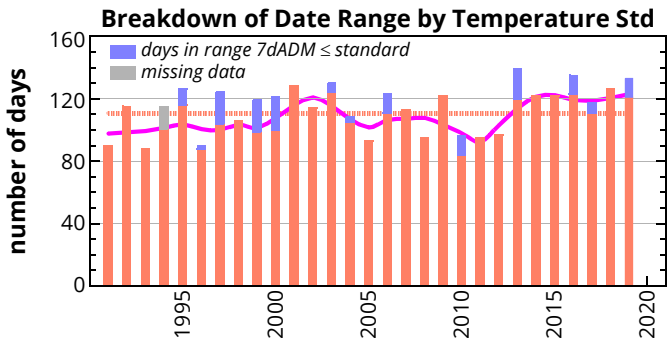
- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard occurred sporadically within the date range of exceedances. When they occurred, they were a minor fraction of the range.

fraction of years with any exceedance	100%
median days/year exceeding standard	111
average first day of exceedance (if it occurred)	Jun-3
average last day of exceedance (if it occurred)	Sep-24

- In 1994, 14 days in August did not have temperature data. The 7dADMs exceeded 20°C on days before and after the data gap.





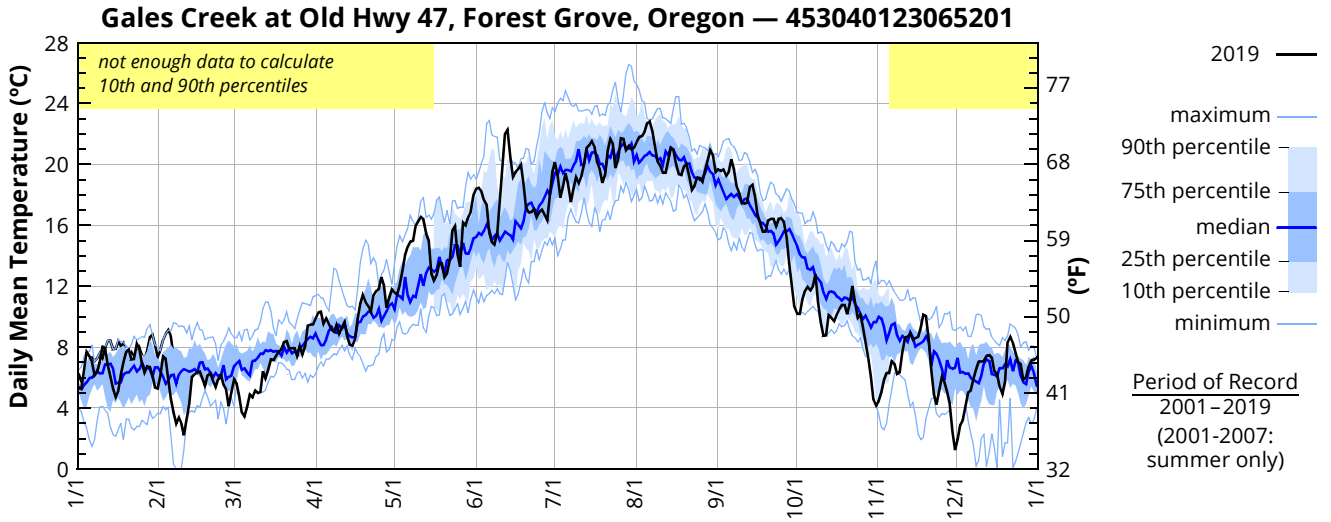


GALES – GALES CREEK AT OLD HWY 47, FOREST GROVE, OREGON – 453040123065201

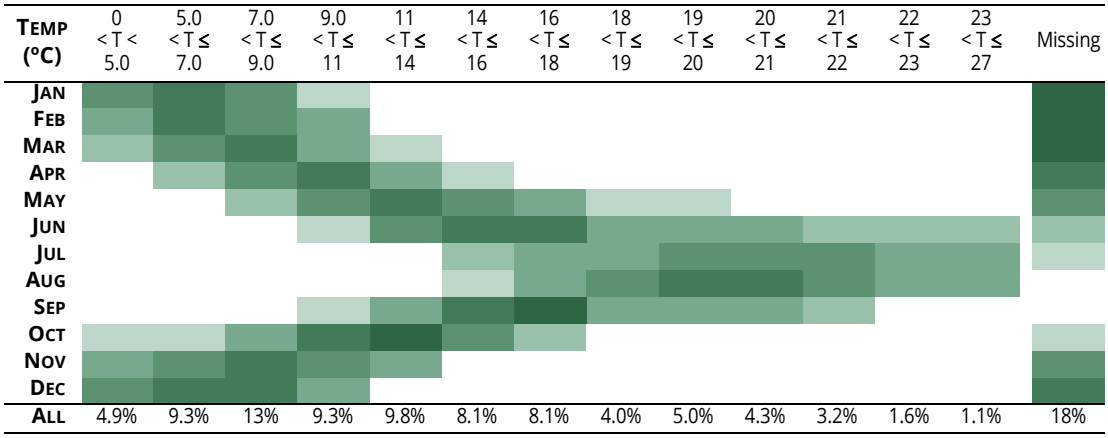
Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 2.36 *Latitude:* 45 28 40 *Longitude:* 123 06 52

2019 — DAILY MEAN WATER TEMPERATURE (°C) — GALES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.38	6.06	5.87	9.89	11.59	18.41	20.14	21.46	19.68	10.18	4.44	1.95
2	5.28	7.38	5.58	10.29	11.44	18.48	19.20	21.79	19.57	10.19	5.06	2.90
3	6.50	7.25	4.76	10.33	12.05	18.24	17.83	21.85	19.68	11.13	5.86	3.20
4	7.68	5.91	3.71	9.56	13.04	17.66	18.53	22.13	19.25	11.69	6.31	4.21
5	7.39	4.65	3.44	9.91	14.04	17.32	19.42	22.70	19.50	11.97	6.30	5.04
6	7.04	3.70	4.11	9.50	14.60	15.51	18.71	22.83	20.33	11.74	7.07	5.17
7	6.15	3.00	4.90	9.13	14.93	14.90	17.53	22.14	19.70	12.00	6.89	5.88
8	6.37	3.40	4.72	9.01	14.99	14.74	18.40	21.13	18.53	12.78	6.25	6.56
9	7.02	2.99	5.17	9.47	15.97	15.47	19.14	20.16	18.09	10.95	6.37	7.08
10	8.04	2.23	4.99	8.90	16.27	17.97	18.78	19.89	17.47	9.57	7.64	7.06
11	7.95	3.30	5.06	9.35	16.54	20.20	19.26	19.44	17.42	8.76	8.64	7.12
12	6.86	4.32	6.43	9.67	16.39	22.01	20.00	19.45	17.46	8.77	8.67	7.43
13	6.11	6.05	5.96	8.73	15.46	22.28	21.08	20.24	18.53	10.10	8.93	7.47
14	5.27	6.22	6.49	8.17	15.00	20.46	21.26	21.07	18.67	9.95	8.49	7.31
15	4.74	6.37	7.20	8.10	12.86	19.20	21.53	20.97	17.92	9.72	8.60	6.41
16	5.14	6.41	7.15	8.58	12.39	19.50	21.12	20.08	16.71	10.14	8.69	6.26
17	6.18	5.94	7.45	9.88	12.76	19.70	20.12	19.37	16.09	10.50	9.31	5.41
18	6.99	5.47	7.71	10.86	13.53	19.98	19.68	19.29	15.57	10.76	10.14	4.92
19	7.70	6.14	7.87	11.43	13.51	18.71	18.79	19.84	15.58	10.77	10.05	5.74
20	7.85	6.30	8.36	10.93	12.59	17.14	19.33	20.02	16.31	10.17	8.48	8.34
21	7.20	5.77	8.42	10.70	12.86	16.83	20.89	19.19	16.42	10.86	6.46	8.69
22	7.22	5.37	7.91	10.31	13.76	16.86	21.66	18.34	16.42	12.03	4.91	8.25
23	8.22	5.90	7.94	11.40	15.69	17.04	21.34	18.59	15.95	11.05	4.24	7.63
24	7.87	6.18	7.94	11.68	15.95	16.55	19.76	19.13	16.41	9.94	5.11	7.01
25	6.93	5.52	7.43	11.82	14.09	16.88	20.39	19.10	16.46	10.16	6.06	6.89
26	6.33	5.21	8.09	12.59	13.29	17.02	21.71	18.85	16.26	9.36	5.68	5.88
27	6.74	4.14	7.53	12.06	16.18	16.67	21.68	19.60	15.20	8.41	5.07	6.05
28	6.69	4.99	8.08	10.60	16.00	16.31	20.96	20.24	13.47	7.28	4.34	6.76
29	6.14	—	9.42	11.30	16.54	17.97	21.22	20.91	12.04	6.09	2.46	7.14
30	5.36	—	9.48	11.81	16.91	19.51	20.98	20.55	10.65	4.55	1.25	7.18
31	5.28	—	9.48	—	18.04	—	21.11	19.51	—	4.17	—	7.31
Mean	6.63	5.22	6.73	10.20	14.49	17.98	20.05	20.32	17.04	9.86	6.59	6.27
Max	8.22	7.38	9.48	12.59	18.04	22.28	21.71	22.83	20.33	12.78	10.14	8.69
Min	4.74	2.23	3.44	8.10	11.44	14.74	17.53	18.34	10.65	4.17	1.25	1.95



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — GALES



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2001–2019
(2001-2007: summer only)

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — GALES

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2001					13.9	15.8	19.9	20.0	17.1	10.8		
2002					12.2	17.1	21.2	19.6	16.3	11.5	7.9	5.9
2003					14.4	16.8	21.0	20.3	17.4	13.7		
2004					14.9	17.3	21.9	21.3	16.6	12.7		
2005						14.7	20.1	20.3	15.4	12.6		
2006					13.3	15.8	20.8	19.3	15.9	11.3	8.7	
2007					14.3	16.8	20.8	19.1	16.3	10.9	7.6	6.2
2008	5.5		6.8	7.8	12.9	15.4	20.0	19.5	16.7	10.7	8.7	4.8
2009	4.6	4.6	6.6	9.3	12.0	16.7	21.6	19.5	16.5	11.3	8.2	4.3
2010	7.5	7.8	8.0	9.7	11.1	12.5	19.1	19.1	16.4	10.9	8.1	7.4
2011	6.6	5.6	7.2	8.1	10.6	14.5	17.8	19.3	17.1	12.1	6.9	4.7
2012	6.1	6.4	7.0	9.4	12.0	14.8	19.6	20.0	16.3	11.1	8.9	7.2
2013	4.7	6.4	7.7	10.1	13.3	16.2	20.5	19.9	18.1	10.3	8.6	3.9
2014	5.1	6.3	8.2	10.0	12.6	16.7	21.2	20.7	17.5	13.9	8.5	8.1
2015	7.3	8.7	9.6	10.1	14.4	20.1	22.0	20.3	16.0	13.9	8.4	8.0
2016	7.4	8.2	8.7	11.3	14.6	18.1	19.4	20.0	16.4	11.6	10.2	6.1
2017	4.1	6.3	7.9	8.9	12.8	16.2	20.2	20.9	16.7	10.6	8.5	5.4
2018	7.5	6.1	7.2	9.0	14.5	16.6	21.8	20.6	15.9	11.9	6.9	7.1
2019	6.7	5.6	7.2	10.1	14.6	17.8	20.1	20.1	17.1	10.2	6.3	6.8
median	6.2	6.4	7.6	9.5	13.2	16.3	20.3	20.0	16.6	11.5	8.2	6.3

KEY

T in °C

$T \leq 4.8$
$4.8 < T \leq 5.9$
$5.9 < T \leq 6.7$
$6.7 < T \leq 7.3$
$7.3 < T \leq 8.5$
$8.5 < T \leq 10.2$
$10.2 < T \leq 12.2$
$12.2 < T \leq 17.7$
$17.7 < T \leq 20.4$
$20.4 < T \leq 21.5$
$T > 21.5$

T as percentile

$T \leq$ 5th
5th < T ≤ 10th
10th < T ≤ 15th
15th < T ≤ 20th
20th < T ≤ 30th
30th < T ≤ 40th
40th < T ≤ 50th
50th < T ≤ 75th
75th < T ≤ 90th
90th < T ≤ 95th
T > 95th

DISTRIBUTION 2019

- Temperatures in 2019 were well above average during periods of May and June. Five day in June had record setting high mean temperatures, including two that exceeded 22ºC. New record high daily mean temperatures were also set January, May, November and December (7 days total).
- Temperatures in July were cooler than in many recent years and closer to the period of record median.
- The highest temperatures occur in July and August.
- Before 2008, temperature was not measured at this site during high flow which is when low temperatures would occur. Consequently, the percentiles are skewed and under-represent low temperatures.

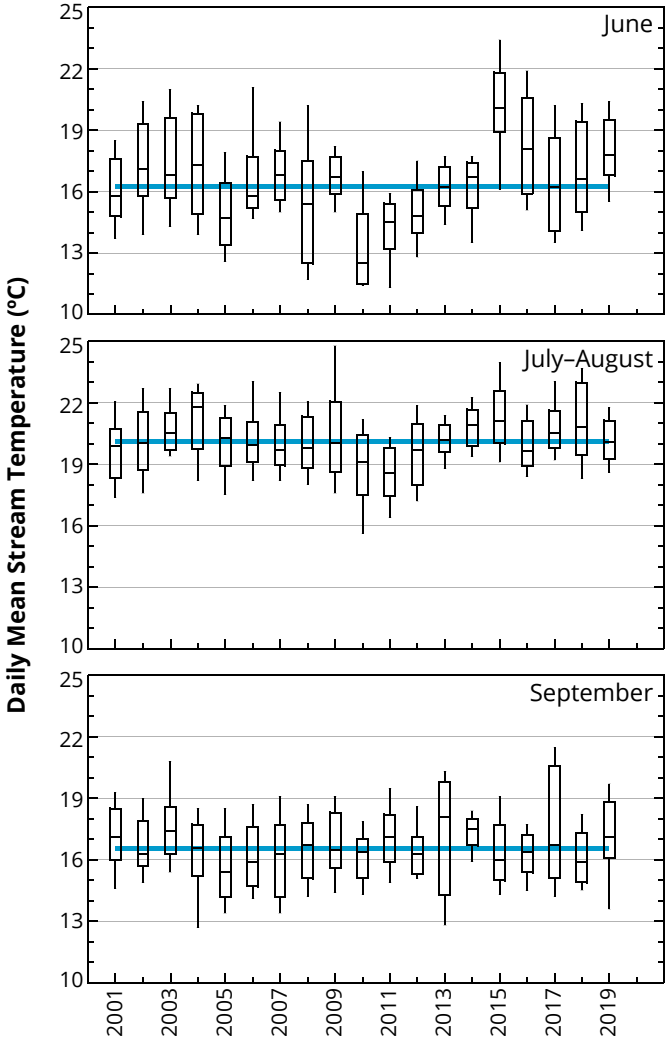
TRENDS

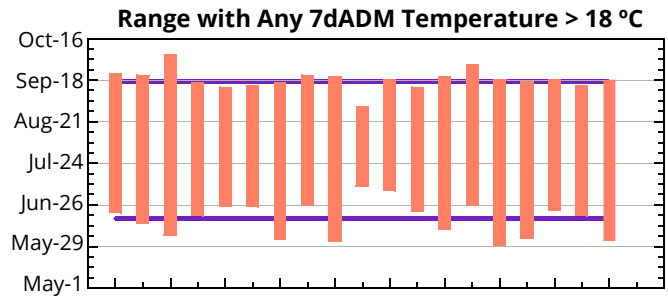
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June and appears somewhat cyclical. Year-to-year variability is less in September than in early summer.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

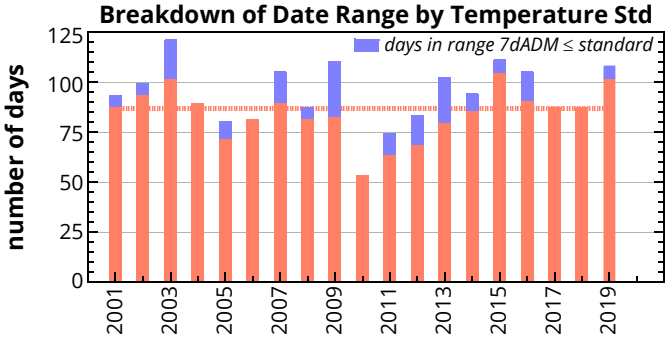
OREGON WATER TEMPERATURE STANDARD

- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard frequently occurred within the date range of exceedances, but were a minor fraction.

fraction of years with any exceedance	100%
median days/year exceeding standard	87
average first day of exceedance (if it occurred)	Jun-16
average last day of exceedance (if it occurred)	Sep-17







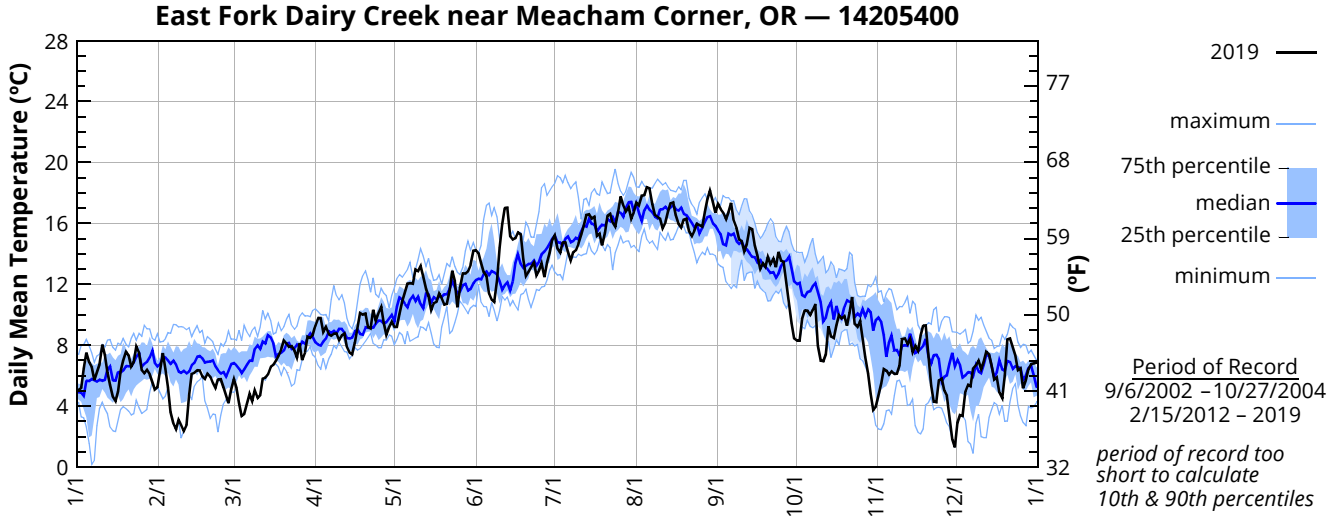
5400 – East Fork Dairy Creek near Meacham Corner, OR – 14205400

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 12.4 *Latitude:* 45 30 40 *Longitude:* 123 06 52

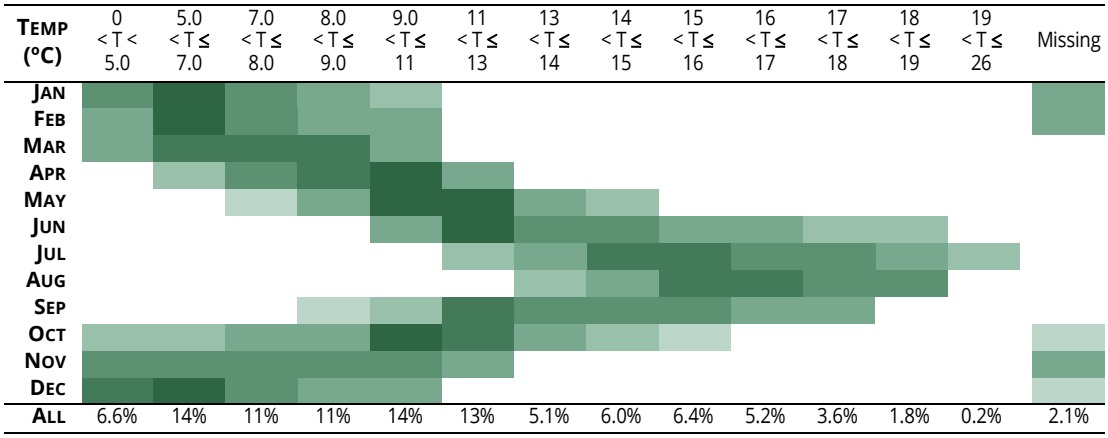
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — 5400

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.06	6.36	5.77	9.27	9.20	14.23	15.22	17.34	17.25	8.29	4.66	2.92
2	5.21	7.49	5.20	9.78	9.20	14.05	14.31	17.17	16.95	8.30	5.47	3.43
3	6.48	6.44	4.19	9.79	10.04	13.39	14.07	17.81	16.72	9.75	6.45	3.35
4	7.52	5.24	3.36	8.88	10.89	12.80	14.74	17.85	16.28	10.28	6.33	4.99
5	6.87	3.61	3.48	9.21	11.47	12.54	14.76	18.38	16.74	10.26	6.07	5.42
6	6.55	2.85	4.20	8.73	12.04	11.38	14.15	18.31	17.35	9.99	6.28	5.30
7	5.71	2.48	4.80	8.62	12.08	10.99	13.56	17.25	16.18	10.34	6.11	6.49
8	6.23	3.09	4.34	8.75	12.03	10.83	14.11	16.54	15.68	10.71	6.12	6.70
9	6.74	2.75	5.03	8.77	12.98	12.28	14.24	16.41	14.96	7.97	6.65	6.99
10	8.03	2.36	4.53	8.34	12.87	14.41	14.66	16.31	14.85	7.00	8.40	6.44
11	7.34	2.80	4.73	8.64	13.20	15.93	15.26	15.69	14.18	6.95	8.44	6.90
12	6.22	4.73	5.81	8.78	12.54	17.01	15.85	16.08	14.63	7.42	8.09	7.56
13	5.40	6.13	5.87	7.87	11.72	17.02	16.54	16.78	15.71	9.24	8.42	7.39
14	4.60	6.19	6.09	7.51	11.23	15.15	16.59	17.32	15.62	8.58	7.56	6.65
15	4.33	6.35	6.59	7.38	10.34	14.95	16.32	17.39	14.55	8.48	7.95	5.75
16	4.96	6.33	6.71	8.19	10.78	15.04	16.44	16.54	13.91	9.29	7.61	5.90
17	6.27	5.96	6.99	9.13	10.85	15.42	15.18	15.96	13.01	9.98	8.62	4.89
18	6.98	5.80	7.31	10.13	11.37	15.29	15.33	15.72	13.38	9.76	9.27	4.52
19	7.57	6.15	7.76	10.02	11.06	13.65	14.56	16.26	13.12	9.91	9.29	6.02
20	7.35	5.93	8.32	10.07	10.67	12.55	15.38	16.31	13.79	9.28	7.20	8.40
21	6.61	5.51	8.12	9.20	10.71	12.82	16.50	15.45	13.34	10.13	5.38	8.45
22	6.91	5.19	7.89	9.12	11.62	13.13	16.64	15.17	13.69	11.18	4.31	7.88
23	7.91	5.75	7.94	10.32	12.90	13.43	16.04	15.52	13.12	9.41	4.27	7.32
24	7.48	5.77	7.66	9.61	12.21	12.59	15.76	15.97	14.14	9.21	5.69	6.36
25	6.38	5.27	7.21	10.17	10.50	12.92	16.74	15.89	13.56	9.61	5.82	6.49
26	6.18	4.72	8.12	10.55	11.74	13.37	17.77	15.79	13.47	8.45	5.02	5.18
27	6.38	4.20	7.03	9.46	12.71	12.48	17.17	16.73	12.07	7.24	4.68	5.74
28	6.09	5.06	7.53	8.70	12.71	13.41	16.77	17.58	10.81	6.15	3.31	6.44
29	5.60	—	8.57	9.22	12.85	14.05	17.07	18.15	9.44	4.83	1.82	6.76
30	5.11	—	8.49	9.56	13.26	14.91	16.32	17.40	8.44	3.75	1.30	6.81
31	5.25	—	8.68	—	14.19	—	16.76	16.69	—	3.97	—	6.86
Mean	6.30	5.02	6.40	9.13	11.68	13.73	15.64	16.70	14.23	8.57	6.22	6.14
Max	8.03	7.49	8.68	10.55	14.19	17.02	17.77	18.38	17.35	11.18	9.29	8.45
Min	4.33	2.36	3.36	7.38	9.20	10.83	13.56	15.17	8.44	3.75	1.30	2.92

†Data after October 2, 2019 are provisional—subject to revision



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — 5400



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
9/2002–10/2004
2/2012–2019

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — 5400

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002									13.5	9.6	7.2	6.2
2003	7.0	6.6	7.9	8.7	9.8	12.9	15.7	15.7	14.3	11.4	5.7	6.5
2004	5.7	7.0	8.4	9.5	11.2	13.6	16.8	16.7	13.9	12.1		
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012		6.1	6.6	8.8	10.3	11.8	15.0	15.9	13.6	9.7	8.1	7.2
2013	4.9	6.2	7.4	9.2	11.0	12.9	15.6	16.3	15.2	9.3	6.0	3.8
2014	4.7	6.4	7.9	9.0	11.0	12.6	16.2	17.2	14.8	12.2	7.9	7.9
2015	6.9	8.4	8.9	8.8	11.7	15.1	17.4	16.7	13.3	12.1	8.2	7.7
2016	7.4	8.1	8.4	10.0	11.7	13.6	15.1	16.6	13.5	11.0	9.8	5.8
2017	4.6	6.5	7.8	8.5	11.0	12.7	15.0	17.0	14.0	9.8	8.0	5.3
2018	7.4	5.5	6.8	8.6	11.9	12.8	17.2	16.6	13.1	10.2	6.7	6.5
2019	6.4	5.4	6.7	9.2	11.7	13.4	15.8	16.5	14.2	9.2	6.2	6.4
median	6.3	6.7	7.8	9.0	11.3	13.0	15.7	16.5	13.8	10.5	7.7	6.5

Key

T in °C

$T \leq 4.6$
$4.6 < T \leq 5.7$
$5.7 < T \leq 6.3$
$6.3 < T \leq 6.9$
$6.9 < T \leq 7.9$
$7.9 < T \leq 8.8$
$8.8 < T \leq 9.9$
$9.9 < T \leq 13.7$
$13.7 < T \leq 16.2$
$16.2 < T \leq 17.2$
$T > 17.2$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

Distribution and 2019

- Temperatures in 2019 were above average during periods of May, June, August and early September. New record high daily mean temperatures were set in all three of these time periods.
- Lower than normal temperatures occurred episodically during February, March, October, November and December and coincided with unusually low flow.
- The highest temperatures occur in July and August.
- Temperature was not monitored at this site from November 2004 through January 2012.

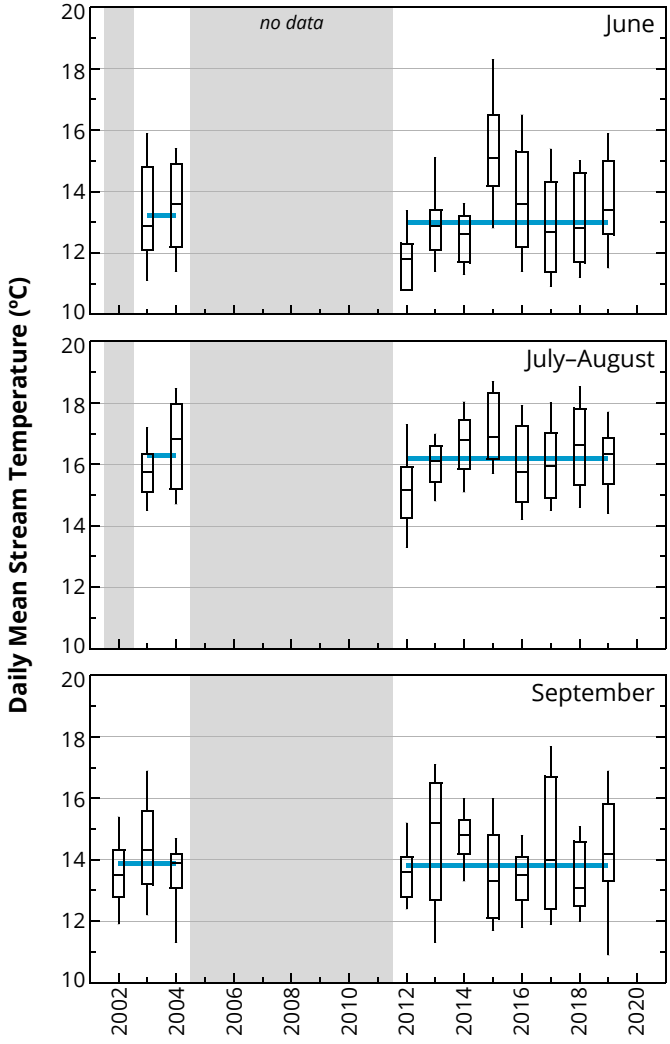
Trends

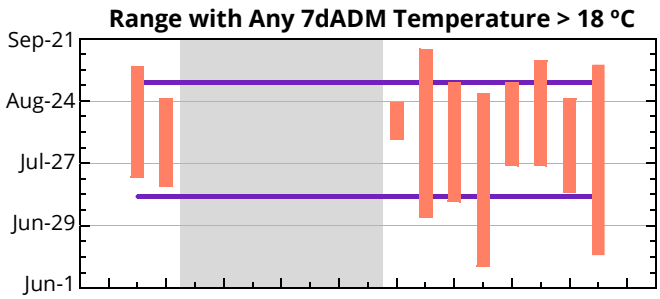
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June. Year-to-year variability is less in September than in the earlier summer months.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

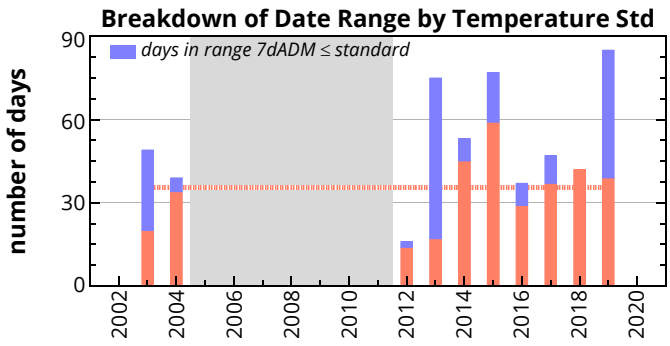
Oregon water temperature standard

- Exceedances of the water temperature standard occurred in all years for which data were available.
- Days when the 7dADM did not exceed the standard frequently occurred within the date range of exceedances. Days that did not exceed the standard but occurred within the range when exceedances occurred varied from none (2018) to more than half the range, as in 2019.

fraction of years with any exceedance	100%
median days/year exceeding standard	34
average first day of exceedance (if it occurred)	Jul-12
average last day of exceedance (if it occurred)	Sep-1





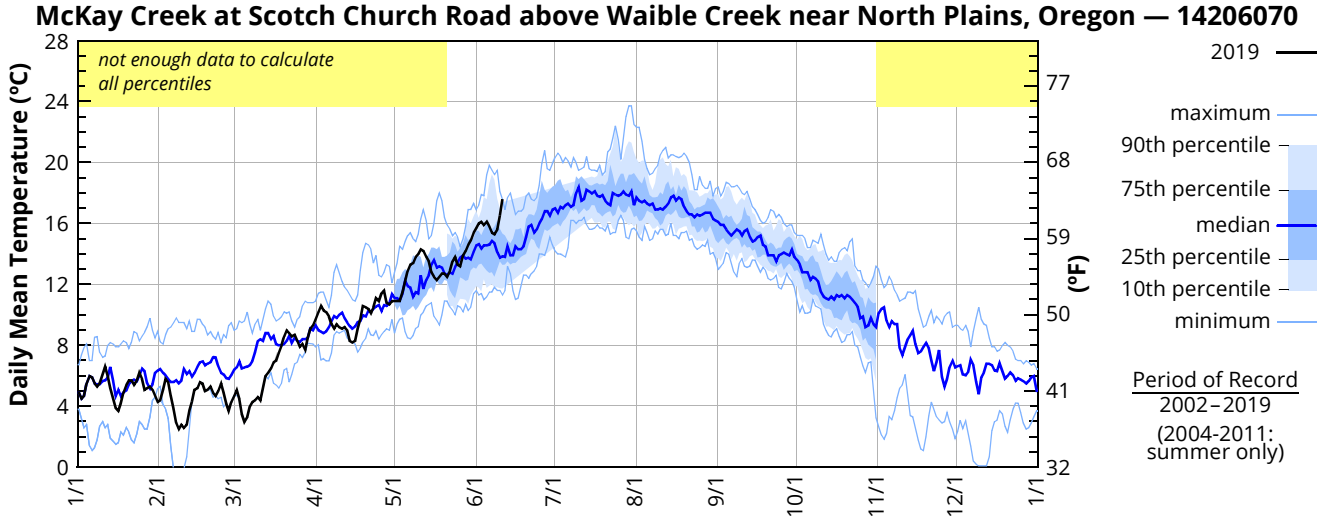


Data source: WEST Consultants for Clean Water Services
River mile: 6.3 *Latitude:* 45 57 21 *Longitude:* 122 99 18

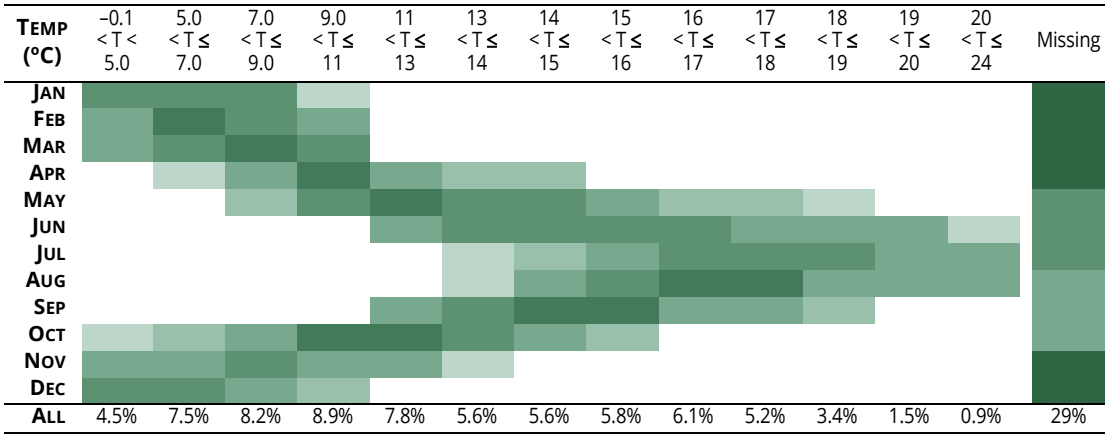
2019 — DAILY MEAN WATER TEMPERATURE (°C) — MCSC

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	4.9	4.4	4.7	9.7	10.9	15.7						
2	4.5	5.1	5.1	10.2	10.9	16.0						
3	4.7	5.8	4.5	10.6	10.9	16.1						
4	5.5	5.6	3.5	10.3	11.5	15.9						
5	6.0	4.7	3.0	10.2	12.2	16.1						
6	5.9	3.8	3.3	9.9	12.9	15.8						
7	5.5	2.9	4.0	9.4	13.3	15.4						
8	5.3	2.5	4.3	9.1	13.4	15.3						
9	5.5	2.8	4.4	9.4	13.8	15.6						
10	6.1	2.6	4.6	9.2	14.0	16.5						
11	6.6	2.8	4.4	9.1	14.3	17.6						
12	6.0	3.7	5.2	9.2	14.2							
13	5.2	4.3	6.0	9.0	13.8							
14	4.5	5.1	6.2	8.3	13.5							
15	3.9	5.2	6.5	8.2	12.8							
16	3.7	5.6	6.9	8.3	12.5							
17	4.2	5.5	7.0	9.1	12.3							
18	4.9	5.0	7.5	9.7	12.5							
19	5.4	5.1	8.0	10.6	12.7							
20	5.7	5.3	8.6	10.5	12.7							
21	5.7	4.9	9.0	10.4	12.5							
22	5.4	4.7	8.8	10.1	12.9							
23	5.7	5.0	8.6	10.5	13.5							
24	6.2	5.5	8.7	11.1	13.8							
25	5.8	4.9	8.3	10.9	13.3							
26	5.1	4.2	7.9	11.4	13.2							
27	5.2	3.7	8.1	11.6	13.9							
28	5.3	4.3	7.7	10.8	14.2							
29	5.1	—	8.5	10.7	14.6							
30	4.7	—	9.1	10.9	14.9							
31	4.3	—	9.3	—	15.4	—			—		—	
Mean	5.2	4.5	6.5	9.9	13.1							
Max	6.6	5.8	9.3	11.6	15.4							
Min	3.7	2.5	3.0	8.2	10.9							

Measurements at this site were suspended in June 2019 because of bridge construction.



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — MCSC



Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2002–2019
(2004-2011: summer only)

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — MCSC

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	5.8	5.7	6.3	9.5	12.1	15.9	18.3	16.7	14.1	9.8	7.0	5.9
2003	6.7	6.2	7.9	9.4	11.0	15.7	18.4	17.5	15.2	12.4	5.3	6.3
2004							20.5	19.3	15.4	12.5		
2005					13.7	14.2	18.2	17.4	13.8	12.2		
2006					12.8	15.1	17.7	16.1	14.8	11.2		
2007					12.9	14.8	17.9	16.6	15.2	10.5		
2008					13.3	13.9	17.5	16.5	14.6	10.4		
2009							19.5	16.9	15.0	10.8		
2010					11.2	12.3	16.7	16.3	14.6	10.3		
2011					10.7	13.7	16.2	16.7	15.2	11.9		
2012	5.6	6.2	6.5	9.7	11.8	14.0	17.1	16.3	13.8	11.0	8.3	7.1
2013	4.0	6.0		10.5	12.9	14.7	17.1	16.7	16.8	9.5	8.6	2.9
2014	3.9	4.6	8.8	10.4	13.5	15.2	18.2	17.9	15.6	13.3	8.3	7.5
2015	7.0	8.6	9.7	10.0	13.8	17.0	18.4	17.7	15.1	13.7	8.7	7.6
2016	7.4	8.4	9.1	11.4	13.8	15.9	16.9	16.7	14.8	12.0	10.6	5.5
2017	3.7	6.2	8.6	9.2	12.3	15.4	17.5	18.0	15.7	10.3	8.2	4.5
2018	7.7	6.6	7.7	9.6	13.9	14.7	17.9	16.7	13.8	10.7	6.1	5.7
2019	5.3	4.8	6.9	10.2	13.3	15.9						
median	5.6	6.2	8.1	9.8	12.8	14.9	17.7	17.0	14.8	11.3	7.9	6.0

Key

T in °C

$T \leq 4.6$
$4.6 < T \leq 5.7$
$5.7 < T \leq 6.6$
$6.6 < T \leq 7.6$
$7.6 < T \leq 9.1$
$9.1 < T \leq 10.8$
$10.8 < T \leq 12.6$
$12.6 < T \leq 15.8$
$15.8 < T \leq 17.7$
$17.7 < T \leq 18.5$
$T > 18.5$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

Distribution and 2019

- Monitoring at this site was discontinued on June 11 because of bridge reconstruction.
- Temperatures in 2019 were above average in May and early June.
- The highest temperatures occur in July and August.
- From 2004 through 2011, temperature was not measured at this site during high flow which is when low temperatures would occur. Consequently, the percentiles are skewed and underrepresent low temperatures.

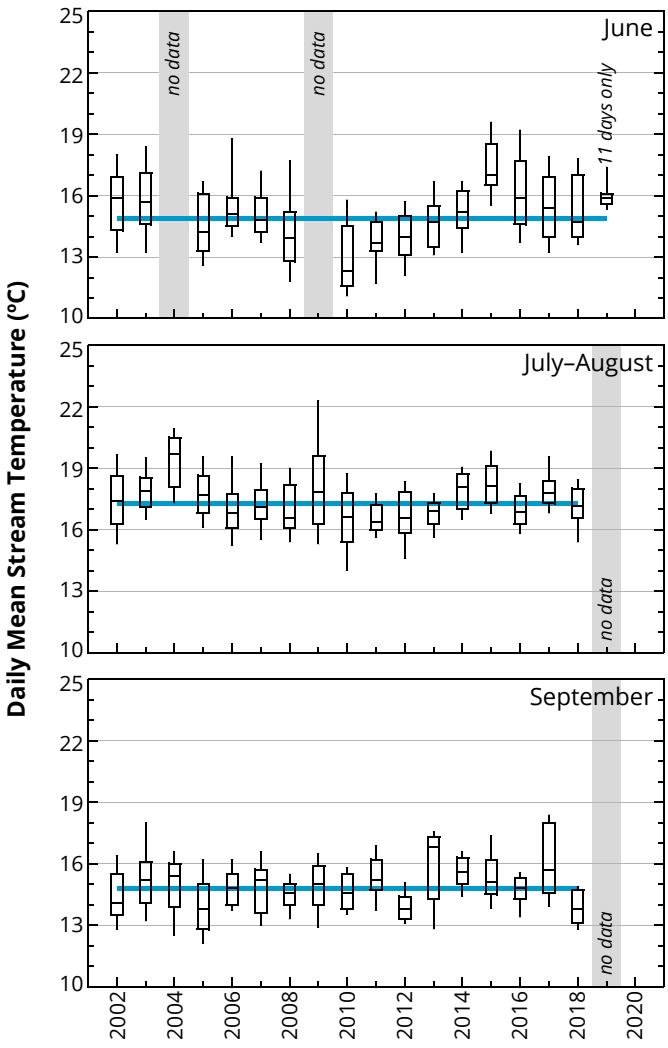
Trends

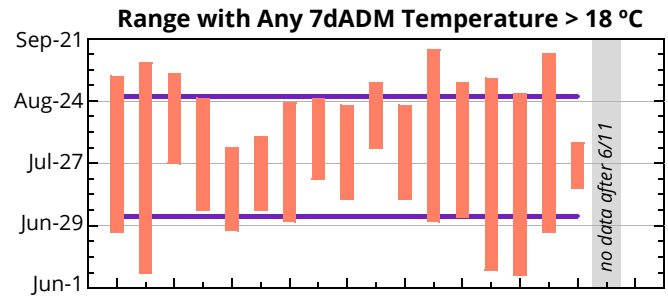
- Water temperatures from June through September do not show any statistically significant trends. The year-to-year variability is considerable, especially in June.
- No trend was evident in the timing of temperature standard exceedances.

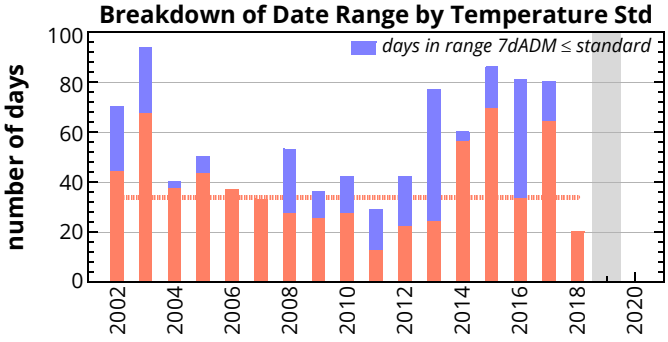
Oregon water temperature standard

- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard frequently occurred within the date range of exceedances. Days that did not exceed the standard but occurred within the date range of exceedances varied from none to more than half the range.

fraction of years with any exceedance	100%
median days/year exceeding standard	34
average first day of exceedance (if it occurred)	Jul-3
average last day of exceedance (if it occurred)	Aug-26







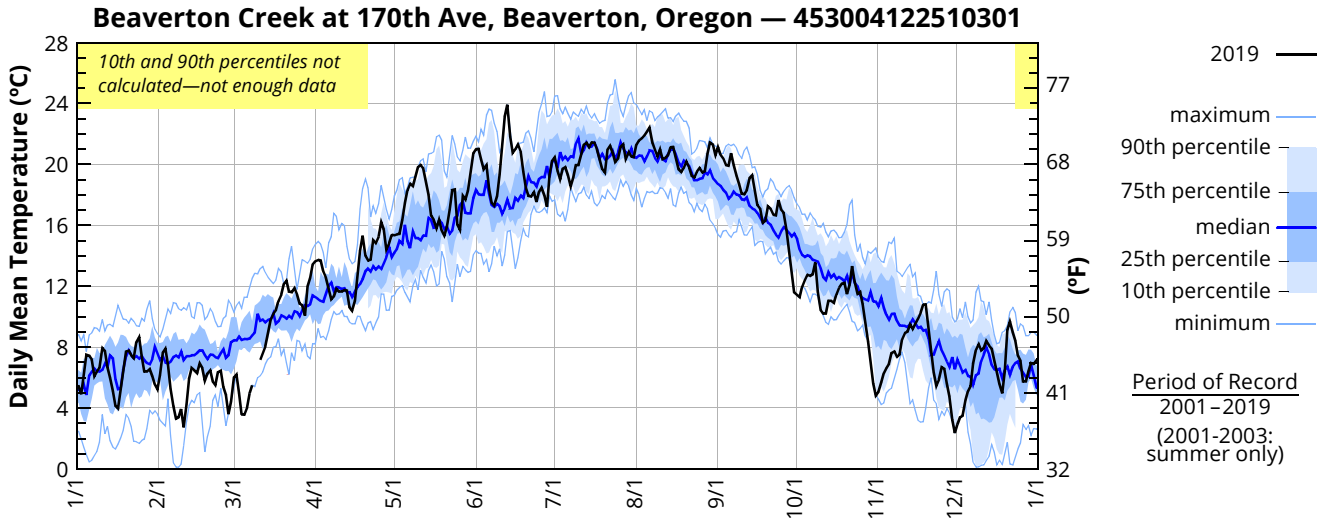
B170 – Beaverton Creek at 170th Ave, Beaverton, OR – 453004122510301

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 4.9 *Latitude:* 45 28 04 *Longitude:* 122 51 03

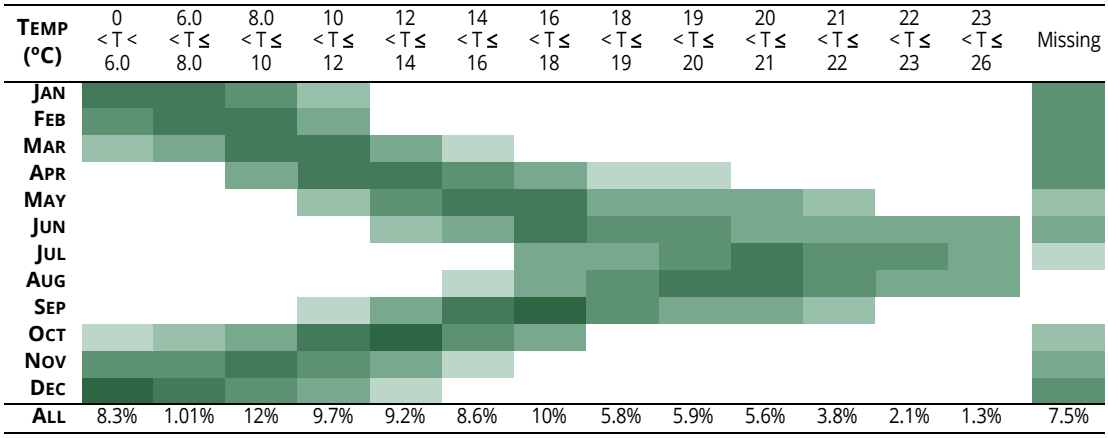
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — B170

DAY	JAN	FEB	MAR*	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.43	6.18	6.02	13.64	15.35	20.99	20.48	21.29	21.12	11.42	5.05	2.93
2	4.92	7.66	6.21	13.73	15.42	21.01	19.56	21.57	20.64	11.27	5.68	3.39
3	6.26	7.91	4.99	13.68	15.44	20.32	19.03	21.71	20.40	11.98	6.29	3.50
4	7.50	6.87	3.59	12.98	16.36	19.70	19.71	21.90	19.95	12.41	6.64	4.52
5	7.43	5.28	3.56	12.57	17.45	19.96	19.83	22.15	19.90	12.77	6.90	5.13
6	7.17	4.14	4.06	11.79	18.32	18.44	19.31	22.42	20.73	12.69	7.62	5.45
7	6.10	3.31	4.98	11.14	18.73	17.50	18.57	21.44	19.97	12.79	7.73	6.93
8	6.43	3.40	5.49	11.33	18.57	17.30	19.12	20.95	19.26	13.57	7.36	7.85
9	6.65	3.94		11.82	19.20	17.92	19.94	20.52	18.71	11.64	7.52	8.20
10	7.96	2.75		11.66	19.82	19.35	19.94	20.97	18.07	10.44	8.52	7.79
11	7.77	4.25	7.18	11.66	19.96	21.15	20.66	20.35	18.03	10.21	8.94	7.94
12	6.68	5.94	7.61	11.75	19.75	23.15	21.29	20.44	18.31	10.20	9.03	8.40
13	6.01	6.64	8.07	11.71	18.86	23.91	21.41	20.61	19.10	11.05	9.49	8.10
14	5.12	6.48	8.90	10.63	18.00	21.84	21.13	21.13	19.28	11.04	9.20	7.91
15	4.16	6.30	9.82	10.40	16.64	20.77	21.43	21.14	18.32	10.90	9.54	7.12
16	3.98	6.92	10.20	11.04	16.35	20.99	21.41	20.46	17.35	11.48	9.88	6.39
17	5.29	6.63	10.44	12.59	15.82	21.32	20.97	19.68	17.10	11.90	10.26	5.61
18	6.48	5.82	11.04	14.34	16.35	20.80	20.36	19.51	16.16	12.16	10.79	4.97
19	7.73	6.27	11.46	15.33	15.64	19.53	19.71	19.79	16.30	12.21	10.82	6.42
20	7.78	6.49	12.15	13.99	15.31	18.45	19.46	20.20	17.24	11.49	9.31	9.14
21	7.48	5.76	12.36	13.70	15.88	17.93	20.97	19.78	17.09	12.08	7.81	9.67
22	7.29	5.51	11.65	13.75	17.02	17.88	21.23	19.25	16.70	13.34	6.33	8.97
23	8.34	6.35	11.62	15.04	18.30	18.19	20.77	19.15	16.66	12.31	5.47	8.42
24	8.68	6.47	11.88	14.85	18.35	17.54	20.15	19.52	17.65	11.50	5.87	7.44
25	7.40	5.39	11.47	15.26	16.02	18.20	20.38	19.75	17.05	11.64	6.69	7.09
26	6.40	4.87	10.88	16.21	15.69	18.48	21.15	19.46	16.83	10.84	6.59	5.76
27	6.41	3.60	10.76	15.74	17.93	17.96	21.32	19.55	15.71	9.62	5.60	5.76
28	6.56	4.43	10.08	14.43	17.67	17.22	20.37	20.66	14.44	8.38	4.76	6.43
29	6.10	—	11.99	14.84	18.27	19.31	20.82	21.44	13.10	7.07	3.23	6.97
30	5.54	—	12.54	15.36	19.50	20.25	20.51	21.31	11.60	5.62	2.36	6.91
31	5.22	—	13.44	—	20.74	—	20.48	20.63	—	4.82	—	7.16
Mean	6.52	5.56	9.12	13.23	17.51	19.58	20.37	20.60	17.76	10.99	7.38	6.72
Max	8.68	7.91	13.44	16.21	20.74	23.91	21.43	22.42	21.12	13.57	10.82	9.67
Min	3.98	2.75	3.56	10.40	15.31	17.22	18.57	19.15	11.60	4.82	2.36	2.93

†Data after October 30, 2019 are provisional—subject to revision; *Incomplete record



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — B170



Temp (°C)	0 < T < 6.0	6.0 < T ≤ 8.0	8.0 < T ≤ 10	10 < T ≤ 12	12 < T ≤ 14	14 < T ≤ 16	16 < T ≤ 18	18 < T ≤ 19	19 < T ≤ 20	20 < T ≤ 21	21 < T ≤ 22	22 < T ≤ 23	23 < T ≤ 26	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
Jul														
Aug														
Sep														
Oct														
Nov														
Dec														
All	8.3%	1.01%	12%	9.7%	9.2%	8.6%	10%	5.8%	5.9%	5.6%	3.8%	2.1%	1.3%	7.5%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

Period of Record
2001–2019

(2001-2003: summer only)

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — B170

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001					17.6		20.4	20.4	17.9	12.6		
2002					15.2	18.7	21.6	19.7	17.1	12.7	9.3	
2003					14.5	20.0	21.8	20.4	17.4	14.3	7.3	
2004		8.2	11.3	13.2	16.3	19.0	22.4	22.1	17.7	14.3	9.0	6.9
2005	5.7	6.9	10.3	11.7	15.7	17.1	21.1	20.6	16.1	13.9	8.1	5.7
2006	8.3	7.3	8.7	12.6	15.8	18.3	21.6	19.5	16.4	12.3	9.4	6.3
2007	5.1	7.8	10.6	12.0	16.3	18.3	20.9	18.9	16.6	12.1	8.4	6.2
2008	5.3	7.1	8.8	10.4	14.9	16.8	19.8	19.1	16.5	11.4	9.5	5.5
2009	4.7	5.8	8.2	12.0	15.0	18.8	20.7	19.0	17.1	11.7	8.7	3.5
2010	8.1	8.9	9.9	12.4	13.9	15.5	19.7	19.2	16.6	12.2	9.5	7.6
2011	7.4	6.4	9.0	10.5	13.4	17.2	19.2	20.0	17.3	12.9	8.5	4.3
2012	6.4	7.5	8.5	12.3	15.2	17.0	20.4	20.2	16.5	12.7	9.6	7.3
2013	4.6	7.6	9.5	12.3	15.7	18.2	20.6	20.2	18.1	11.4	10.0	4.5
2014	5.5	7.1	10.2	12.5	16.8	18.3	21.8	20.8	17.8	14.7	9.8	8.3
2015	7.5	9.9	11.5	12.5	16.6	19.9	21.3	19.7	15.9	13.9	9.6	8.0
2016	8.0	9.5	10.9	14.6	16.8	18.8	19.5	19.6	16.2	13.5	11.9	5.9
2017	3.6	7.2	10.1	11.9	17.3	19.4	21.2	20.2	16.9	12.3	9.5	5.0
2018	8.1	7.1	9.6	12.6	17.8	18.6	21.1	20.2	16.0	12.5	7.9	7.4
2019	6.5	5.9	10.2	13.7	17.7	19.4	20.5	20.6	17.8	11.5	7.4	7.0
median	6.6	7.5	9.7	12.3	15.9	18.3	20.8	20.0	16.9	12.8	9.1	6.6

Key

T in °C

- $T \leq 4.7$
- $4.7 < T \leq 6.2$
- $6.2 < T \leq 7.2$
- $7.2 < T \leq 8.1$
- $8.1 < T \leq 9.5$
- $9.5 < T \leq 11.3$
- $11.3 < T \leq 13.3$
- $13.3 < T \leq 18.2$
- $18.2 < T \leq 20.6$
- $20.6 < T \leq 21.6$
- $T > 21.6$

T as percentile

- $T \leq$ 5th
- 5th $< T \leq$ 10th
- 10th $< T \leq$ 15th
- 15th $< T \leq$ 20th
- 20th $< T \leq$ 30th
- 30th $< T \leq$ 40th
- 40th $< T \leq$ 50th
- 50th $< T \leq$ 75th
- 75th $< T \leq$ 90th
- 90th $< T \leq$ 95th
- $T >$ 95th

DISTRIBUTION AND 2019

- Temperatures in 2019 were above average for periods in May, June and September. New record high daily mean temperatures were set in all three of these time periods.
- The mean daily temperature exceeded 23ºC on two days in June (12–13).
- The highest temperatures occur in July and August.
- The lowest temperatures occur in December and January.

TRENDS

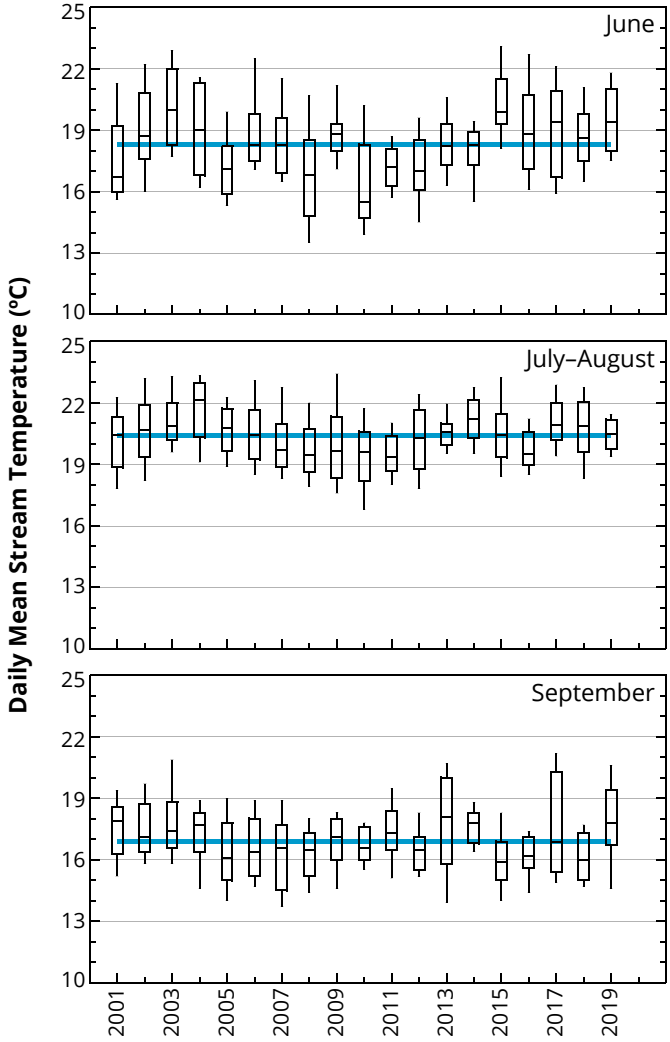
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June.
- The first day when the temperature standard is exceeded appears to be occurring earlier. The trend is statistically significant. In the past 4 years, the first day of the temperature standard exceedance was on May 8 or earlier.
- No trend was evident in number of days with temperature standard exceedances.

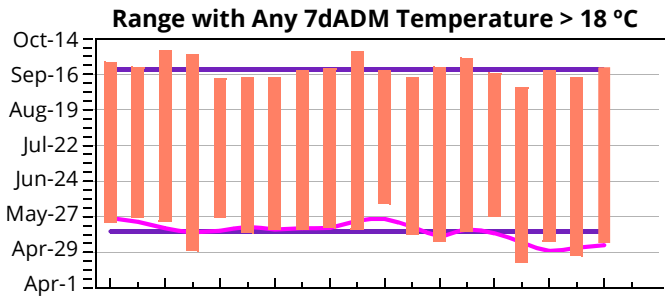
OREGON WATER TEMPERATURE STANDARD

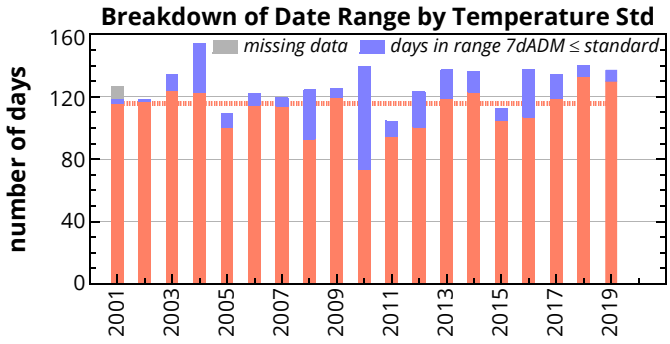
- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard always occurred within the date range of exceedances, but in most years were a minor fraction.

fraction of years with any exceedance	100%
median days/year exceeding standard	116
average first day of exceedance (if it occurred)	May-15
average last day of exceedance (if it occurred)	Sep-19

- In 2001, 7dADM could not be computed for 8 days in June because of gaps in the temperature data. Based on data from the surrounding days, most of these days likely had 7dADMs that exceeded the temperature standard.







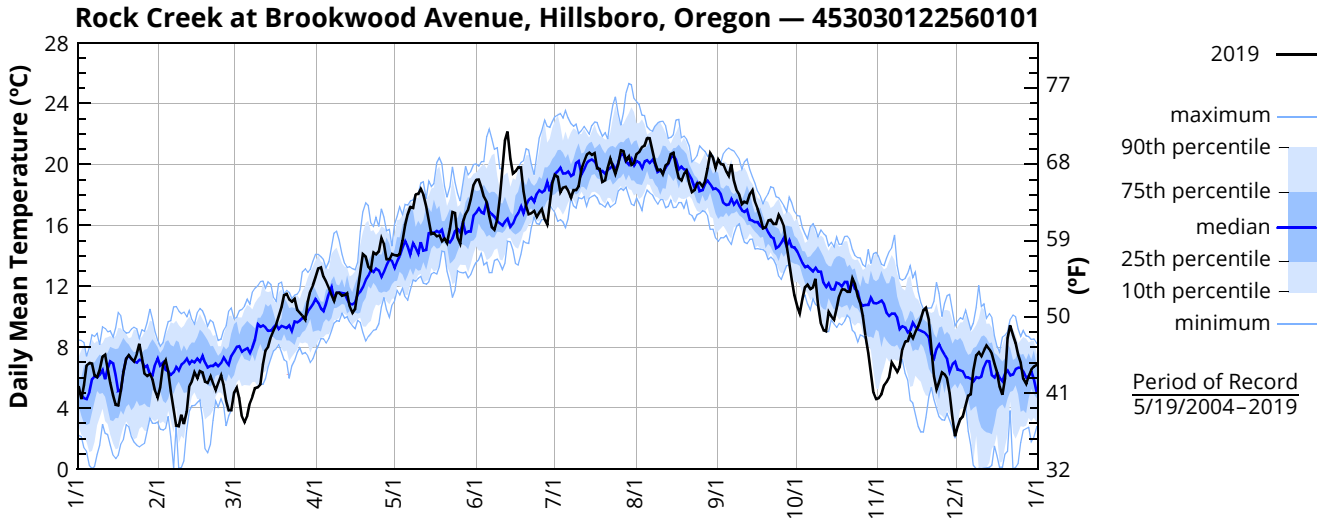
RCBR – Rock Creek at Brookwood Avenue, Hillsboro, OR – 453030122560101

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 2.4 *Latitude:* 45 30 30 *Longitude:* 122 56 01

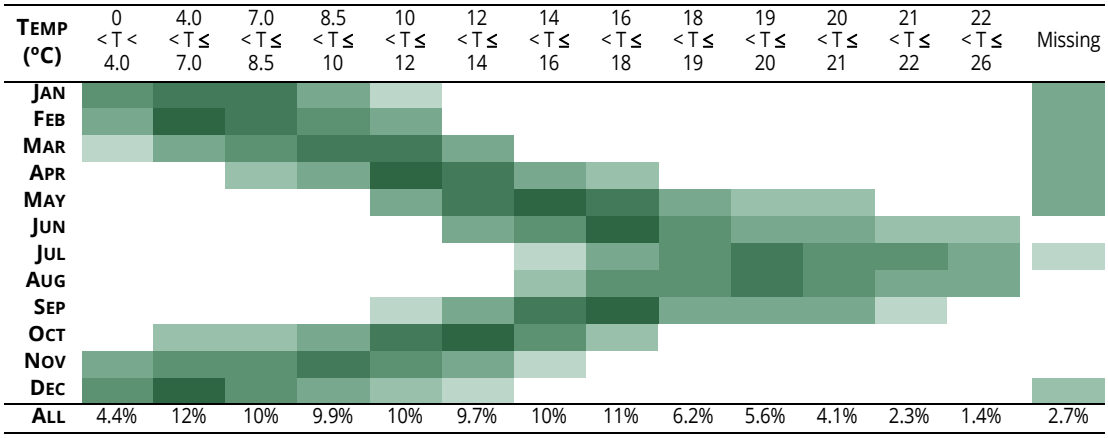
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — RCBR

DAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5.37	5.36	5.03	12.57	14.05	18.98	19.32	20.69	20.30	10.69	4.65	2.79
2	4.59	6.85	5.36	13.18	14.00	19.00	19.19	20.81	20.01	10.22	4.92	3.28
3	5.51	7.16	4.63	13.24	14.12	18.50	18.18	21.15	19.99	11.14	5.49	3.45
4	6.80	6.42	3.47	12.61	15.00	17.86	18.48	21.23	19.53	11.92	5.74	4.20
5	6.96	5.15	3.09	12.30	16.00	17.52	18.55	21.73	19.24	12.10	6.05	4.82
6	6.92	3.95	3.52	11.87	16.72	16.61	18.27	21.72	20.01	11.83	6.99	4.92
7	6.16	2.86	4.35	11.43	17.20	15.87	17.80	20.85	18.93	11.92	6.68	6.47
8	6.04	2.81	4.77	11.02	17.13	15.71	18.32	20.11	18.26	12.49	6.38	7.47
9	6.50	3.56	5.30	11.57	18.04	16.38	18.31	19.62	18.00	10.79	6.72	7.66
10	7.38	2.96	5.38	11.57	18.06	17.81	18.56	19.66	17.38	9.53	7.88	7.42
11	7.51	3.77	5.57	11.39	18.39	19.72	19.68	19.35	17.56	9.11	8.37	7.79
12	6.61	5.46	6.89	11.42	18.01	21.57	20.21	19.94	17.48	9.04	8.40	8.12
13	5.67	5.77	7.78	11.55	17.23	22.16	20.65	20.07	18.06	10.30	8.89	7.88
14	4.83	6.33	8.02	10.67	16.33	20.37	20.76	20.69	18.30	10.04	8.59	7.55
15	4.21	5.97	8.71	10.26	15.43	19.40	20.63	20.76	17.53	9.81	9.02	6.92
16	4.17	6.45	9.11	10.54	15.50	19.54	20.74	19.91	17.10	10.53	9.39	6.35
17	5.14	6.35	9.46	11.66	15.28	19.80	19.74	19.09	16.49	11.37	9.85	5.44
18	6.33	5.75	10.01	12.84	15.35	19.81	19.70	18.95	15.81	11.80	10.41	4.90
19	7.27	5.66	10.63	14.10	14.94	18.25	18.86	19.38	15.87	11.77	10.58	5.95
20	7.49	6.11	11.43	13.95	15.12	17.27	18.97	19.59	16.31	11.63	9.80	8.59
21	7.27	5.63	11.50	13.30	14.83	16.74	19.75	18.74	16.35	11.63	7.80	9.43
22	7.07	5.19	11.12	13.09	15.77	16.79	20.36	18.18	16.09	12.53	6.11	8.79
23	7.57	5.66	10.98	14.21	16.89	16.95	19.86	18.30	16.08	12.15	5.24	8.29
24	8.22	6.18	11.17	14.09	16.81	16.54	19.39	18.75	16.68	11.35	5.70	7.51
25	7.33	5.53	10.45	14.27	15.17	16.84	20.01	18.81	16.36	10.89	6.34	6.98
26	6.25	4.48	10.26	15.15	14.79	17.08	20.92	18.57	15.94	10.04	6.21	5.92
27	6.10	3.86	10.07	14.77	16.22	16.37	20.88	18.89	14.73	8.78	5.93	5.58
28	6.23	3.87	9.80	13.78	16.76	16.04	20.27	19.74	13.60	7.62	5.00	6.10
29	5.87	—	10.99	13.77	17.04	17.33	20.54	20.73	12.44	6.29	3.36	6.54
30	5.13	—	11.69	14.13	17.71	18.77	19.97	20.42	11.43	5.02	2.17	6.73
31	4.67	—	12.07	—	18.66	—	20.10	19.76	—	4.60	—	6.85
Mean	6.23	5.18	8.15	12.68	16.21	18.05	19.58	19.88	17.06	10.29	6.96	6.47
Max	8.22	7.16	12.07	15.15	18.66	22.16	20.92	21.73	20.30	12.53	10.58	9.43
Min	4.17	2.81	3.09	10.26	14.00	15.71	17.80	18.18	11.43	4.60	2.17	2.79

†Data after December 16, 2019 are provisional—subject to revision



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — RCBR



TEMP (°C)	0 < T < 4.0	4.0 < T ≤ 7.0	7.0 < T ≤ 8.5	8.5 < T ≤ 10	10 < T ≤ 12	12 < T ≤ 14	14 < T ≤ 16	16 < T ≤ 18	18 < T ≤ 19	19 < T ≤ 20	20 < T ≤ 21	21 < T ≤ 22	22 < T ≤ 26	Missing
JAN														
FEB														
MAR														
APR														
MAY														
JUN														
JUL														
AUG														
SEP														
OCT														
NOV														
DEC														
ALL	4.4%	12%	10%	9.9%	10%	9.7%	10%	11%	6.2%	5.6%	4.1%	2.3%	1.4%	2.7%

KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2004–2019

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — RCBR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004						18.4	21.3	20.5	16.5	13.7	8.5	6.4
2005	5.4	6.1	9.8	11.3	15.3	16.4	20.0	19.8	15.1	13.4	7.6	5.7
2006	8.1	6.6	8.3	12.4	15.0	17.6	20.3	18.4	15.7	11.5	9.2	6.0
2007	4.3	7.6	9.9	11.4	14.9	16.8	19.8	18.3	16.0	11.8	8.0	6.3
2008	4.4	6.5	8.3	9.9	14.7	15.6	19.0	18.8	15.9	10.5	9.4	4.9
2009	4.3	4.8	7.9	11.6	14.6	18.0	20.4	19.0	16.6	11.4	8.6	3.2
2010	7.9	8.6	9.3	11.9	13.6	15.0	18.6	18.3	16.3	11.5	9.3	7.3
2011	7.1	6.0	8.6	10.1	12.9	16.2	18.1	18.9	16.8	12.8	8.0	3.9
2012	6.0	7.1	7.9	11.6	14.4	16.4	19.5	19.5	15.7	12.1	9.2	7.1
2013	4.0	7.0	9.2	12.1	15.0	17.4	19.5	19.9	18.1	10.6	9.6	3.9
2014	4.9	6.9	9.7	12.3	16.1	17.4	20.9	20.4	17.4	14.6	9.5	8.2
2015	7.1	9.4	11.2	12.0	15.5	19.1	21.0	19.7	15.4	13.4	9.5	7.6
2016	7.7	8.8	10.4	13.7	15.8	17.7	18.9	19.1	15.8	13.4	11.9	5.5
2017	3.0	6.8	9.7	11.3	16.0	18.2	20.0	20.0	16.3	11.7	9.1	4.7
2018	7.9	6.7	9.2	12.0	16.7	17.1	20.9	19.9	15.3	11.9	7.5	7.1
2019	6.3	5.6	9.1	12.7	16.2	17.7	19.7	19.8	17.2	10.8	6.5	6.7
median	6.2	6.9	9.2	11.8	15.1	17.3	19.8	19.5	16.2	12.2	8.9	6.2

KEY

T in °C

$T \leq 4.2$
$4.2 < T \leq 5.7$
$5.7 < T \leq 6.7$
$6.7 < T \leq 7.5$
$7.5 < T \leq 8.8$
$8.8 < T \leq 10.4$
$10.4 < T \leq 12.4$
$12.4 < T \leq 17.2$
$17.2 < T \leq 19.7$
$19.7 < T \leq 20.7$
$T > 20.7$

T as percentile

$T \leq$ 5th
5th < T ≤ 10th
10th < T ≤ 15th
15th < T ≤ 20th
20th < T ≤ 30th
30th < T ≤ 40th
40th < T ≤ 50th
50th < T ≤ 75th
75th < T ≤ 90th
90th < T ≤ 95th
T > 95th

DISTRIBUTION AND 2019

- Temperatures in 2019 were above average for periods in May, June, and late-August through early-September. New record high daily mean temperatures were set in all three of these time periods, including seven consecutive days in June (11-17).
- July had temperatures that were much closer to the period of record median and lower than the past two years.
- The highest temperatures occur in July and August.
- The lowest temperatures occur in December and January.

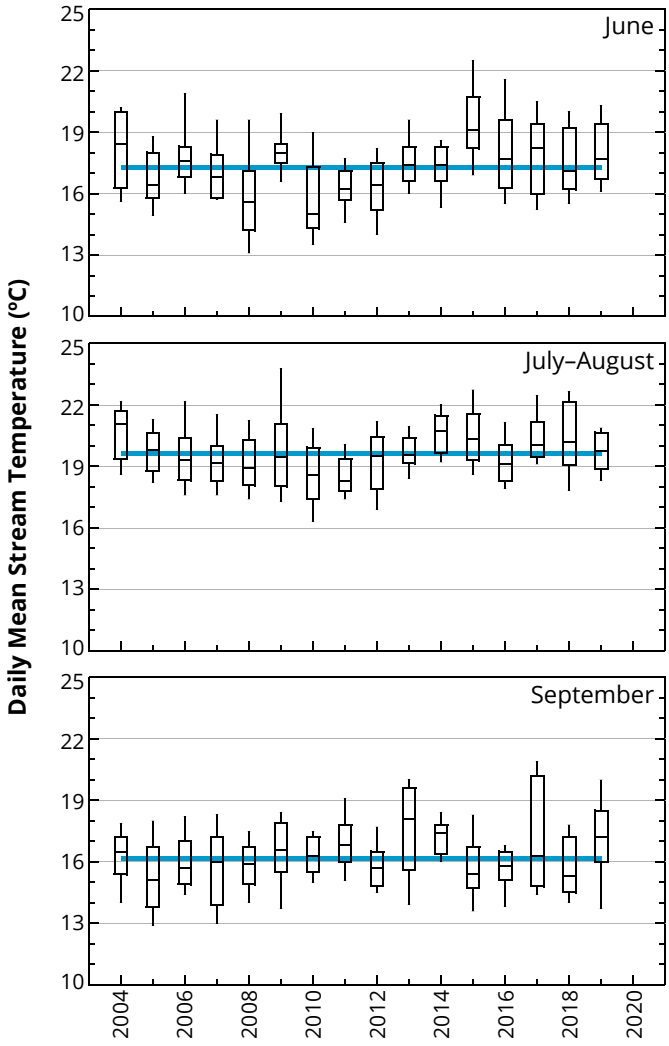
TRENDS

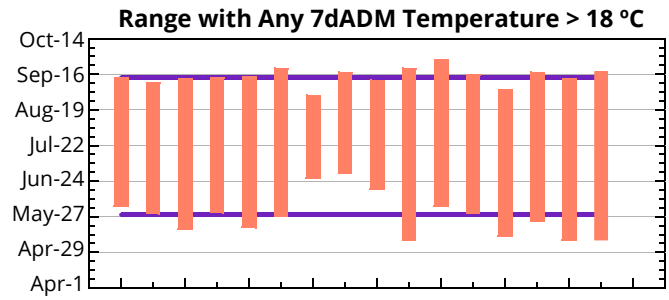
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

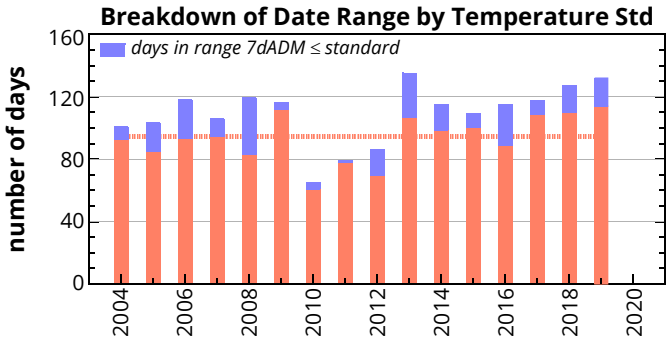
OREGON WATER TEMPERATURE STANDARD

- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard frequently occurred within the date range of exceedances, but were a minor fraction.

fraction of years with any exceedance	100%
median days/year exceeding standard	95
average first day of exceedance (if it occurred)	May-28
average last day of exceedance (if it occurred)	Sep-13







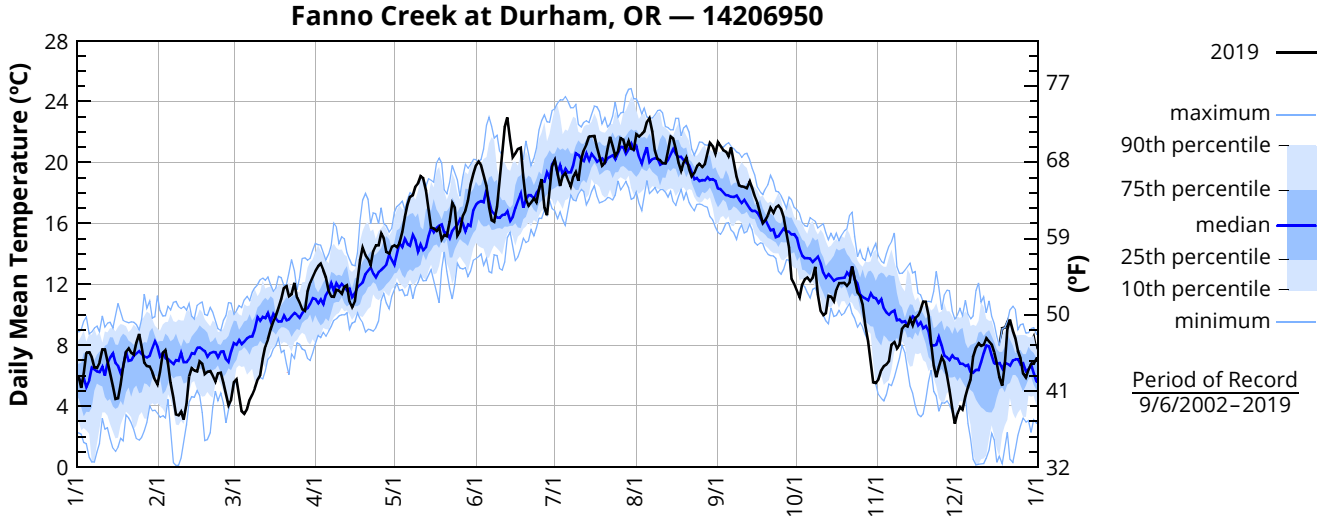
FANO – FANNO CREEK AT DURHAM, OR – 14206950

Data source: U.S. Geological Survey, Oregon Water Science Center
River mile: 1.2 *Latitude:* 45 24 13 *Longitude:* 122 45 13

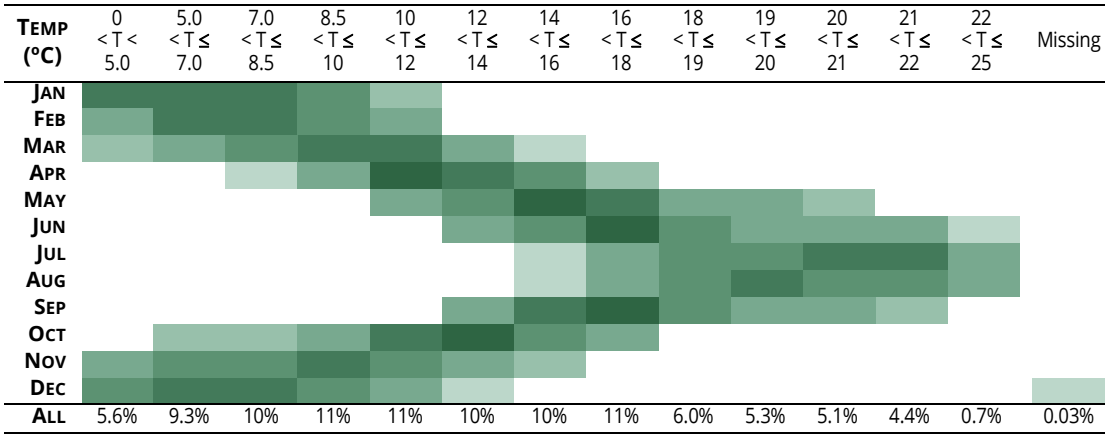
2019 — DAILY MEAN WATER TEMPERATURE (°C)† — FANO

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.97	6.24	5.58	12.88	14.55	19.80	20.17	21.83	21.31	11.55	5.75	3.52
2	5.21	7.50	5.78	13.19	14.43	20.06	19.29	21.70	21.07	11.13	6.36	3.94
3	6.17	7.66	4.77	13.35	14.70	19.80	18.45	21.86	20.81	11.98	6.64	3.78
4	7.51	6.81	3.67	12.93	15.44	19.17	19.10	22.03	20.70	12.33	6.74	4.64
5	7.53	5.55	3.51	12.48	16.42	18.43	19.30	22.66	20.38	12.46	6.95	5.24
6	7.21	4.55	3.81	11.55	17.22	17.08	18.85	22.92	20.98	12.23	8.05	5.75
7	6.54	3.47	4.43	11.19	17.74	16.21	18.39	22.00	20.03	12.43	8.21	7.25
8	6.51	3.39	4.76	11.16	17.84	16.11	19.06	20.76	19.07	13.15	7.79	7.86
9	6.87	3.66	5.16	11.64	18.42	17.10	19.39	20.23	18.50	11.33	8.04	8.13
10	7.72	3.13	5.75	11.58	18.62	18.62	18.79	20.16	18.41	10.23	9.09	7.96
11	7.72	4.18	6.05	11.38	19.09	20.44	20.23	19.95	18.39	9.97	9.32	8.03
12	6.93	5.93	7.11	11.84	18.96	22.33	20.84	19.93	18.30	10.09	9.24	8.48
13	6.18	6.48	7.93	11.95	18.15	22.96	21.18	20.75	18.77	11.23	9.74	8.25
14	5.30	6.33	8.38	10.85	16.93	21.46	21.69	21.69	18.32	11.19	9.29	8.07
15	4.48	6.28	9.06	10.49	15.71	20.35	21.72	21.57	17.77	10.87	9.78	7.54
16	4.51	6.93	9.58	10.92	15.66	20.59	21.74	20.90	17.35	11.67	9.95	6.83
17	5.42	6.78	9.95	12.21	15.49	20.89	21.00	19.96	16.64	12.08	10.32	5.91
18	6.60	6.11	10.43	13.56	15.73	20.98	20.36	19.44	16.02	12.07	10.85	5.36
19	7.57	6.26	11.05	14.41	14.94	19.03	19.78	20.01	16.21	12.09	10.85	6.73
20	7.78	6.30	11.75	13.91	15.24	17.57	20.00	20.32	16.55	11.90	9.96	9.04
21	7.50	5.98	11.88	13.67	15.17	17.16	20.87	19.58	17.01	12.12	8.13	9.67
22	7.37	5.60	11.22	13.25	16.12	17.36	21.67	19.09	16.69	13.17	6.68	8.96
23	8.15	6.15	11.34	14.20	17.32	17.63	21.09	19.31	17.04	12.34	5.90	8.47
24	8.73	6.19	12.09	14.56	17.00	17.37	20.44	19.74	17.17	11.46	6.57	7.65
25	7.88	5.54	11.13	14.55	15.21	18.23	20.75	19.91	16.95	11.25	7.19	7.16
26	6.86	4.82	10.79	15.33	15.49	18.89	21.58	19.69	16.41	10.67	6.87	6.14
27	6.63	4.08	10.38	15.01	16.51	17.04	21.50	19.89	15.34	9.34	6.07	5.88
28	6.60	4.43	10.26	14.13	16.84	16.54	20.87	20.60	14.43	8.27	5.09	6.41
29	6.23	—	11.53	14.03	17.49	18.20	21.40	21.30	12.33	6.90	3.84	6.80
30	5.73	—	12.11	14.47	18.53	19.79	20.89	21.07	12.01	5.57	2.86	6.79
31	5.41	—	12.50	—	19.25	—	20.84	20.58	—	5.52	—	7.13
Mean	6.67	5.58	8.51	12.89	16.65	18.91	20.36	20.69	17.70	10.92	7.74	6.88
Max	8.73	7.66	12.50	15.33	19.25	22.96	21.74	22.92	21.31	13.17	10.85	9.67
Min	4.48	3.13	3.51	10.49	14.43	16.11	18.39	19.09	12.01	5.52	2.86	3.52

†Data after December 12, 2019 are provisional—subject to revision



FREQUENCY OF DAILY MEAN TEMPERATURE BY MONTH — FANO



KEY

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

Period of Record
2003–2019

7

MEDIAN OF DAILY MEAN TEMPERATURE BY MONTH AND YEAR — FANO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002									15.7	12.0	9.1	7.1
2003	7.8	7.8	10.0	11.9	14.0	17.8	20.3	19.5	16.5	14.1	7.1	7.6
2004	6.3	7.9	11.0	12.5	15.5	18.1	21.1	20.8	16.7	13.8	9.0	6.9
2005	5.6	6.7	10.0	11.5	15.4	16.3	20.0	19.7	15.6	13.7	8.0	5.9
2006	8.3	7.0	8.6	12.3	15.1	17.4	20.3	18.6	15.8	11.8	9.6	6.4
2007	5.0	7.6	10.3	11.6	14.8	16.9	20.0	18.6	16.6	12.1	8.8	6.6
2008	5.6	7.2	8.5	9.8	14.5	15.8	19.4	18.9	16.1	11.2	9.9	5.6
2009	4.9	5.8	8.0	11.7	14.9	18.0	20.8	19.1	17.0	11.8	8.9	4.1
2010	8.1	8.8	9.7	12.0	13.7	15.0	19.1	19.0	16.4	12.1	9.6	7.4
2011	7.6	6.2	8.8	10.4	13.1	16.2	18.1	19.5	17.1	13.2	8.6	4.5
2012	6.6	7.5	8.2	12.2	14.8	16.6	19.7	19.6	16.4	12.6	9.8	7.4
2013	4.2	7.5	9.4	12.3	15.2	17.8	20.0	20.3	18.2	11.4	9.9	4.9
2014	5.8	7.0	10.0	12.6	16.5	17.7	21.4	21.0	17.9	14.7	9.8	8.2
2015	7.4	9.8	11.7	12.5	15.7	20.0	21.8	20.4	16.2	14.2	9.6	8.0
2016	7.9	9.4	10.6	14.1	16.2	18.4	19.3	20.3	16.6	13.5	11.9	6.0
2017	3.2	7.0	9.9	11.6	15.9	18.4	20.5	20.5	17.0	12.4	9.6	5.4
2018	8.1	7.1	9.3	12.1	17.0	17.9	21.7	20.8	16.0	12.6	8.5	7.6
2019	6.6	6.0	9.6	13.1	16.5	18.8	20.8	20.6	17.6	11.5	7.9	7.1
median	6.7	7.4	9.6	12.0	15.3	17.6	20.2	19.9	16.6	12.8	9.1	6.8

KEY

T in °C

$T \leq 4.9$
$4.9 < T \leq 6.2$
$6.2 < T \leq 7.1$
$7.1 < T \leq 7.8$
$7.8 < T \leq 9.1$
$9.1 < T \leq 10.6$
$10.6 < T \leq 12.5$
$12.5 < T \leq 17.2$
$17.2 < T \leq 19.9$
$19.9 < T \leq 21.0$
$T > 21.0$

T as percentile

$T \leq$ 5th
5th $< T \leq$ 10th
10th $< T \leq$ 15th
15th $< T \leq$ 20th
20th $< T \leq$ 30th
30th $< T \leq$ 40th
40th $< T \leq$ 50th
50th $< T \leq$ 75th
75th $< T \leq$ 90th
90th $< T \leq$ 95th
$T >$ 95th

DISTRIBUTION AND 2019

- Temperatures in 2019 were above average for periods in May, June, and late-August through early-September. New record high daily mean temperatures were set in all three of these time periods, including eight consecutive days in June (11-18).
- July had temperatures that were close to the period of record median.
- The highest temperatures occur in July and August.
- The lowest temperatures occur in December and January.

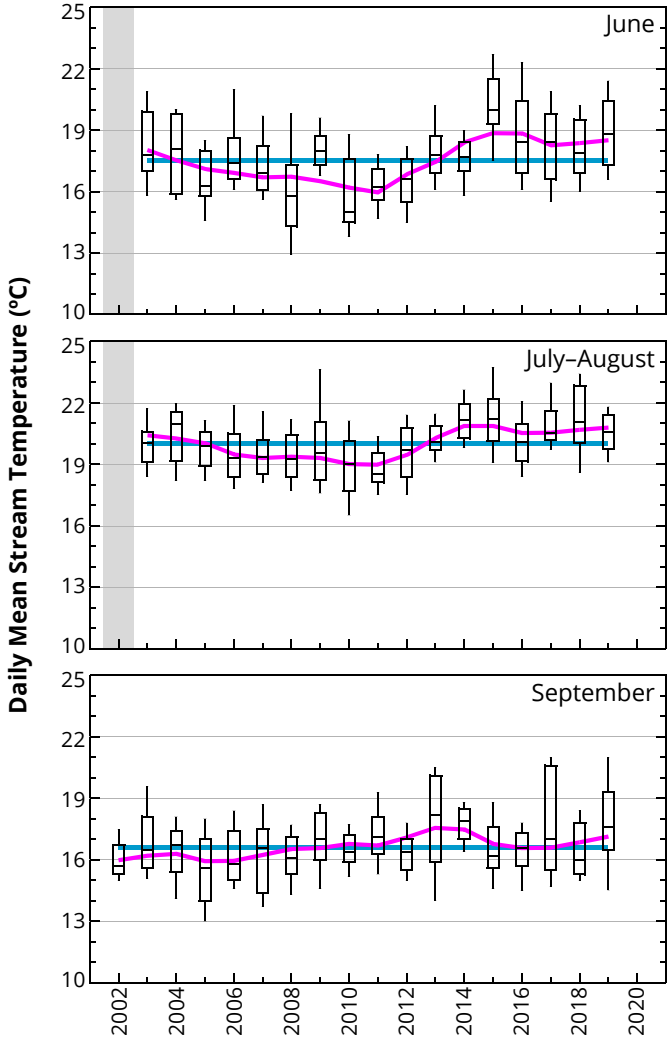
TRENDS

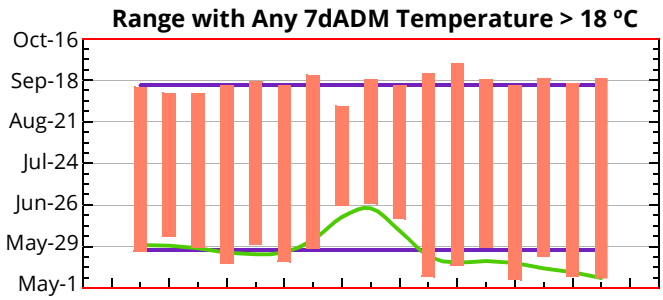
- Water temperatures in June, July–August and September all show an increasing trend. The trend is weak but statistically significant. The increase is small and the period of record is relatively short. More years will be required to know if this trend persists.
- Both the timing of and number of days with temperature standard exceedances may be trending. Whether the trends will persist is unknown.
- The first day when the temperature standard is exceeded is highly variable and may be occurring earlier, although the trend is not statistically significant.
- The number of days when the temperature standard is exceeded may have increased. In every year since 2013 the temperature standard was exceeded on at least 108 days. From 2003 to 2012, the number of days that exceeded the standard reached 108 days only once and 100 days only once (122 days in 2019). The change is statistically significant.

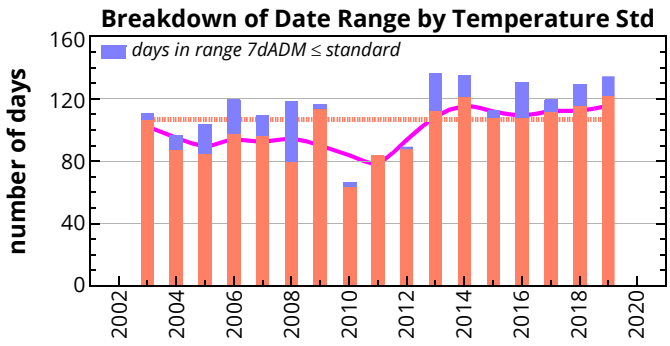
OREGON WATER TEMPERATURE STANDARD

- Exceedances of the water temperature standard occurred in all years.
- Days when the 7dADM did not exceed the standard frequently occurred within the date range of exceedances, but were a minor fraction.

fraction of years with any exceedance	100%
median days/year exceeding standard	107
average first day of exceedance (if it occurred)	May-26
average last day of exceedance (if it occurred)	Sep-14







DATA SOURCES

Data for the statistical distributions were obtained from the USGS database and from previous Tualatin River Flow Management Reports. For some sites, the data were collected by different organizations over the period of record; it is not known if these data are fully comparable with one another.

DATA SOURCES

SITE ID	SITE NAME	START DATE	SOURCES OF DATA FOR DISTRIBUTION
Mainstem Tualatin River and Scoggins Creek sites			
14202980	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4/30/2002	USGS database: all (data collected by USGS)
14203500	Tualatin River at Dilley, Oregon	5/16/1997	USGS database: 2016–present; previous Flow Reports: 1997–2000 (data collected by: OWRD 1997—2007, consultant 2008–2011, USGS 2016–present)
14206241	Tualatin River at Hwy 219 Bridge	10/15/2004	Stewart Rounds, USGS pers. comm.: all (data collected by: Jackson Bottom Wetland Education Center)
14206694	Tualatin River at RM 24.5 near Scholls, Oregon	5/31/1997	USGS database: all (data collected by USGS; no data collection in winter)
14207200	Tualatin River at Oswego Dam near West Linn, Oregon	5/7/1991	USGS database: all (data collected by USGS)
Tributary sites			
453040123065201 OWRD#: 14204530	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	5/9/2001	USGS database: all (data collected by USGS)
14205400	East Fork Dairy Creek near Meacham Corner, OR	9/6/2002	USGS database: all (data collected by USGS) (no data from 10/28/2004–2/15/2012)
14206070	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	1/1/2002	previous Flow Reports: all (data collected by: OWRD 2002—2007, consultant 2008–present)
453004122510301	Beaverton Creek at 170th, Beaverton, Oregon	5/11/2001	USGS database: all (data collected by: USGS 2001–WY2015, CWS WY2016–present)
453030122560101	Rock Creek at Brookwood Ave, Hillsboro, Oregon	5/19/2004	USGS database: all (data collected by USGS)
14206950	Fanno Creek at Durham Road near Tigard, Oregon	9/6/2002	USGS database: all (data collected by USGS)

Abbreviations: CWS=Clean Water Services; OWRD=Oregon Water Resources Department; USGS=United States Geological Survey; WY=water year

this page intentionally blank

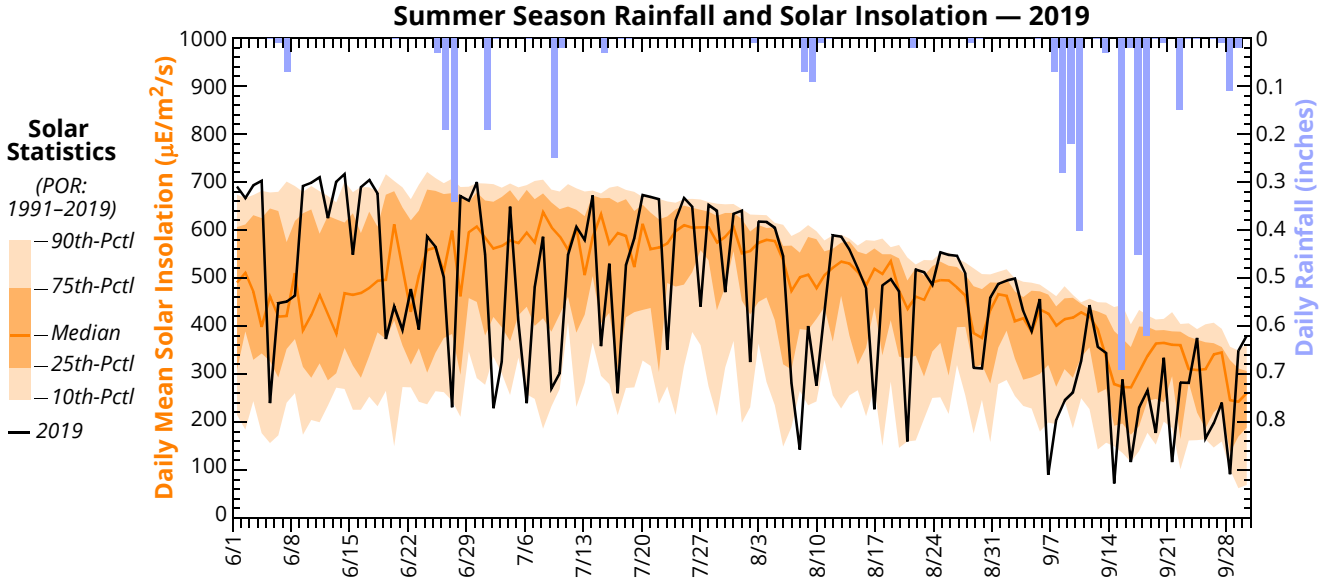
APPENDIX G
PRECIPITATION

SCOPE

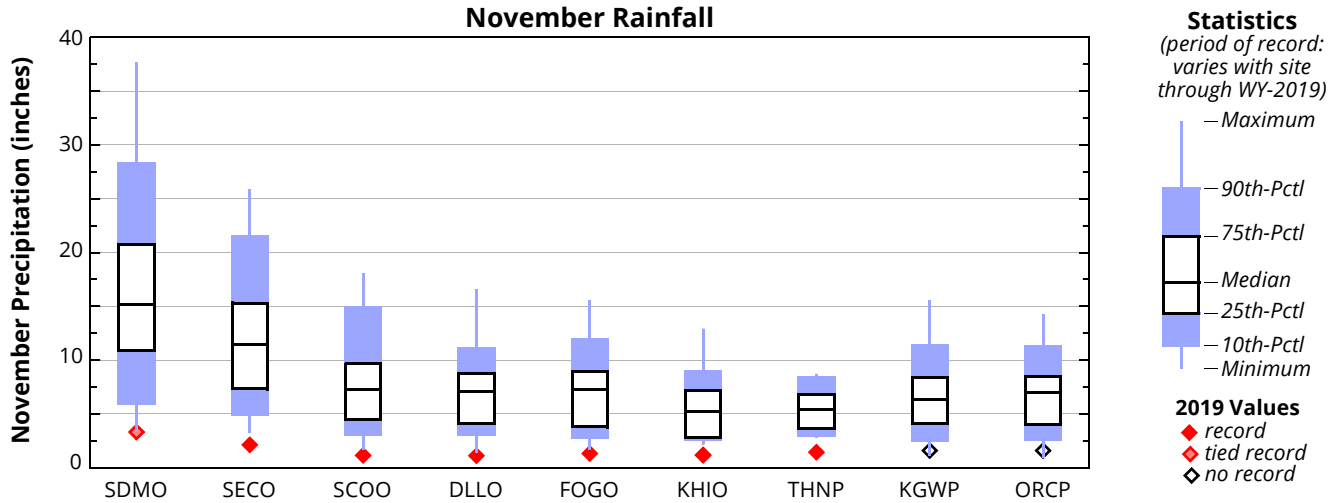
This appendix shows precipitation data for selected sites the Tualatin River Basin. Because relatively few active precipitation monitoring stations with an adequate period of record are located in the basin, three sites are located just outside the basin boundaries. Precipitation may be monitored at other sites in the basin that are not included in the Appendix. Streamflow measurements are in Appendix A.

2019 HIGHLIGHTS

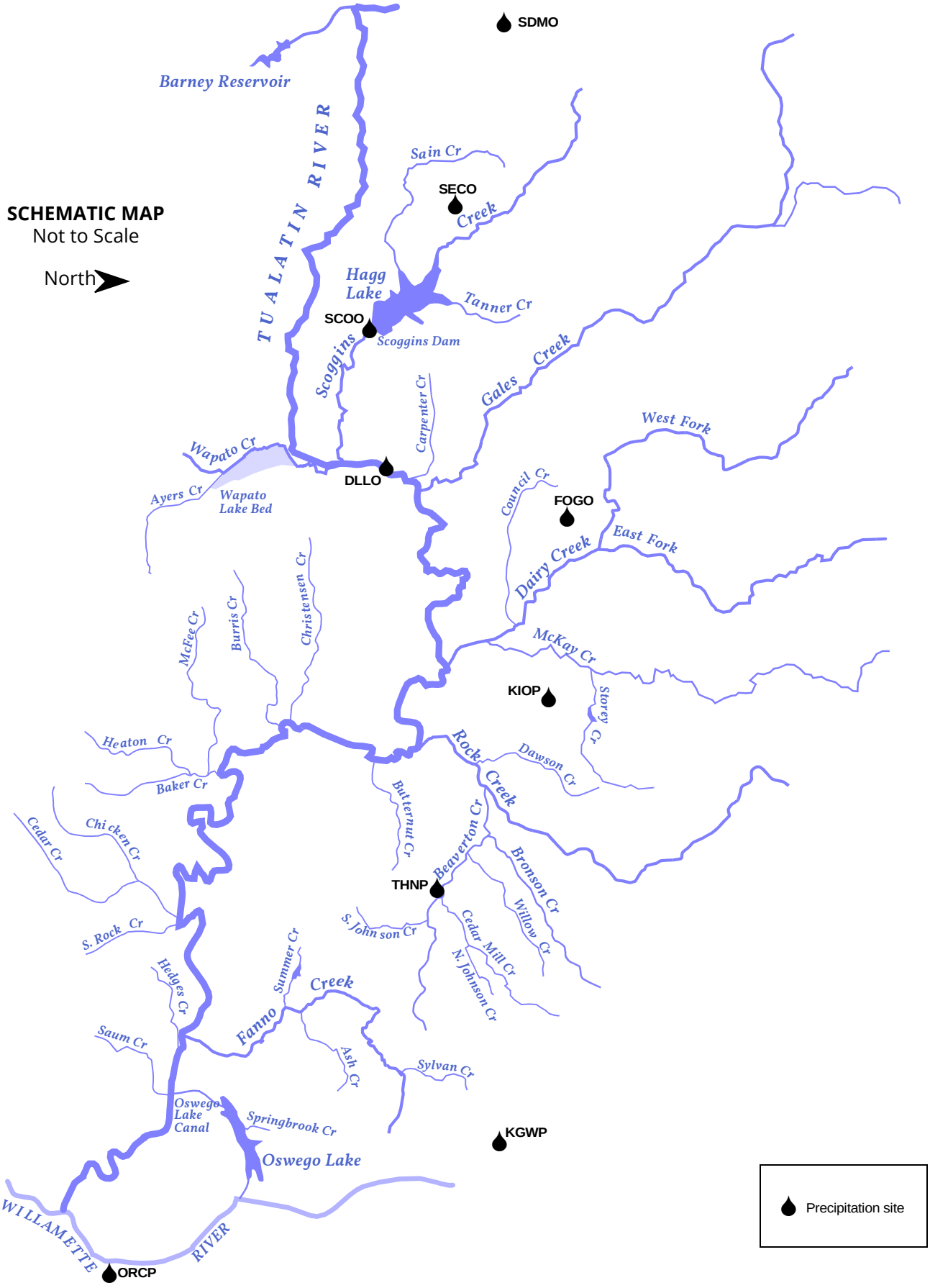
- In general, monthly rainfall in water year 2019 was between the 25th and 75th percentiles. The first four months of water year 2019 (October–January) had lower than median rainfall. Rainfall in February was high. March was unusually dry and records for low monthly rainfall were set at some sites.
- June was drier and sunnier than most years. In contrast, July, August and September were wetter than many recent years, although rainfall was not record setting. These months were also particularly cloudy.



- Total rainfall for October 2019 (water year 2020) was generally in the lower 50% of the record, but most of that rain was early in the month. Late October through mid-December 2019 was unusually dry. Rainfall during November in particular set records for low monthly total at several sites. More typical rainfall did not resume until December.



SELECTED PRECIPITATION MONITORING SITES



SELECTED PRECIPITATION MONITORING SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	ELEVATION (FT)	PAGE
DLLO	Dilley Precipitation Station (COOP ID#352325)	170	G-10
FOGO	Forest Grove, Oregon AgriMet Weather Station (Verboort)	180	G13
KHIO	Hillsboro Airport Weather Station (WBAN ID#94261)	204	G-15
KGWP	*KGW-TV Weather Station – Portland (COOP ID#356749)	159	G-19
ORCP	*Oregon City (COOP ID#356334)	167	G-21
SCOO	Scoggins Creek below Henry Hagg Lake	215	G-8
SDMO	*South Saddle Mountain Precipitation Station (SNOTEL #726)	3250	G-4
SECO	Sain Creek Precipitation Station (SNOTEL #743)	2000	G-6
THNP	Tualatin Hills Nature Park (COOP ID#355945)	185	G-17

*Stations that are not within the Tualatin Basin boundary.

SITES OUTSIDE OF TUALATIN BASIN

- South Saddle Mountain is located in the Coast Range and indicative of conditions in the headwaters and Barney Reservoir area. Because this site is at a higher elevation and on the western side of the Coast Range divide, it will receive greater rainfall than most areas in the basin.
- KGW-TV is located in downtown Portland and indicative of conditions in the northeastern part of the basin. Because this site is in the rain shadow of the Tualatin Mountains (east side), it likely receives less rain than locations in the basin which are on the west side.
- Oregon City is directly across the Willamette River from West Linn. This site is representative of the far southeastern part of the basin.

EXPLANATION OF FIGURES AND TABLES IN THIS APPENDIX

One table and two graphs are included for every site. Water year, rather than calendar year, is used for precipitation data.

Page 1 (-2) –historic record: Tabled data for precipitation by month and year for the period of record.

- The monthly total was not reported if more than 3 days of data were missing.
- Data for October–December of the next water year are included to provide compatibility with the other parts of the flow report that use calendar year. This line is shaded in gray and these data were not used to compute any statistics in this appendix.
- A statistical summary for each month is at the bottom of the table. Data in the gray shaded line were not used to compute these statistics.
- In some cases this table continues on a second page.

Page 2 (3) –graphical summary: Two graphs showing the distribution of precipitation by month and year:

- *A graph of expanded boxplots of monthly total precipitation* for the period of record is at the top of the page. An explanation of the features of this graph is shown next to the graph on the right side.
- *A graph of total precipitation for each water year* for the period of record is at the bottom of the page.
  - —Bars shown in blue have up to 3 days of missing data per month.
  - —Gray bars have more than 3 days of missing data in at least one month and up to 36 days in a year.
  - —The extent to which the gray bars underestimate the total annual precipitation is unknown. If the missing data occurred during the rainy season, the bar could be significantly less than the true total. If the missing data occurred during the dry months (July–August), the bar is likely a close estimate of the total.

SDMO – South Saddle Mountain Precipitation Station

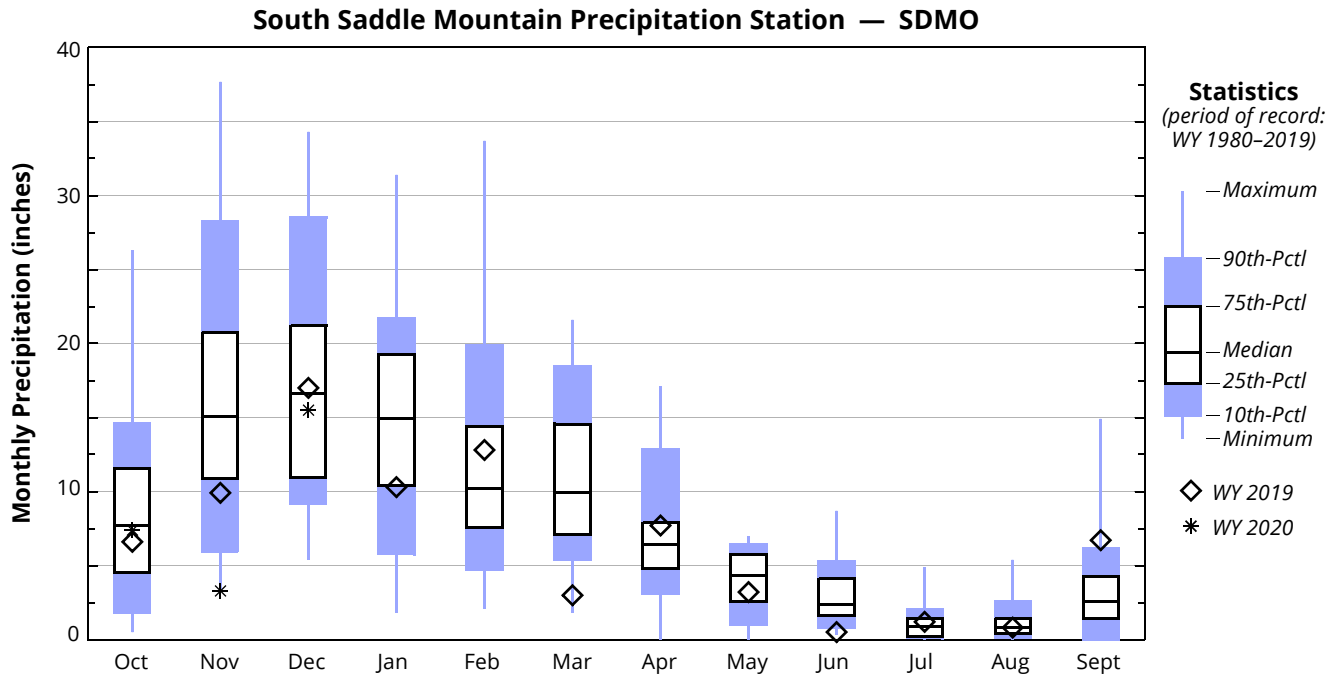
Data source: Natural Resources Conservation Service (SNOTEL #726)
https://wcc.sc.egov.usda.gov/nwcc/rgrpt?report=precsnotelmon&state=OR

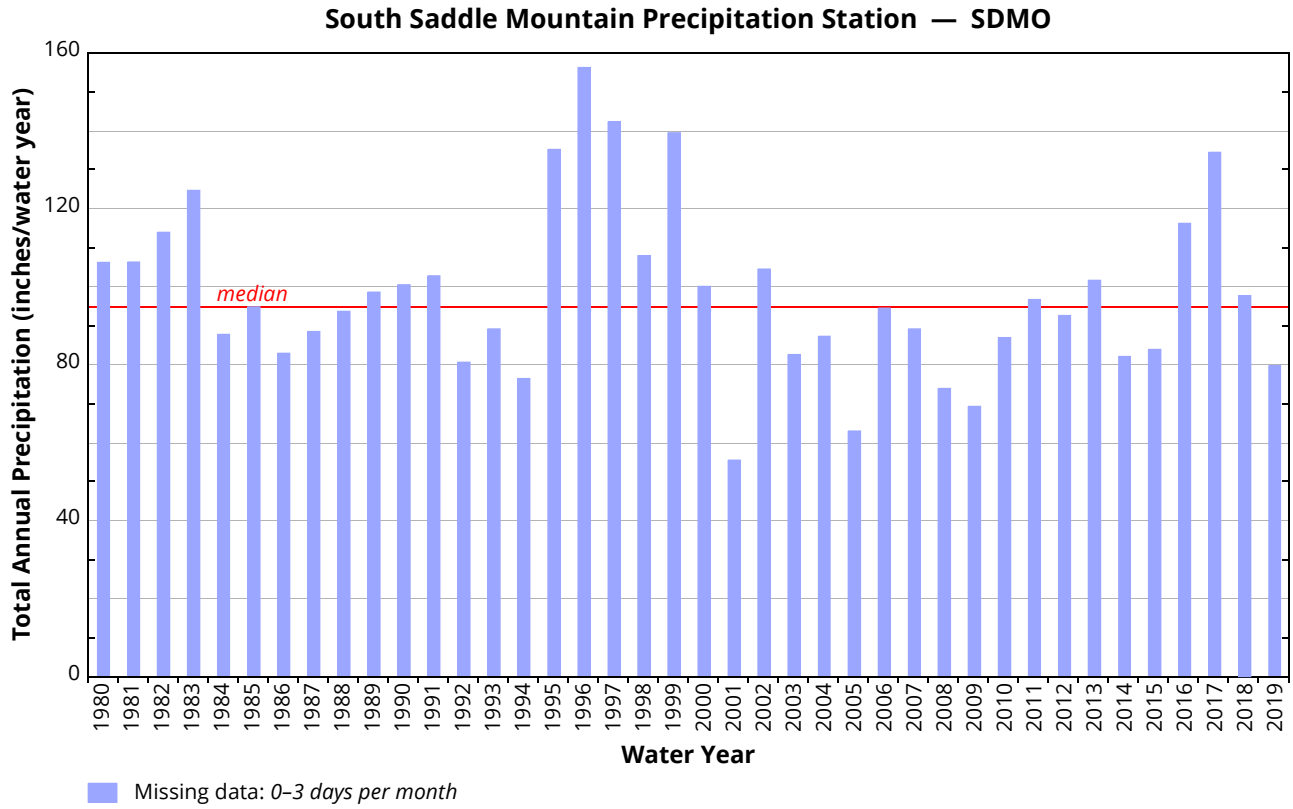
Elevation: 3250 ft Latitude: 45 31 48 Longitude: 123 22 12

MONTHLY TOTAL PRECIPITATION (inches) — SDMO

Water Year*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	10.8	7.5	19.2	19.3	11.2	10.1	6.5	6.4	8.7	1.0	0.6	4.9
1981	4.2	19.3	26.8	5.2	18.6	7.5	7.9	4.1	7.2	0.4	0.7	4.4
1982	13.0	14.9	26.6	19.3	17.2	7.5	7.2	0.0	2.0	1.1	1.9	3.3
1983	13.4	16.7	21.5	17.3	15.2	11.5	7.1	4.3	4.7	4.9	3.4	4.7
1984	1.7	23.3	11.8	8.3	12.6	8.1	6.3	6.4	3.8	0.6	1.1	3.8
1985	11.4	28.6	12.9	1.8	10.2	11.8	4.8	1.5	4.3	0.2	1.4	5.9
1986	12.2	11.1	5.4	15.8	13.4	7.2	5.7	3.2	1.1	1.4	0.2	6.2
1987	5.3	20.2	11.1	17.1	7.7	16.0	2.3	4.9	1.1	1.7	0.2	0.9
1988	0.7	10.8	22.2	14.1	9.6	15.0	7.8	6.1	2.4	2.0	0.3	2.7
1989	2.5	28.5	11.4	14.9	10.2	17.4	5.3	2.8	1.7	1.9	2.0	0.0
1990	5.8	9.6	8.6	31.4	20.8	7.0	6.4	3.3	4.9	0.4	0.8	1.5
1991	11.4	18.7	10.0	12.7	12.7	12.1	15.3	4.4	2.7	1.0	1.2	0.6
1992	2.8	14.4	11.8	19.1	8.8	1.8	10.5	2.4	1.2	1.4	1.1	5.3
1993	6.8	13.8	16.2	10.8	3.3	12.4	13.7	6.4	3.2	1.6	0.9	0.0
1994	2.7	3.3	18.8	11.0	15.2	9.3	5.5	3.6	4.2	0.9	0.5	1.5
1995	14.7	20.9	31.0	19.7	13.5	14.8	6.8	1.5	4.3	3.0	1.3	3.7
1996	8.5	34.8	21.7	21.2	32.6	6.0	17.1	6.4	2.0	1.2	1.0	3.7
1997	11.6	16.9	34.3	17.2	7.3	20.1	8.3	5.9	5.3	2.1	2.6	10.7
1998	19.8	15.3	9.3	24.2	14.7	10.4	3.3	6.1	1.6	0.2	0.4	2.7
1999	7.7	25.9	28.7	20.3	33.7	12.9	2.8	5.0	0.9	0.2	1.3	0.0
2000	6.1	23.6	18.6	17.7	10.1	6.3	2.9	4.9	6.0	0.1	0.6	3.2
2001	4.3	5.6	9.2	5.5	4.8	6.2	6.1	5.2	3.3	1.4	3.1	0.8
2002	6.6	23.0	20.3	21.7	7.5	10.7	7.6	2.9	3.6	0.2	0.3	0.1
2003	0.5	5.8	17.2	21.5	5.4	19.5	7.5	2.3	0.3	0.3	0.4	1.9
2004	9.4	12.1	13.5	15.0	8.7	5.4	4.4	4.9	2.7	0.1	5.4	5.7
2005	7.4	5.0	10.9	9.3	2.1	11.0	6.5	5.8	2.2	1.0	0.4	1.4
2006	9.4	12.4	18.2	29.8	6.1	7.3	3.4	3.1	2.0	0.7	0.0	2.1
2007	1.9	37.7	15.1	9.0	10.3	4.9	3.7	0.5	2.0	0.9	1.1	2.1
2008	7.7	9.5	21.9	11.5	4.7	7.6	4.9	1.1	2.3	0.3	2.4	0.0
2009	6.6	11.9	10.7	11.6	4.4	7.1	4.8	7.0	0.8	0.5	1.3	2.6
2010	7.8	15.5	9.2	14.5	8.5	9.7	7.2	4.8	5.0	0.5	0.5	3.8
2011	9.1	14.1	19.1	12.3	8.2	13.8	10.0	5.1	1.7	1.4	0.1	1.8
2012	5.8	14.6	12.2	17.3	9.6	18.0	5.9	5.0	3.7	0.2	0.0	0.3
2013	14.8	19.4	19.4	4.8	5.9	5.6	6.1	6.5	2.0	0.3	1.9	14.9
2014	1.8	9.9	6.6	9.5	15.3	18.5	9.1	5.5	1.8	0.8	0.8	2.5
2015	13.5	12.1	18.4	8.8	11.4	8.3	3.7	2.5	0.6	0.2	2.0	2.4
2016	11.1	17.5	34.2	15.7	12.1	15.3	3.1	1.0	2.5	0.9	0.5	2.4
2017	26.3	18.0	14.4	11.1	20.0	21.6	11.7	4.2	3.1	0.0	0.2	3.9
2018	13.8	21.9	10.9	18.9	7.8	7.6	13.0	0.1	1.2	0.1	0.1	2.3
2019	6.6	9.9	17.0	10.3	12.8	3.0	7.7	3.2	0.5	1.2	0.8	6.7
2020	7.4	3.3	15.5	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.5	3.3	5.4	1.8	2.1	1.8	2.3	0.0	0.3	0.0	0.0	0.0
MAX	26.3	37.7	34.3	31.4	33.7	21.6	17.1	7.0	8.7	4.9	5.4	14.9
MEDIAN	7.7	15.1	16.6	15.0	10.2	9.9	6.5	4.4	2.4	0.9	0.8	2.6
MEAN	8.44	16.35	16.91	14.91	11.61	10.66	7.00	4.01	2.87	0.96	1.12	3.19

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


South Saddle Mountain Precipitation Station — SDMO
Monthly Precipitation (inches)
0
10
20
30
40
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record:
WY 1980–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


South Saddle Mountain Precipitation Station — SDMO
Total Annual Precipitation (inches/water year)
0
40
80
120
160
median
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Water Year
Missing data: 0–3 days per month

SECO – Sain Creek Precipitation Station

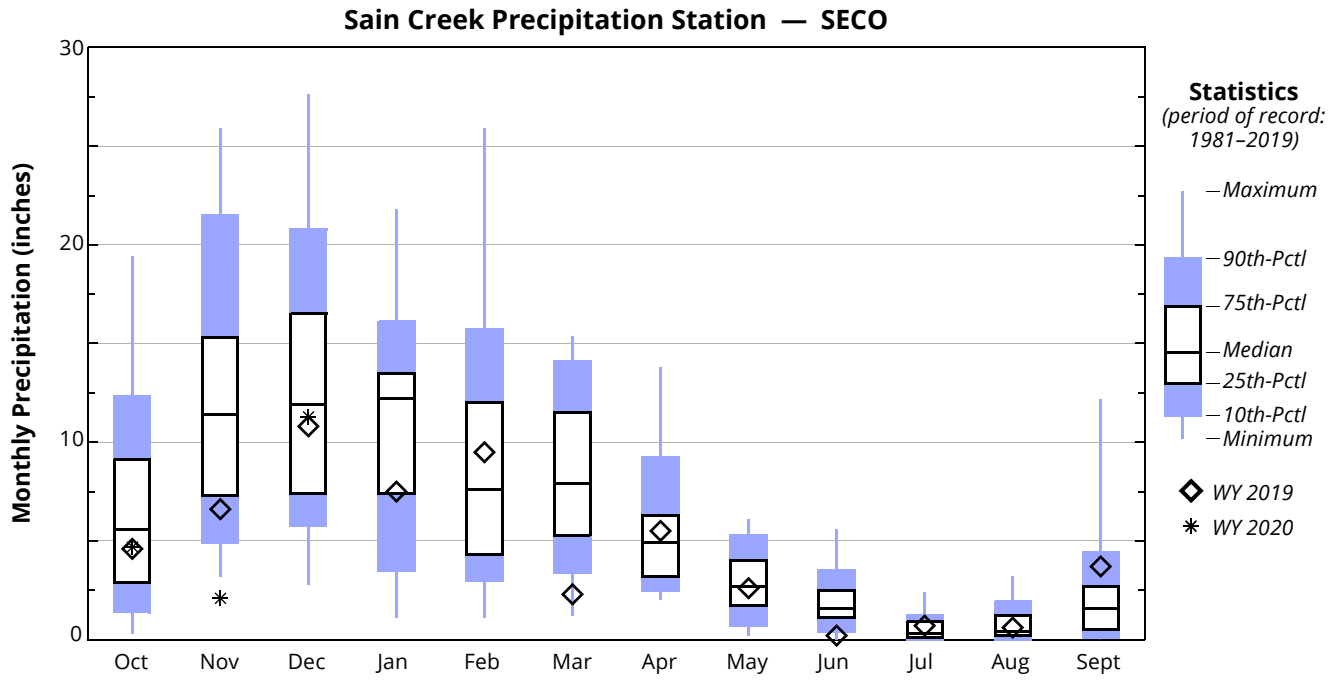
Data source: Natural Resources Conservation Service (SNOTEL #743)
https://wcc.sc.egov.usda.gov/nwcc/rgrpt?report=precsnotelmon&state=OR

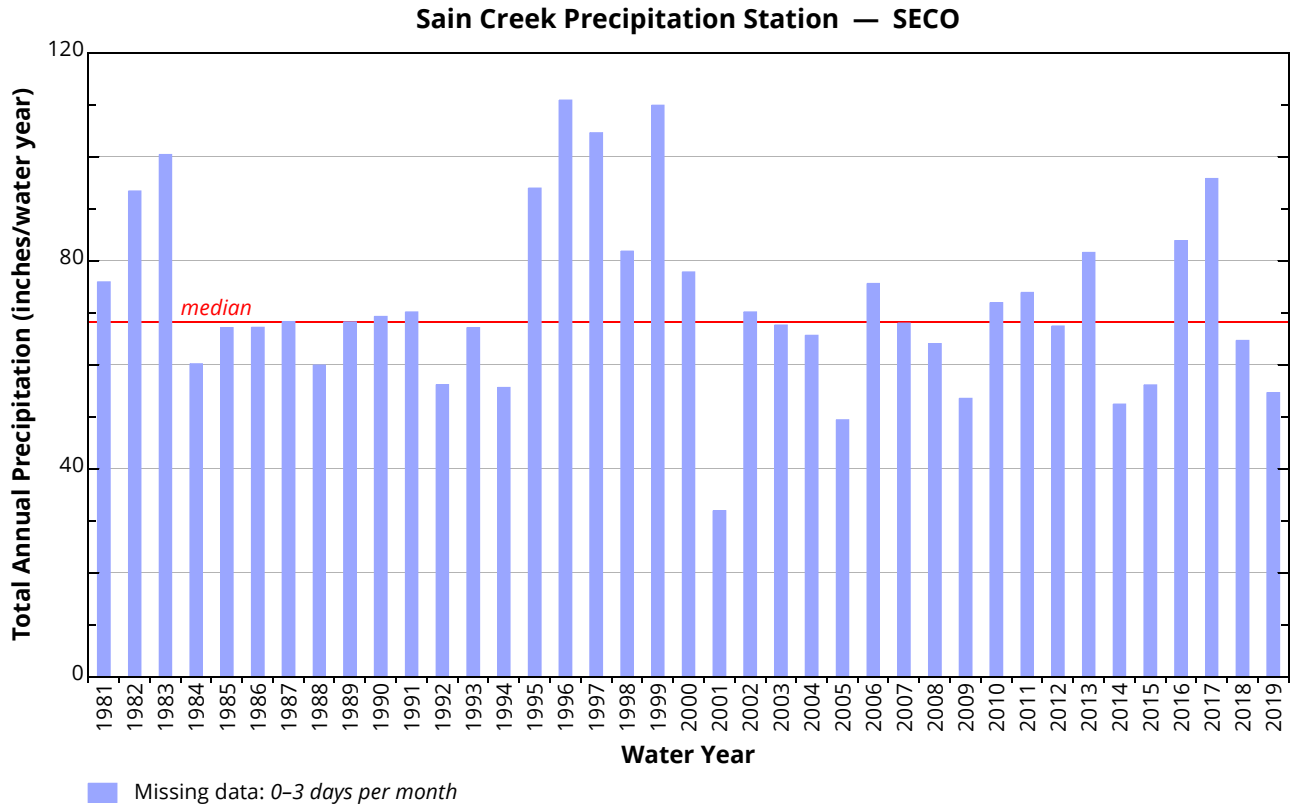
Elevation: 2000 ft Latitude: 45 31 12 Longitude: 123 16 48

MONTHLY TOTAL PRECIPITATION (inches) — SECO

Water Year*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	2.3	13.5	17.8	5.8	12.8	5.3	6.0	3.6	5.6	0.0	0.2	3.0
1982	10.3	11.8	20.8	13.2	14.9	7.9	6.4	0.7	2.0	1.1	1.9	2.4
1983	11.1	11.4	17.0	15.5	17.3	14.5	6.3	2.5	3.1	1.6	0.0	0.1
1984	1.4	16.7	3.5	3.5	12.1	9.1	2.5	5.3	3.3	0.0	0.0	2.8
1985	10.4	22.6	7.0	1.1	4.0	7.9	4.3	1.4	3.5	0.1	1.6	3.2
1986	9.3	4.9	2.8	13.2	15.1	2.9	5.2	6.1	0.2	1.0	0.2	6.3
1987	4.5	15.3	8.4	12.4	6.4	12.3	3.6	3.3	0.4	1.2	0.2	0.3
1988	0.7	6.8	15.8	12.2	2.8	9.1	4.4	4.0	2.0	0.7	0.0	1.4
1989	1.3	21.5	7.4	9.1	7.3	11.6	3.7	1.7	1.9	0.9	1.7	0.1
1990	4.5	6.2	5.8	21.8	14.5	6.4	3.2	2.6	2.5	0.3	0.7	0.8
1991	8.4	10.9	6.1	7.4	9.1	8.3	12.9	2.8	2.1	0.8	0.8	0.5
1992	2.5	9.7	8.4	12.2	6.7	1.2	9.2	1.1	1.1	0.6	0.4	3.1
1993	5.0	9.3	11.9	8.9	2.0	8.8	9.9	5.7	2.7	2.4	0.5	0.0
1994	1.7	4.5	12.7	8.5	10.7	5.9	4.2	3.1	2.4	0.1	0.2	1.6
1995	13.0	13.4	16.6	16.0	9.3	11.2	5.2	1.9	2.9	1.1	0.8	2.5
1996	6.6	24.6	15.7	15.3	21.9	3.4	13.8	4.8	1.4	0.4	0.4	2.6
1997	8.4	12.7	27.6	13.3	4.7	13.7	5.6	4.8	3.4	0.4	1.9	8.1
1998	13.0	12.0	6.4	19.8	12.0	8.5	2.5	5.1	0.8	0.0	0.2	1.5
1999	5.6	20.5	22.3	16.1	25.9	11.1	2.0	4.0	1.0	0.2	1.2	0.0
2000	4.6	18.3	15.4	13.5	8.5	5.3	2.6	3.8	4.0	0.0	0.2	1.6
2001	2.9	3.7	6.4	3.2	3.1	3.7	3.7	2.4	1.1	0.3	1.2	0.2
2002	3.8	16.7	13.3	14.9	5.1	6.6	5.1	2.0	2.0	0.1	0.0	0.5
2003	0.3	7.8	16.5	15.8	4.3	14.1	5.9	1.4	0.0	0.0	0.0	1.5
2004	5.8	7.3	12.0	12.2	7.6	3.9	4.7	2.3	2.0	0.2	3.2	4.4
2005	5.6	3.2	8.3	8.4	1.1	8.5	4.9	5.3	2.5	0.4	0.2	1.0
2006	9.1	10.4	14.7	21.8	3.7	6.9	3.0	3.2	1.5	0.2	0.0	1.1
2007	1.8	25.9	12.0	6.1	9.5	4.0	3.2	0.4	1.1	1.2	0.9	1.9
2008	4.7	7.5	20.0	11.2	5.0	7.5	4.5	0.5	0.6	0.6	1.9	0.0
2009	5.8	7.4	11.3	7.9	3.0	5.9	2.9	5.3	0.8	0.0	1.3	1.9
2010	6.2	12.5	7.7	13.0	7.2	8.2	6.7	3.3	4.1	0.1	0.2	2.7
2011	7.0	10.1	16.1	7.3	6.6	12.3	7.7	2.7	1.4	1.4	0.0	1.3
2012	4.8	10.2	7.7	13.4	6.5	15.4	4.0	2.7	2.0	0.0	0.4	0.3
2013	12.3	16.8	16.6	2.1	4.0	3.5	5.3	5.9	1.2	0.2	1.5	12.2
2014	1.4	6.1	2.9	4.7	11.4	13.0	5.8	3.1	1.4	0.6	0.4	1.6
2015	9.0	7.1	11.7	6.0	8.9	6.3	2.1	1.3	0.9	0.2	1.1	1.5
2016	6.2	11.9	25.0	12.9	8.5	11.5	2.5	0.7	1.6	0.9	0.6	1.6
2017	19.4	12.7	10.2	8.7	15.7	15.1	7.7	2.1	1.3	0.3	0.1	2.5
2018	9.1	14.7	7.3	12.9	3.8	5.4	8.7	0.2	1.1	0.0	0.1	1.4
2019	4.6	6.6	10.8	7.5	9.5	2.3	5.5	2.6	0.2	0.7	0.6	3.7
2020	4.7	2.1	11.3	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.3	3.2	2.8	1.1	1.1	1.2	2.0	0.2	0.0	0.0	0.0	0.0
MAX	19.4	25.9	27.6	21.8	25.9	15.4	13.8	6.1	5.6	2.4	3.2	12.2
MEDIAN	5.6	11.4	11.9	12.2	7.6	7.9	4.9	2.7	1.6	0.3	0.4	1.6
MEAN	6.27	11.93	12.31	10.99	8.78	8.17	5.32	2.97	1.87	0.52	0.69	2.13

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


Sain Creek Precipitation Station — SECO
Monthly Precipitation (inches)
30
20
10
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1981–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


Sain Creek Precipitation Station — SECO
Total Annual Precipitation (inches/water year)
120
80
40
0
median
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Water Year
Missing data: 0–3 days per month

SCOO – SCOGGINS CREEK BELOW HENRY HAGG LAKE PRECIPITATION STATION

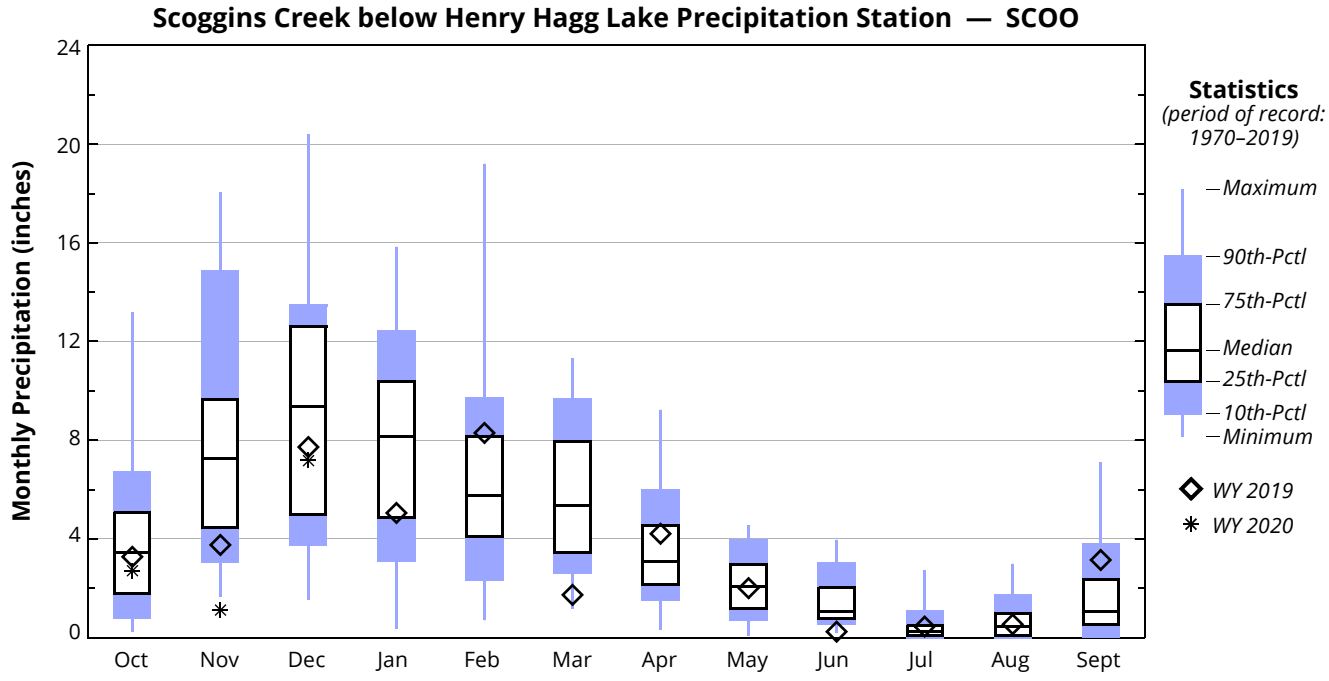
Data source: Tualatin Valley Irrigation District
data not available online

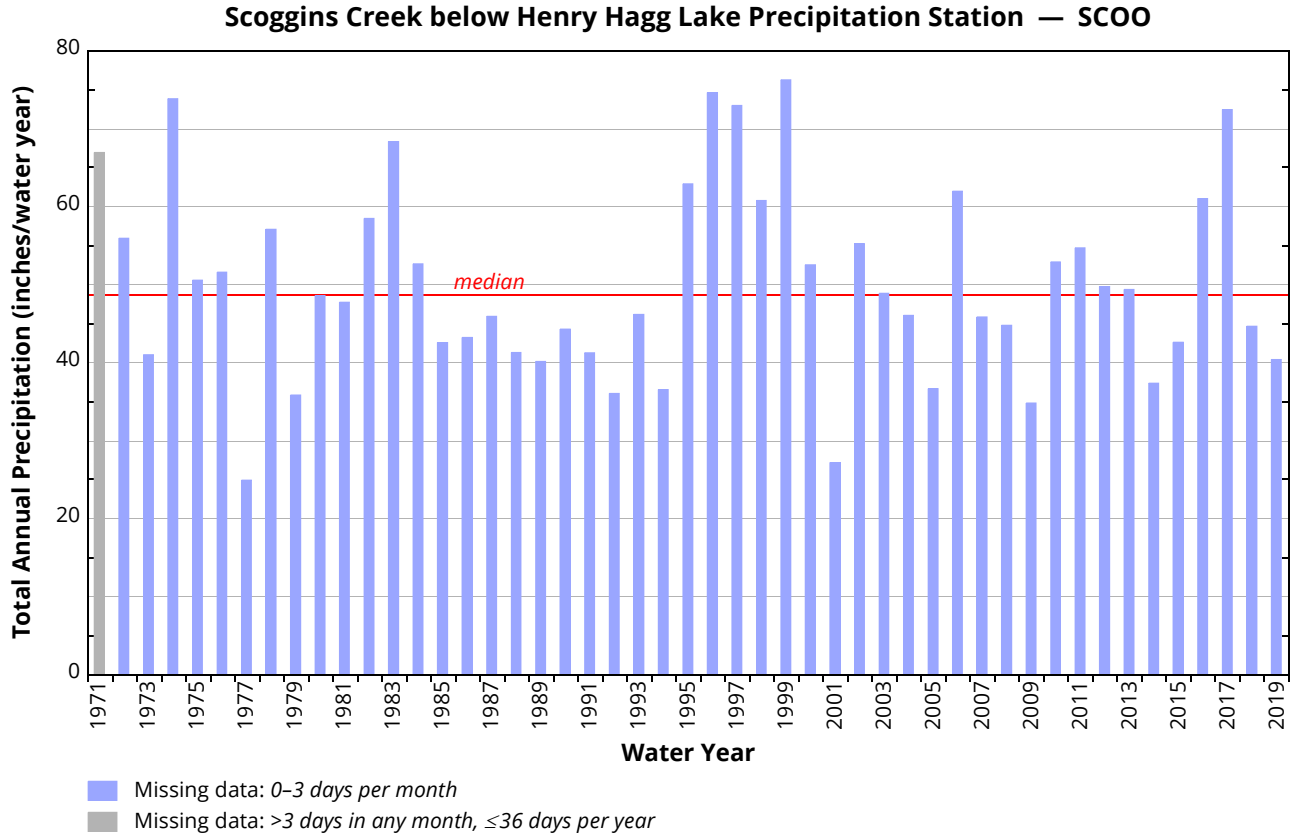
Elevation: 187.5 ft Latitude: 45 28 10 Longitude: 123 11 56

MONTHLY TOTAL PRECIPITATION (inches) — SCOO

WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1970			8.53	15.85	6.30	3.47	3.49	1.27	0.77	0.01	0.00	1.10
1971	4.40	6.86	16.85	10.82	5.60	10.30	3.96	1.54	2.03	0.14	0.52	3.92
1972	4.02	8.68	12.12	10.20	5.05	6.79	3.92	0.92	0.58	0.28	0.25	3.12
1973	0.72	6.31	12.28	6.44	2.36	3.75	2.15	1.19	1.37	0.04	0.86	3.54
1974	3.82	18.05	14.64	12.46	7.92	9.31	3.98	1.31	0.86	1.38	0.02	0.06
1975	1.33	8.02	9.94	10.45	8.11	5.71	2.00	2.12	0.67	0.47	1.72	0.03
1976	6.69	6.38	9.50	7.68	8.25	5.98	1.81	1.63	0.48	0.70	1.80	0.69
1977	1.26	1.65	1.54	1.05	3.37	5.33	0.32	2.50	1.11	0.41	2.99	3.42
1978	2.76	8.11	13.47	7.92	6.66	2.47	5.04	2.95	1.00	0.65	2.11	3.94
1979	0.81	4.29	3.77	3.16	9.75	3.30	2.83	2.99	0.68	0.15	1.71	2.42
1980	6.69	4.25	9.21	8.30	7.13	4.09	4.38	1.10	1.81	0.22	0.05	1.37
1981	1.76	8.71	11.80	3.60	6.07	3.22	2.88	2.67	3.14	0.08	0.06	3.77
1982	5.55	6.77	13.00	7.21	8.43	4.85	6.45	0.51	1.41	0.37	1.46	2.49
1983	5.82	6.90	13.00	8.13	13.46	9.93	2.88	1.54	2.10	2.73	1.19	0.67
1984	1.34	15.16	7.91	3.09	7.92	4.81	4.05	3.95	3.34	0.00	0.00	1.13
1985	5.16	14.86	4.88	0.37	4.03	5.22	1.50	0.73	2.58	0.41	0.68	2.17
1986	4.48	4.55	2.93	9.23	8.42	4.13	2.57	2.65	0.59	1.07	0.00	2.60
1987	3.43	7.85	5.96	8.19	6.67	8.51	1.80	2.10	0.31	0.79	0.11	0.23
1988	0.23	3.09	12.51	9.46	1.67	4.50	3.32	2.78	2.59	0.15	0.09	0.89
1989	0.27	12.19	4.64	4.61	4.59	8.21	1.26	1.63	0.89	0.48	0.83	0.55
1990	2.74	4.39	3.52	13.00	8.87	2.60	2.20	3.01	2.02	0.26	1.18	0.49
1991	4.35	4.49	3.87	4.69	4.72	5.38	9.03	2.29	1.44	0.22	0.54	0.23
1992	1.80	6.31	5.74	7.72	4.66	1.16	5.63	0.09	0.71	0.42	0.35	1.47
1993	2.84	5.94	8.85	6.25	1.21	5.40	6.71	3.95	2.26	2.59	0.17	0.04
1994	1.21	1.92	9.97	6.47	7.71	3.41	2.49	0.96	1.30	0.00	0.13	0.98
1995	4.94	9.30	11.54	12.00	5.36	7.88	4.53	1.47	2.44	0.58	1.01	1.89
1996	3.70	12.24	12.17	11.53	13.61	2.81	9.23	4.49	1.59	0.58	0.34	2.32
1997	5.44	8.73	20.40	10.71	2.98	9.22	3.38	2.68	3.34	0.29	1.28	4.52
1998	8.57	9.32	4.41	14.18	9.08	6.26	2.31	4.56	0.96	0.24	0.00	0.91
1999	4.51	15.20	13.27	11.84	19.20	6.25	1.77	2.15	0.93	0.08	0.96	0.06
2000	3.13	12.68	9.50	9.02	6.51	4.08	1.40	2.94	2.26	0.03	0.19	0.81
2001	3.24	3.08	5.11	2.30	2.36	3.05	2.19	2.20	1.79	0.23	1.12	0.52
2002	3.28	12.10	11.86	11.36	4.11	5.84	2.79	1.58	1.46	0.13	0.19	0.57
2003	0.73	4.37	13.26	9.33	4.20	9.29	5.17	0.86	0.20	0.01	0.62	0.86
2004	3.34	5.26	9.92	8.84	5.96	3.11	3.12	1.63	0.90	0.00	2.01	2.00
2005	4.60	2.75	4.95	4.92	0.70	7.73	3.34	4.52	1.99	0.38	0.39	0.38
2006	5.54	8.57	12.92	15.72	4.10	6.13	3.63	2.96	1.53	0.15	0.00	0.75
2007	0.83	17.64	7.76	4.37	6.42	2.79	2.15	0.90	0.76	0.69	0.58	0.99
2008	3.91	4.68	13.42	8.69	3.30	5.03	2.50	0.92	1.25	0.02	0.98	0.09
2009	2.89	6.29	4.58	6.36	2.20	4.13	1.99	3.95	0.76	0.21	0.66	0.82
2010	3.73	8.95	5.11	10.29	5.16	5.72	5.79	3.20	3.04	0.36	0.05	1.54
2011	4.53	7.24	12.96	4.99	4.78	9.67	5.35	2.96	0.78	1.11	0.00	0.35
2012	2.29	8.12	3.93	9.33	4.53	11.32	2.99	2.94	3.98	0.25	0.02	0.04
2013	6.95	9.95	11.78	1.19	2.35	2.61	1.93	3.79	0.94	0.00	0.79	7.10
2014	1.04	3.33	2.06	3.28	8.96	9.39	4.56	2.01	0.94	0.33	0.10	1.37
2015	7.15	3.75	9.16	4.36	7.79	5.42	1.49	0.54	0.65	0.23	0.77	1.33
2016	3.35	8.38	19.38	10.36	4.97	9.21	2.39	0.72	0.97	0.29	0.29	0.71
2017	13.19	10.43	7.82	6.41	14.24	9.75	5.99	1.85	0.86	0.00	0.15	1.74
2018	6.05	10.21	5.02	8.37	2.51	4.75	5.70	0.10	0.78	0.01	0.02	1.13
2019	3.28	3.75	7.72	5.05	8.30	1.73	4.21	2.00	0.24	0.45	0.54	3.15
2020	2.72	1.12	7.18	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.23	1.65	1.54	0.37	0.70	1.16	0.32	0.09	0.20	0.00	0.00	0.03
MAX	13.19	18.05	20.40	15.85	19.20	11.32	9.23	4.56	3.98	2.73	2.99	7.10
MEDIAN	3.43	7.24	9.36	8.16	5.78	5.36	3.06	2.06	1.06	0.26	0.46	1.05
MEAN	3.75	7.80	9.21	7.82	6.25	5.70	3.53	2.13	1.43	0.41	0.64	1.55

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


Scoggins Creek below Henry Hagg Lake Precipitation Station — SCOO
Monthly Precipitation (inches)
0
4
8
12
16
20
24
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1970–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


Scoggins Creek below Henry Hagg Lake Precipitation Station — SCOO
Total Annual Precipitation (inches/water year)
0
20
40
60
80
median
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
Water Year
Missing data: 0–3 days per month
Missing data: >3 days in any month, ≤36 days per year

DLLO – DILLEY PRECIPITATION STATION

Data source: National Weather Service COOP Program (COOP ID#352325)
http://scacis.rcc-acis.org

Elevation: 170 ft Latitude: 45 27 48 Longitude: 123 06 49

MONTHLY TOTAL PRECIPITATION (inches) — DLLO

WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1944			4.08		3.98	3.22	3.93	0.94	0.74	1.06	0.20	2.80
1945	1.56	5.50	2.74	4.13	6.99	7.18	2.09	3.71	0.22	0.20	0.13	3.17
1946	1.45	11.82	7.56	7.21	7.61	6.09	1.41	1.51	1.74			
1947			5.38	5.47	4.46	4.69	1.30	0.09	3.12	0.86	0.50	1.28
1948	9.68	4.08	4.99	7.28	7.52	4.55	3.97	4.92	0.90	0.59	1.35	2.72
1949	2.52	8.67	10.59	2.06	11.83	2.99	0.55	2.98	0.55	0.82	0.03	0.58
1950	2.48	7.55	5.93	10.43	6.58	6.77	1.46	0.48	2.19	0.54	0.84	1.13
1951	9.62	9.55	8.93	11.03	5.01	4.74	0.88	1.67	0.15	0.11	0.15	2.38
1952	6.96	7.89	9.70	7.08	5.65	4.20	1.35	0.77	2.62	0.00	0.03	0.38
1953	0.61	2.29	9.28	14.98	4.86	5.36	2.74	2.87	1.25	0.10	1.51	1.60
1954	3.55	7.37	7.40	13.80	7.32	2.95	3.26	1.33	2.06	0.56		1.97
1955	3.92	7.61	7.66	4.36	4.36	5.23	4.56	0.77	1.78	1.41	0.00	2.65
1956	6.97	10.49	12.90	13.36	4.43	7.27	0.64	1.42	1.29	0.03	1.32	1.84
1957	4.83	1.98	4.55	3.02	5.77	7.09	2.09	3.03	1.52	0.27	0.47	0.75
1958	3.55	3.77	10.90	9.29	8.50	2.62	4.24	1.05	2.96	0.02	0.00	0.59
1959	2.34	8.74	6.90	12.18	5.10	4.42	1.76	2.55	2.57	0.92	0.08	2.75
1960	2.71	4.44	4.86	6.56	6.94		4.65	4.37	4.16	0.00	0.74	0.53
1961	4.24	10.95	3.64	7.05	11.15	10.02	2.94	2.36	0.24	0.48	0.52	0.46
1962	5.98	4.95	7.67	1.61	4.14	5.78	4.79	2.43	0.44	0.00	1.43	2.08
1963	4.57	11.23	3.48	1.91	5.39	6.65	4.03	2.82	1.94	1.01	1.64	1.42
1964	3.68	7.10	5.24	16.01	1.47	5.23	1.34	0.85	1.53	0.66	0.54	0.23
1965	1.87	9.80	14.38	9.04	2.72	0.69	2.21	1.14	0.91	1.02	0.87	0.00
1966	1.92	8.73	9.87	9.62	2.67	8.47	0.66	1.28	1.84	1.10	0.46	1.39
1967	3.62	6.98	11.57	10.14	1.83	6.07	2.63	0.64	0.76	0.00	0.00	0.65
1968	6.35	3.28	7.17	7.94	9.00	5.53	1.41	3.01	2.10		4.01	2.08
1969	5.45	7.48	12.91	9.61	4.33	1.21	2.19	1.72	2.01	0.02	0.00	2.14
1970	4.64	3.26	11.18	14.21	5.81	3.12	2.64	1.26	0.57	0.01	0.00	1.26
1971	4.01	5.89	14.28	8.96	4.74	8.29	3.68	1.22	1.61	0.13	0.36	3.19
1972	3.21	8.35	10.45	8.19	4.90	7.32	4.41	1.39	0.56	0.28	0.25	3.12
1973	0.61	4.78	11.33	5.37	2.18	3.40	1.57	1.40	1.27	0.05	0.76	3.30
1974	3.36	16.59	12.01	11.25	6.75	8.51	2.96	1.46	0.65	1.25	0.00	0.07
1975	1.32	7.50	8.64	8.99	7.00	4.86	1.75	1.94	0.62	0.44	1.60	0.00
1976	6.42	5.16	8.59	6.85	7.20	5.54	2.31	1.30	0.39	0.82	2.41	0.79
1977	1.30	1.32	1.60	1.05	2.98	4.46	0.51	2.50	1.12	0.60	3.07	3.18
1978	2.94	7.21	11.39	7.37	5.92	2.27	3.70	2.67	0.99	0.99	1.65	3.23
1979	0.71	3.85	3.77	3.06	8.00	2.49	2.41	2.07	0.58	0.13	0.94	2.54
1980	6.67	3.93	7.50	8.14	6.25	4.02	3.70	1.21	2.24	0.22	0.06	1.36
1981	1.63	8.35	11.43	2.65	5.17	2.98	2.17	1.96	3.00	0.15	0.05	3.83
1982	5.90	5.89	12.15	9.42	7.75	3.89	4.83	0.44	1.31	0.36	1.24	2.40
1983	4.87	5.36	11.16	7.40	12.20	8.23	2.49	1.40	1.65	2.74	1.38	0.54
1984	1.32	13.07	6.87	2.70	5.95	4.29	3.95	3.36	3.88	0.00	0.00	1.21
1985	4.63	12.83	3.87	0.27	3.18	4.56	1.20	0.36	2.94	0.45	1.45	1.63
1986	3.97	3.95	2.77	8.38	7.35	3.81	1.59	1.99	0.37	0.85	0.00	2.74
1987	3.31	6.52	5.47	8.00	5.18	7.47	1.72	1.85	0.19	0.85	0.15	0.20
1988	0.20	3.66	10.41	8.14	1.16	3.67	2.60	2.23	2.27	0.07	0.17	1.16
1989	0.14	10.98	3.81	4.14	3.51	7.05	0.81	1.62	0.78	0.36	0.93	0.51
1990	2.47	4.02	3.47	10.42	7.14	2.08	1.71	2.98	1.82	0.27	0.93	0.72
1991	4.14	4.15	3.36	3.97	4.46	5.07	6.36	2.19	1.39	0.29	0.39	0.24
1992	1.91	6.26	4.91	6.62	3.97	1.19	4.79	0.07	0.80	0.31	0.51	1.28
1993	2.79	5.44	7.42	5.39	0.78	5.00	6.76	3.79	1.95	1.76	0.08	0.00

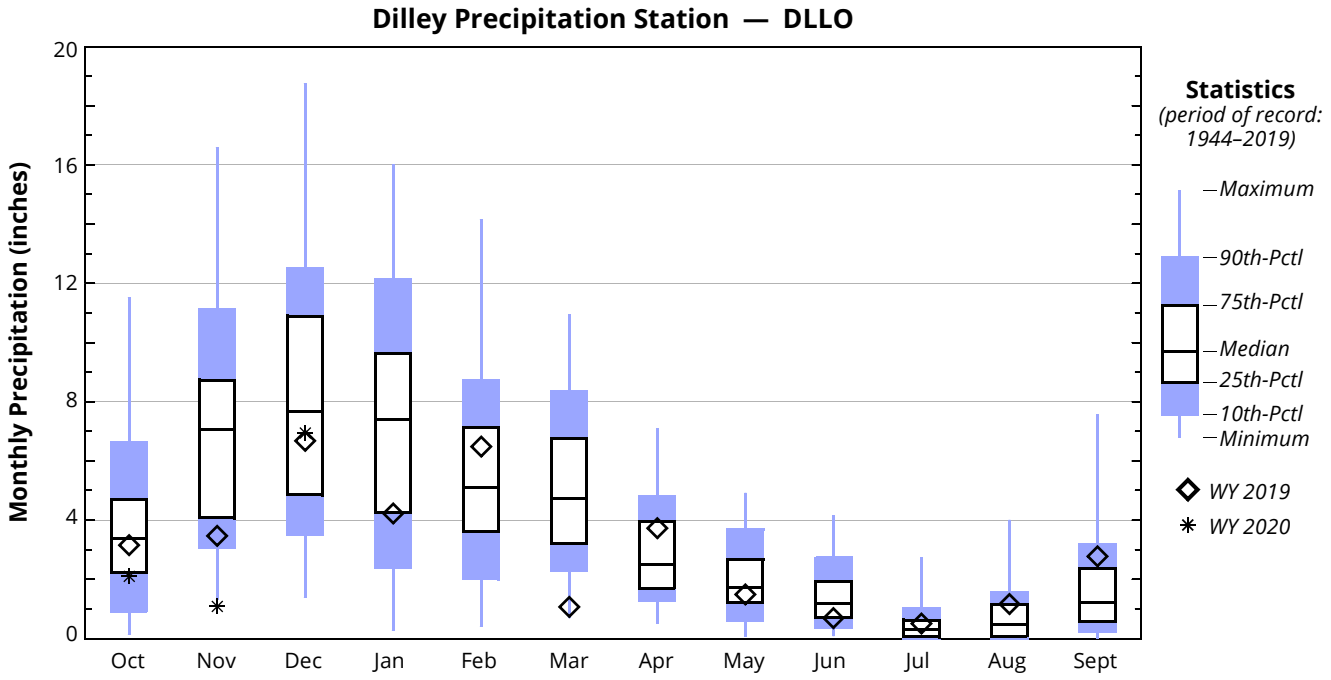
MONTHLY TOTAL PRECIPITATION (inches) — DLLO (continued)

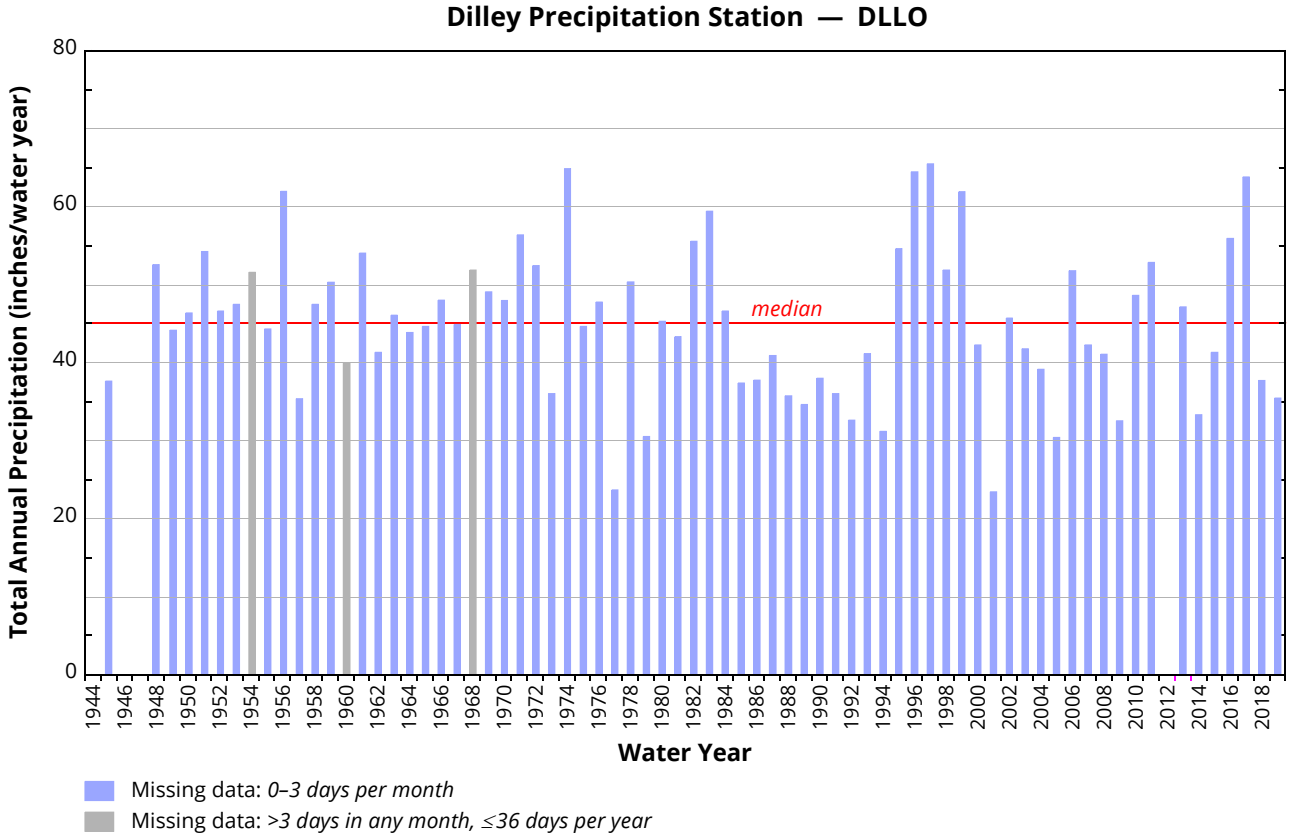
WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1994	1.26	1.49	9.12	5.67	6.45	3.14	1.41	0.89	0.95	0.00	0.24	0.58
1995	4.64	8.12	10.29	10.56	5.02	6.53	3.74	1.29	1.76	0.45	0.49	1.74
1996	3.41	9.78	10.09	9.69	12.68	2.46	7.09	4.84	1.12	0.60	0.26	2.43
1997	5.37	8.05	18.46	9.63	2.51	8.29	2.98	2.65	2.38	0.47	1.38	3.33
1998	6.58	8.36	3.54	12.10	7.66	5.20	1.76	4.82	1.05	0.09	0.00	0.73
1999	3.24	13.00	10.81	10.29	14.15	4.85	1.90	1.71	0.76	0.02	1.14	0.04
2000	2.55	10.10	7.10	7.81	5.46	3.25	1.52	2.15	1.21	0.00	0.22	0.89
2001	3.09	2.46	4.20	2.17	1.98	2.25	1.72	1.60	1.84	0.32	1.27	0.54
2002	2.91	10.26	10.66	9.00	3.61	4.04	1.93	1.14	1.32	0.19	0.07	0.57
2003	0.59	3.35	12.22	8.61	3.69	7.41	4.24	0.46	0.07	0.01	0.32	0.79
2004	2.87	4.10	9.01	7.70	5.21	2.32	2.24	1.25	1.21	0.00	1.66	1.56
2005	3.80	2.53	3.89	4.25	0.41	5.97	2.79	4.26	1.84	0.29	0.13	0.24
2006	4.16	7.58	11.79	14.09	3.38	4.21	2.58	2.26	0.92	0.17	0.00	0.63
2007	1.01	15.05	8.03	4.03	4.62	2.48	2.32	1.22	0.83	0.82	0.63	1.21
2008	3.80	4.35	10.41	7.03	2.93	4.66	2.91	2.72	0.97	0.00	0.96	0.32
2009	2.42	6.01	4.85	5.53	2.04	3.43	1.72	3.53	0.23	0.17	1.29	1.32
2010	3.67	8.41	4.48	8.95	4.91	5.26	4.82	3.36	3.03	0.16	0.08	1.50
2011	4.00	7.00	13.55	5.63	4.36	8.93	4.62	2.47	0.84	0.98	0.07	0.42
2012	2.56	8.00				10.95	2.54	2.30	2.52	0.37	0.07	0.04
2013	5.86	8.87	11.29	1.96	2.17	2.38	1.66	3.66	1.17	0.00	0.54	7.57
2014	0.85	2.92	1.37	2.87	7.64	8.69	3.98	1.80	1.05	0.37	0.54	1.23
2015	7.66	3.21	8.18	3.91	7.90	4.87	1.96	0.87	0.59	0.43	0.66	1.09
2016	2.71	6.52	18.77	10.09	4.22	7.54	3.22	0.71	0.69	0.35	0.27	0.82
2017	11.53	9.66	5.97	5.91	12.83	8.70	4.53	1.99	1.18	0.00	0.09	1.42
2018	5.15	8.42	4.70	7.24	1.86	3.79	4.91	0.06	0.62	0.00	0.05	0.92
2019	3.15	3.47	6.68	4.23	6.48	1.07	3.73	1.49	0.69	0.51	1.17	2.78
2020	2.11	1.09	6.95	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.14	1.32	1.37	0.27	0.41	0.69	0.51	0.06	0.07	0.00	0.00	0.00
MAX	11.53	16.59	18.77	16.01	14.15	10.95	7.09	4.92	4.16	2.74	4.01	7.57
MEDIAN	3.39	7.05	7.67	7.39	5.10	4.74	2.52	1.72	1.20	0.30	0.46	1.23
MEAN	3.67	6.91	8.10	7.37	5.51	5.00	2.80	1.96	1.39	0.43	0.66	1.48

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.

DLLO – DILLEY PRECIPITATION STATION

Data source: National Weather Service COOP Program (COOP ID#352325)





FOGO – Forest Grove Precipitation Station (Verboort)

Data source: Bureau of Reclamation – AgriMet
https://www.usbr.gov/pn/agrimet/webarcread.html

Elevation: 180 ft Latitude: 45 33 11 Longitude: 123 05 01

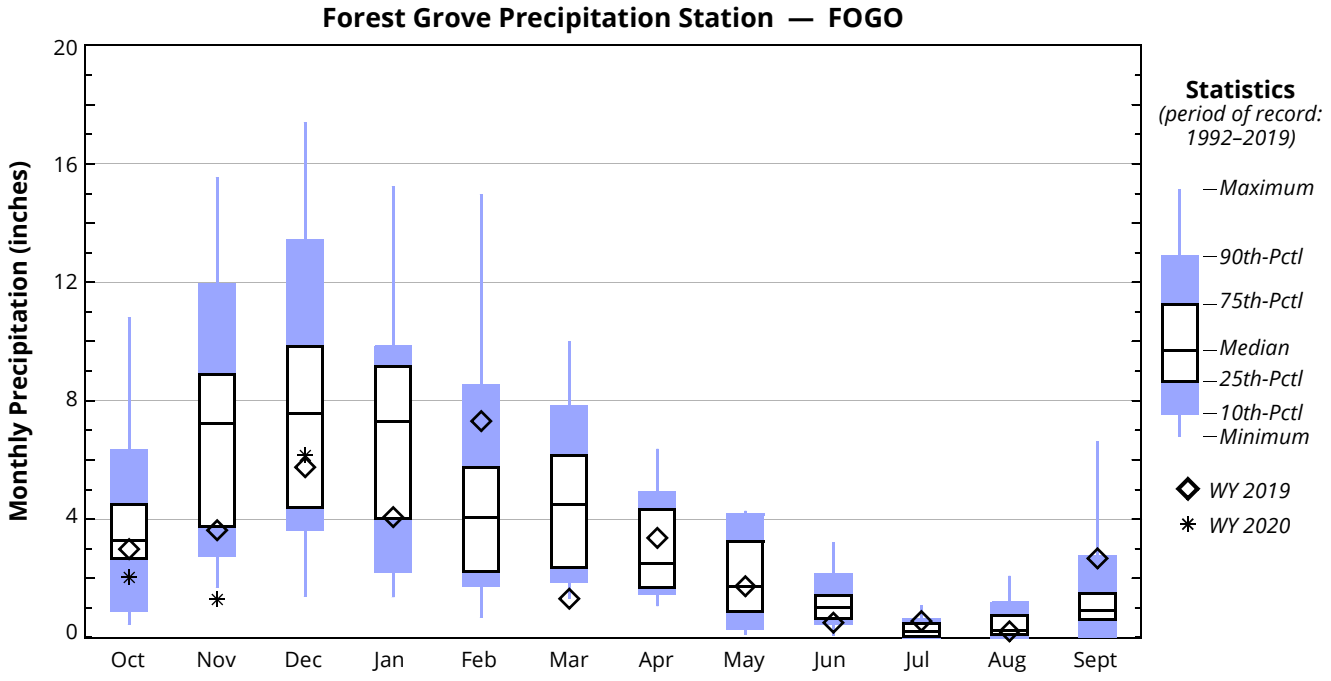
MONTHLY TOTAL PRECIPITATION (inches) — FOGO

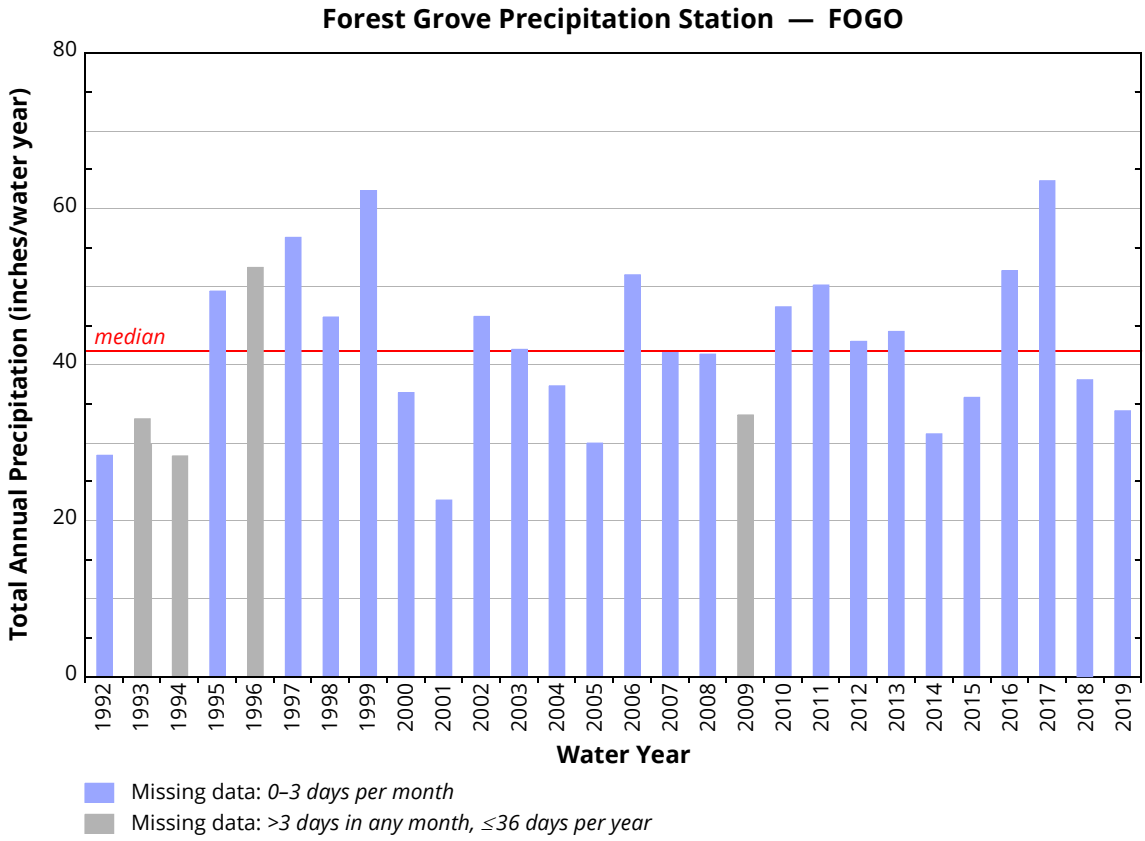
Water Year*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1992	1.50	5.10	3.68	5.93	3.56	1.56	4.35	0.10	0.94	0.26	0.28	1.08
1993	2.41	4.17	6.00		2.22	4.15	4.88	4.22	0.57	1.09	0.14	0.00
1994	1.08	1.68	7.61		5.75	2.34	1.49	1.31	1.04	0.02	0.23	0.77
1995	6.26	7.51	7.56	9.72	4.05	5.78	3.09	1.57	1.23	0.53	0.50	1.62
1996	3.08	11.72	8.55	9.06		2.33	6.37	4.14	0.85	0.48	0.26	1.99
1997	4.53	7.99	14.96	7.64	1.78	7.76	3.27	1.83	1.80	0.18	1.32	3.25
1998	6.99	7.08	3.47	9.12	7.20	4.57	1.44	4.28	1.06	0.07	0.00	0.80
1999	3.44	13.67	9.83	9.65	14.97	5.39	1.69	1.68	0.98	0.35	0.66	0.02
2000	2.78	7.84	5.89	7.72	3.99	2.37	1.05	2.06	1.58	0.09	0.13	0.92
2001	3.08	2.63	4.30	1.66	1.74	2.13	1.68	1.07	2.11	0.44	1.15	0.63
2002	2.79	11.22	9.74	9.30	3.45	4.60	1.61	1.16	1.20	0.20	0.03	0.90
2003	0.43	3.02	12.24	10.06	3.18	6.19	5.13	0.55	0.07	0.00	0.35	0.73
2004	3.49	4.62	7.87	6.09	5.23	1.93	2.55	1.10	0.81	0.00	2.08	1.50
2005	3.80	2.78	4.38	2.47	0.67	6.00	2.60	4.08	1.56	0.21	0.11	1.28
2006	4.32	7.44	11.35	15.24	2.15	4.38	2.19	2.91	0.69	0.20	0.07	0.58
2007	0.95	15.55	8.57	3.88	4.24	2.45	2.12	0.78	0.59	0.57	0.50	1.32
2008	3.14	4.51	13.02	8.81	2.70	4.13	2.46	0.71	0.78	0.01	0.97	0.11
2009	2.66	5.69		6.06	1.91	3.69	1.77	3.43	1.17	0.13	1.06	1.22
2010	3.78	7.70	5.34	7.44	4.78	5.28	4.24	3.37	3.23	0.51	0.23	1.52
2011	4.39	7.42	11.53	5.08	5.52	7.35	4.38	2.37	0.62	1.05	0.00	0.48
2012	2.75	8.28	3.82	7.25	4.17	10.00	2.16	2.15	2.22	0.08	0.08	0.02
2013	6.25	9.20	9.56	1.36	2.24	2.08	1.67	3.36	1.44	0.00	0.78	6.33
2014	0.68	2.96	1.39	2.98	7.57	7.73	3.70	1.30	0.87	0.29	0.10	1.55
2015	6.13	3.19	7.45	3.61	5.90	4.67	1.48	0.80	0.44	0.28	1.02	0.84
2016	4.12	5.50	17.40	9.42	4.58	7.09	1.97	0.31	0.46	0.24	0.32	0.61
2017	10.82	9.09	6.96	6.15	12.26	8.37	4.49	1.74	1.41	0.00	0.11	2.16
2018	4.90	9.19	4.08	7.35	2.53	3.31	4.70	0.11	1.11	0.02	0.00	0.75
2019	2.99	3.62	5.76	4.07	7.31	1.31	3.37	1.73	0.50	0.55	0.21	2.67
2020	2.04	1.29	6.16	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.43	1.68	1.39	1.36	0.67	1.31	1.05	0.10	0.07	0.00	0.00	0.00
MAX	10.82	15.55	17.40	15.24	14.97	10.00	6.37	4.28	3.23	1.09	2.08	6.33
MEDIAN	3.44	7.25	7.56	7.30	4.05	4.48	2.51	1.71	1.01	0.21	0.25	0.91
MEAN	3.70	6.80	7.86	6.81	4.65	4.61	2.93	1.94	1.12	0.28	0.45	1.27

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.

FOGO – Forest Grove Precipitation Station (Verboort)

Data source: Bureau of Reclamation – AgriMet





KHIO – Hillsboro Airport Precipitation Station

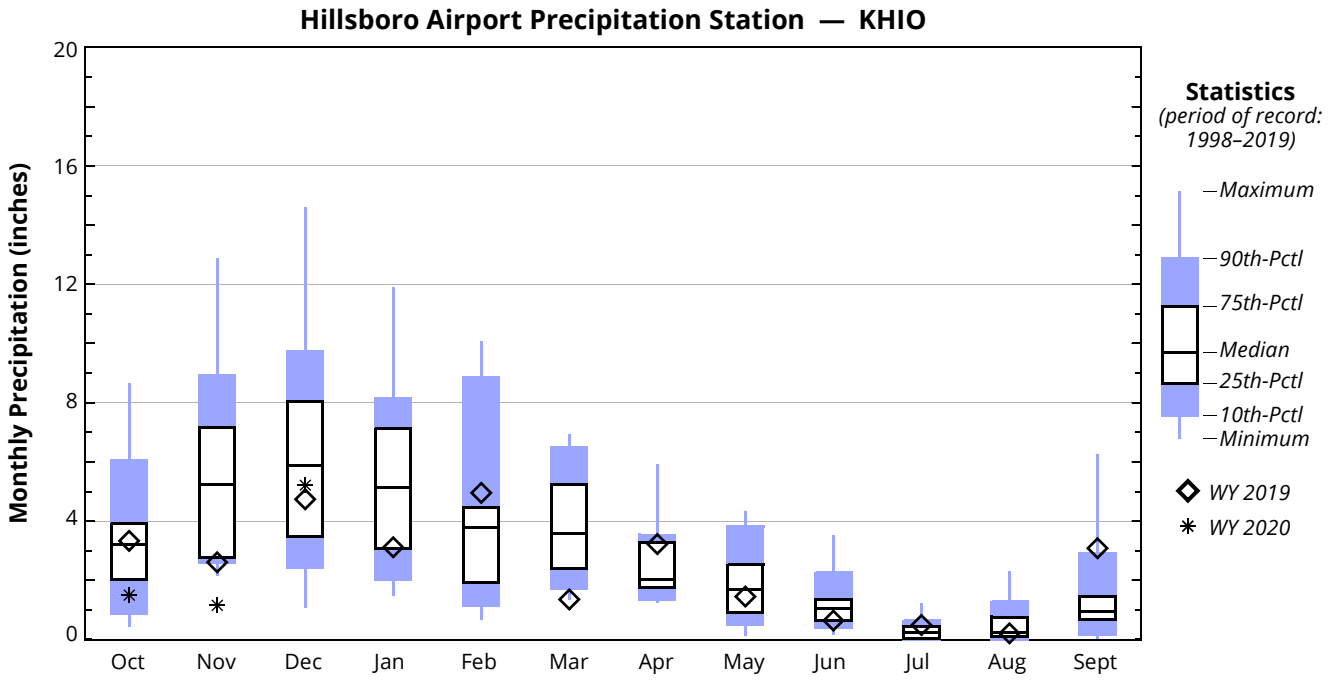
Data source: National Weather Service COOP Program (WBAN ID#94261)
http://scacis.rcc-acis.org

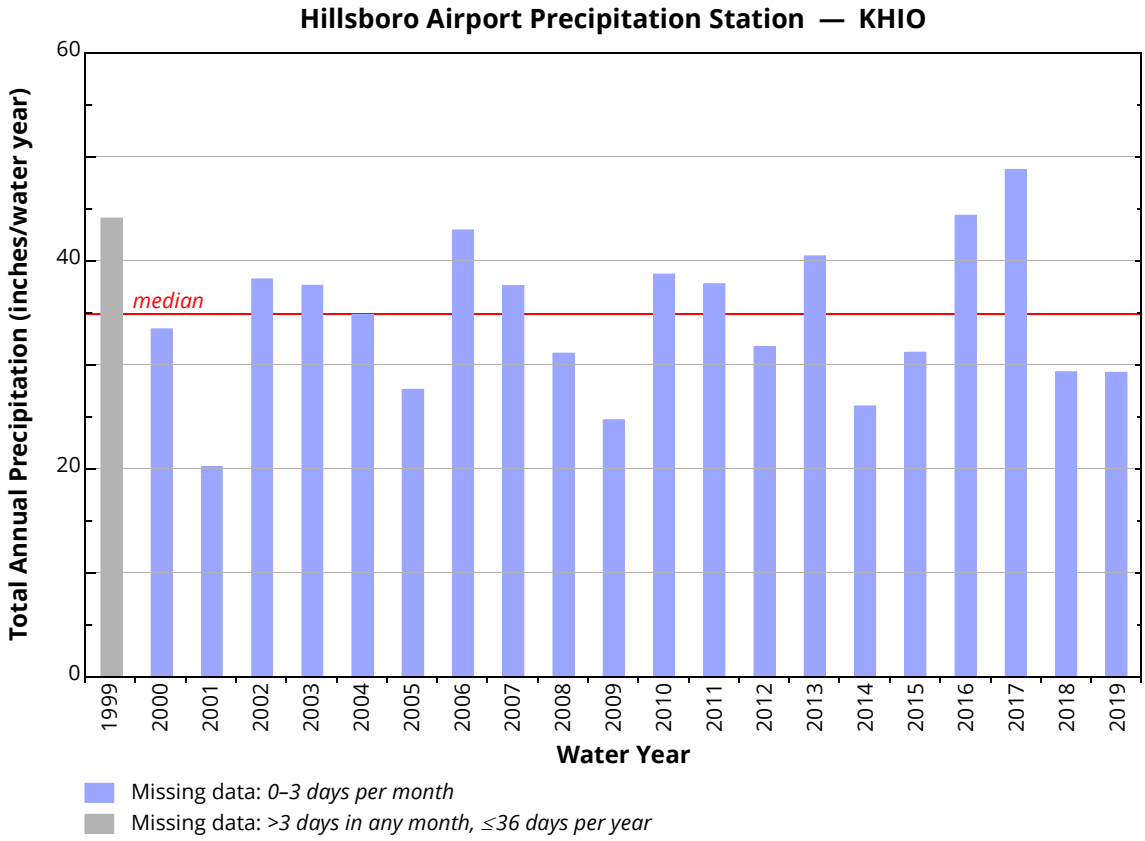
Elevation: 204 ft Latitude: 45 32 26 Longitude: 122 56 55

MONTHLY TOTAL PRECIPITATION (inches) — KHIO

Water Year*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1998										0.32	0.00	0.87
1999		9.03	7.07	7.48	9.78	4.29	1.50	1.74	1.55	0.66	0.84	0.14
2000	2.49	6.91	3.91	6.92	4.35	3.02	1.36	1.91	1.04	0.08	0.15	1.27
2001	3.00	2.16	3.24	1.94	1.58	2.33	1.86	0.85	1.20	0.45	0.79	0.79
2002	3.13	8.54	6.98	7.31	3.13	3.49	1.71	1.44	1.30	0.32	0.05	0.83
2003	0.43	2.61	9.88	8.29	2.93	5.16	5.91	0.75	0.15	0.00	0.55	0.94
2004	3.07	4.43	7.93	5.90	4.27	1.68	1.79	1.24	0.82	0.00	2.31	1.37
2005	3.55	2.61	3.72	2.27	0.68	4.42	2.56	4.35	1.55	0.24	0.32	1.36
2006	3.68	6.09	9.09	11.90	1.99	3.57	2.02	2.70	1.08	0.14	0.08	0.59
2007	0.90	12.88	7.49	3.24	3.80	2.39	1.96	1.29	0.97	0.40	0.53	1.73
2008	3.12	3.90	8.94	5.38	1.49	3.31	1.94	0.97	0.36	0.09	1.37	0.22
2009	1.69	4.51	2.77	4.36	1.08	2.40	1.24	2.92	1.34	0.13	0.72	1.51
2010	3.32	5.72	3.96	5.14	4.06	3.76	3.22	3.16	3.52	0.45	0.17	2.21
2011	3.98	5.23	8.16	3.59	3.83	5.39	3.42	2.10	0.59	1.23	0.00	0.26
2012	1.88	5.38	2.33	5.79	2.48	6.59	2.38	2.34	2.42	0.09	0.02	0.04
2013	5.45	7.59	7.50	1.47	1.87	1.81	2.33	3.98	1.31	0.00	0.85	6.27
2014	0.87	2.73	1.08	2.41	5.06	6.07	3.42	1.70	0.92	0.52	0.14	1.10
2015	6.12	2.83	5.88	3.01	4.57	4.68	1.41	0.44	0.54	0.32	0.55	0.86
2016	3.42	4.00	14.60	7.53	3.96	5.31	1.88	0.80	1.33	0.33	0.25	0.93
2017	8.66	6.25	4.77	4.11	10.06	6.96	3.56	1.82	1.05	0.00	0.13	1.39
2018	4.04	7.38	2.92	5.17	2.15	2.79	3.32	0.11	0.65	0.00	0.00	0.79
2019	3.33	2.61	4.74	3.12	4.96	1.36	3.23	1.45	0.64	0.49	0.21	3.08
2020	1.51	1.16	5.22	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.43	2.16	1.08	1.47	0.68	1.36	1.24	0.11	0.15	0.00	0.00	0.04
MAX	8.66	12.88	14.60	11.90	10.06	6.96	5.91	4.35	3.52	1.23	2.31	6.27
MEDIAN	3.23	5.23	5.88	5.14	3.80	3.57	2.02	1.70	1.05	0.24	0.25	0.94
MEAN	3.31	5.40	6.05	5.06	3.72	3.85	2.48	1.81	1.16	0.28	0.48	1.32

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


Hillsboro Airport Precipitation Station — KHIO
Monthly Precipitation (inches)
0
4
8
12
16
20
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1998–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


Hillsboro Airport Precipitation Station — KHIO
Total Annual Precipitation (inches/water year)
0
20
40
60
median
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Water Year
Missing data: 0–3 days per month
Missing data: >3 days in any month, ≤36 days per year

THNP – Tualatin Hills Nature Park Precipitation Station

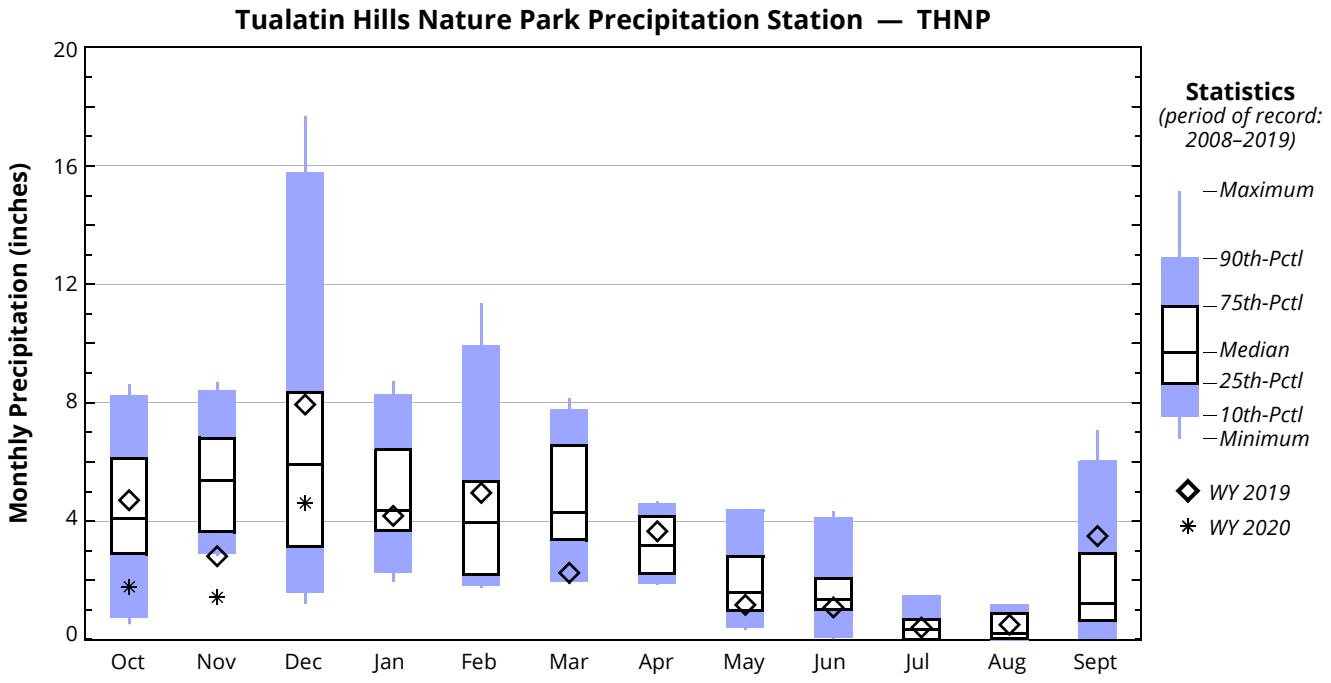
Data source: National Weather Service COOP Program (COOP ID#355945)
http://scacis.rcc-acis.org

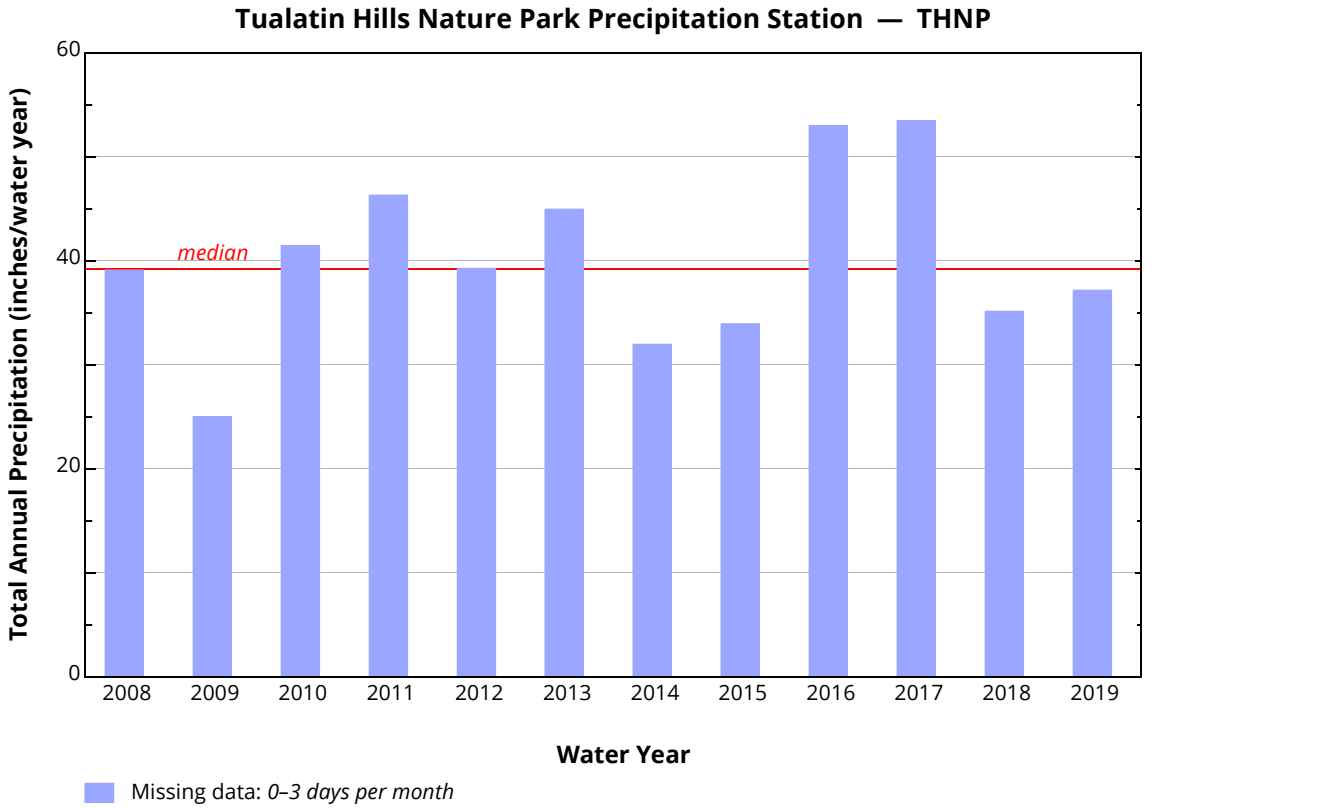
Elevation: 185 ft Latitude: 45 29 53 Longitude: 122 50 22

MONTHLY TOTAL PRECIPITATION (inches) — THNP

Water Year*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2008	3.92	4.43	11.17	6.38	2.18	3.98	2.18	1.30	0.99	1.50	0.94	0.13
2009	1.38	4.65	3.26	4.46	2.31	3.16	2.73	0.90	0.00	0.00	0.70	1.45
2010	3.62	6.41	3.08	5.22	3.87	4.07	2.76	4.26	4.33	0.42	0.01	3.39
2011	4.86	6.60	8.38	4.28	5.45	6.08	4.41	2.83	1.40	1.37	0.03	0.60
2012	2.65	5.46	2.50	7.08	3.36	8.15	3.60	2.70	3.52	0.19	0.00	0.04
2013	6.51	8.71	8.22	1.96	1.76	1.87	2.11	4.41	1.21	0.00	1.11	7.07
2014	0.52	3.21	1.23	3.12	6.51	6.77	4.65	2.47	1.53	0.72	0.12	1.09
2015	7.32	3.37	5.56	3.52	4.03	4.48	1.85	0.70	0.33	0.26	1.17	1.34
2016	4.23	5.32	17.69	8.72	4.21	5.81	2.42	1.37	1.74	0.53	0.19	0.76
2017	8.61	7.60	6.29	4.25	11.37	6.69	3.92	1.80	1.34	0.01	0.24	1.33
2018	3.93	6.86	3.93	6.41	2.14	4.09	4.21	0.34	2.18	0.00	0.03	1.01
2019	4.71	2.81	7.94	4.18	4.96	2.25	3.55	1.17	1.08	0.40	0.50	3.50
2020	1.79	1.43	4.62	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.52	2.81	1.23	1.96	1.76	1.87	1.85	0.34	0.00	0.00	0.00	0.04
MAX	8.61	8.71	17.69	8.72	11.37	8.15	4.65	4.41	4.33	1.50	1.17	7.07
MEDIAN	4.08	5.39	5.92	4.37	3.95	4.28	3.18	1.58	1.37	0.33	0.22	1.21
MEAN	4.36	5.45	6.60	4.97	4.35	4.78	3.21	2.02	1.64	0.45	0.42	1.81

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


Tualatin Hills Nature Park Precipitation Station — THNP
Monthly Precipitation (inches)
0
4
8
12
16
20
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 2008–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


Tualatin Hills Nature Park Precipitation Station — THNP
Total Annual Precipitation (inches/water year)
0
20
40
60
median
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Water Year
Missing data: 0–3 days per month

KGWP – KGW-TV PRECIPITATION STATION

Data source: National Weather Service COOP Program (COOP ID#356749)
http://scacis.rcc-acis.org

Elevation: 159 ft Latitude: 45 31 05 Longitude: 122 41 22

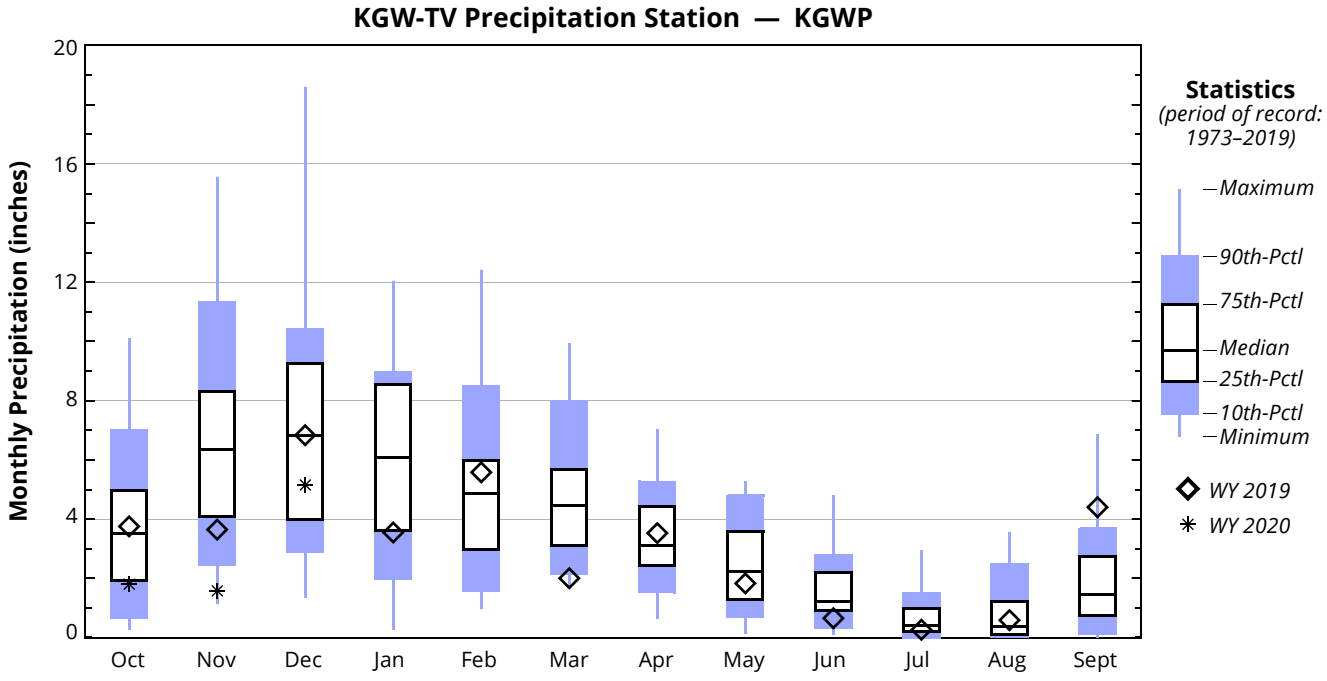
MONTHLY TOTAL PRECIPITATION (inches) — KGWP

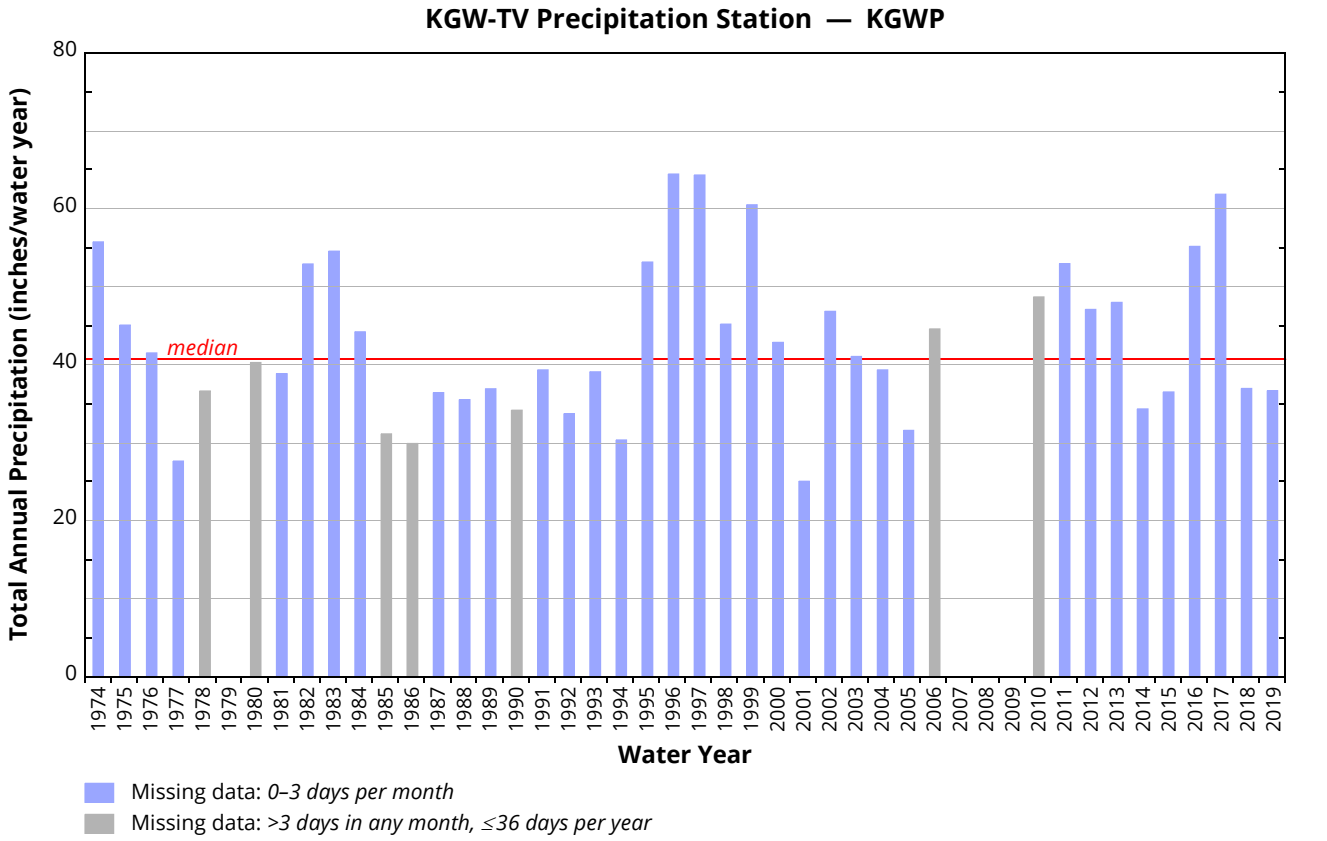
WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1973											1.66	3.76
1974	3.81	13.46	9.88	9.07	4.85	6.43	2.64	2.17	0.86	2.27	0.14	0.15
1975	2.22	7.13	6.93	8.83	6.03	5.02	2.48	1.97	1.22	0.41	2.84	0.00
1976	5.67	4.71	6.74	6.07	5.41	3.41	2.63	1.74	0.92	0.75	2.50	0.93
1977	1.73	1.13	1.36	1.26	2.71	4.10	0.63	4.39	0.99	1.05	3.57	4.69
1978	3.51	5.87		5.93	3.81	1.73	3.53	3.70	1.41	1.17	2.36	3.58
1979	0.48	4.08	2.85	3.04	7.00	2.58	2.83	2.18	0.39	0.25		
1980		4.58	7.35	8.88	4.51	4.45	3.11	2.16	2.77	0.18	0.21	2.06
1981	1.25	7.09	10.27	1.67	3.84	2.74	3.11	1.81	4.03	0.21	0.04	2.76
1982	4.57	5.99	10.34	8.76	7.10	3.61	4.89	0.59	0.99	0.83	1.92	3.33
1983	4.96	3.84	9.40	7.71	9.05	7.31	2.44	2.38	2.04	2.94	2.01	0.47
1984	1.92	10.73	5.78	2.38	4.05	4.32	4.38	4.09	4.48	0.00	0.08	1.99
1985	4.60	10.69	3.38	0.27		4.06	1.14	0.88	2.28	0.12	0.99	2.71
1986	3.05		2.20	5.87	7.15	2.78	1.32	2.33	0.32	1.86	0.04	2.96
1987	2.09	6.36	4.23	7.33	2.99	6.50	2.45	1.88	0.20	1.56	0.46	0.36
1988	0.28	1.97	9.19	6.31	1.38	4.08	5.08	2.97	2.20	0.26	0.11	1.66
1989	0.33	8.34	3.04	4.43	2.64	8.74	1.63	3.53	0.97	1.01	1.11	1.13
1990	1.68	4.46	3.82	8.51	5.44	2.68	3.01		1.89	1.10	1.04	0.52
1991	5.87	4.88	3.74	3.66	4.92	4.52	4.02	4.13	2.43	0.12	0.93	0.10
1992	2.17	7.44	4.88	5.04	4.58	1.78	5.06	0.13	0.56	0.45	0.25	1.33
1993	3.17	5.45	6.84	3.60	0.96	5.20	6.31	4.02	1.94	1.42	0.18	0.00
1994	1.44	1.79	6.86	4.95	6.11	2.72	2.31	1.23	1.10	0.07	0.14	1.63
1995	9.02	7.49	6.53	7.44	5.22	5.02	4.19	1.13	2.29	0.98	1.69	2.14
1996	4.35	11.71	7.84	8.56	12.43	4.46	5.95	4.84	0.09	0.49	0.50	3.22
1997	6.17	9.72	16.28	8.86	2.14	8.24	3.78	2.46	1.62	0.64	1.55	2.84
1998	7.58	5.19	4.01	7.76	6.80	4.21	1.49	5.18	1.61	0.34	0.00	1.02
1999	3.57	13.36	9.21	8.97	11.39	5.67	1.61	2.59	2.45	0.38	1.12	0.19
2000	2.89	7.67	7.67	8.08	4.96	3.62	2.39	2.51	0.90	0.25	0.15	1.76
2001	3.19	2.91	3.85	1.99	1.79	3.73	3.09	1.12	1.40	0.46	0.87	0.66
2002	4.37	7.44	7.83	8.03	4.92	5.40	3.60	1.57	2.19	0.19	0.01	1.31
2003	0.32	2.49	10.48	9.14	3.17	5.16	7.03	1.60	0.11	0.00	0.06	1.50
2004	2.30	5.38	10.43	5.02	4.86	2.01	2.16	1.17	1.03	0.00	3.20	1.76
2005	3.27	2.46	4.58	2.02	0.99	4.73	4.44	5.06	2.03	0.39	0.22	1.37
2006	4.26	6.54	10.20	12.05	2.38	3.63	2.52		1.12	0.19	0.07	1.12
2007	1.83	15.56										
2008								1.22				
2009												1.63
2010	3.54	7.21	4.99	6.68	3.96	5.62	3.99	4.63	4.79	0.30		2.94
2011	5.16	7.39	10.23	5.13	5.79	7.59	5.37	3.25	0.87	1.36	0.10	0.70
2012	2.64	8.32	3.37	8.74	3.71	9.95	3.85	3.21	2.78	0.51	0.00	0.01
2013	6.59	8.53	9.14	3.11	1.51	2.37	2.59	5.26	1.43	0.00	0.63	6.85
2014	0.93	3.52	1.77	3.34	5.95	7.58	4.51	2.79	1.84	0.92	0.13	1.05
2015	7.26	3.58	6.78	3.69	4.11	5.12	2.61	0.64	0.44	0.60	0.78	0.87
2016	4.39	5.61	18.61	8.93	4.87	5.71	2.46	1.30	1.11	0.75	0.16	1.26
2017	10.11	8.74	6.12	5.65	12.18	8.40	4.63	2.25	1.12	0.00	0.09	2.53
2018	5.19	7.90	4.23	6.21	2.93	3.11	5.08	0.29	1.06	0.00	0.03	0.90
2019	3.75	3.65	6.84	3.55	5.58	2.00	3.53	1.83	0.65	0.26	0.59	4.40
2020	1.81	1.58	5.16	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.28	1.13	1.36	0.27	0.96	1.73	0.63	0.13	0.09	0.00	0.00	0.00
MAX	10.11	15.56	18.61	12.05	12.43	9.95	7.03	5.26	4.79	2.94	3.57	6.85
MEDIAN	3.51	6.36	6.81	6.07	4.86	4.46	3.11	2.22	1.22	0.41	0.36	1.44
MEAN	3.66	6.57	6.91	5.97	4.91	4.70	3.39	2.48	1.56	0.63	0.82	1.78

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.

KGWP – KGW-TV Precipitation Station

Data source: National Weather Service COOP Program (COOP ID#356749)





ORCP – OREGON CITY PRECIPITATION STATION

Data source: National Weather Service COOP Program (COOP ID#356334)
http://scacis.rcc-acis.org

Elevation: 167 ft Latitude: 45 21 21 Longitude: 122 36 17

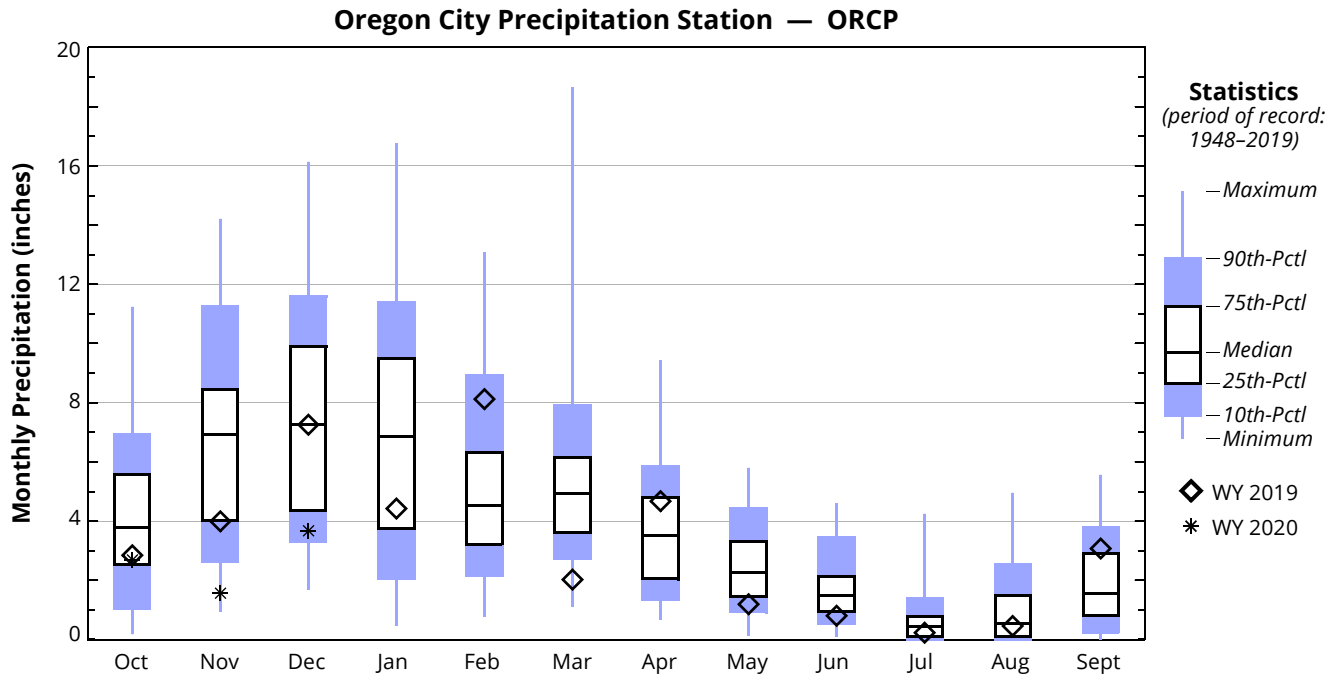
MONTHLY TOTAL PRECIPITATION (inches) — ORCP

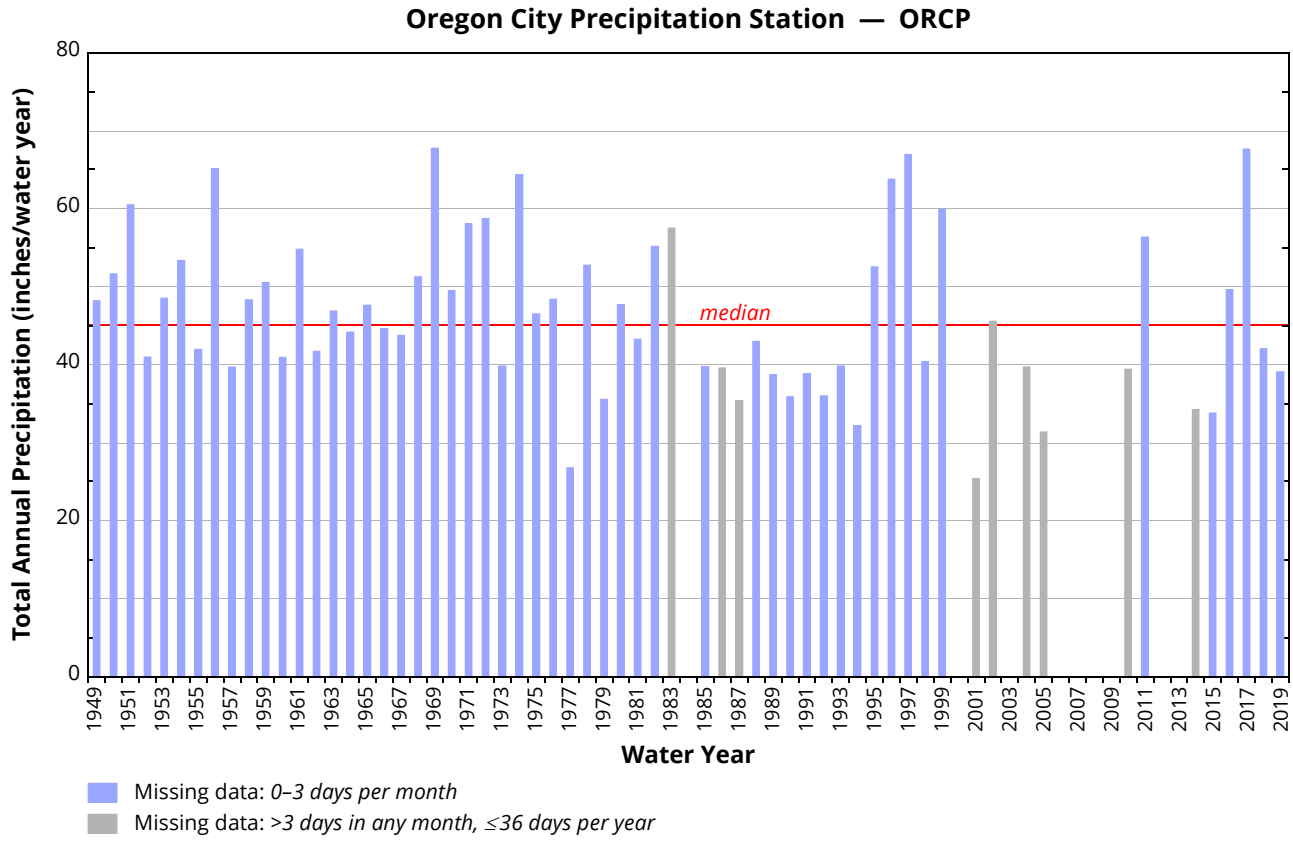
WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1948					7.57	4.70	4.27	4.73	1.15	0.91	2.07	3.46
1949	2.70	8.46	10.26	1.48	13.09	3.34	1.16	2.69	1.25	0.94	0.22	2.60
1950	3.17	6.92	6.50	11.44	6.97	6.29	3.13	1.09	2.05	1.35	0.45	2.26
1951	10.34	12.70	7.48	10.50	5.93	5.63	1.06	2.58	0.09	0.16	0.34	3.71
1952	5.55	6.25	7.29	6.20	4.72	4.51	1.75	0.89	3.30	0.00	0.09	0.42
1953	0.87	1.32	7.70	16.77	4.76	4.96	2.52	4.15	1.50	0.04	2.53	1.40
1954	3.39	7.46	9.04	11.25	5.06	3.46	3.88	2.17	3.76	0.69	2.18	1.01
1955	3.91	5.61	6.49	3.02	3.62	5.32	6.30	1.45	1.37	1.39	0.00	3.46
1956	7.68	9.71	11.20	14.25	4.44	7.61	0.68	2.30	1.99	0.02	3.57	1.67
1957	7.69	1.81	4.53	3.26	4.81	9.43	1.66	3.10	1.95	0.43	0.37	0.68
1958	3.97	4.02	10.60	9.43	6.93	2.67	5.38	0.61	3.26	0.00	0.04	1.40
1959	1.73	8.21	7.12	10.41	5.75	5.07	1.65	3.76	2.00	0.83	0.17	3.81
1960	4.17	3.34	3.86	4.91	4.94	6.64	4.09	5.80	0.64	0.00	1.33	1.20
1961	3.49	12.68	4.18	5.22	11.74	7.01	3.47	4.14	0.60	0.57	0.85	0.84
1962	4.04	6.01	6.65	2.13	4.33	5.88	4.05	3.62	1.15	0.06	1.37	2.43
1963	4.36	11.78	3.00	1.96	4.99	6.33	5.06	4.36	1.74	1.30	0.54	1.46
1964	3.68	7.73	4.22	13.64	1.22	4.43	1.85	1.07	2.90	0.76	0.95	1.72
1965	1.22	9.65	14.78	10.67	1.99	1.47	3.42	1.91	0.75	0.24	1.50	0.03
1966	2.54	7.28	8.87	9.75	2.19	6.43	1.29	1.31	1.67	1.26	0.31	1.72
1967	3.32	6.60	8.29	8.65	2.76	6.08	3.54	2.52	1.17	0.00	0.00	0.81
1968	6.36	2.74	6.24	5.53	8.87	3.60	1.95	3.23	3.44	0.50	4.95	3.83
1969	7.09	7.89	14.56	10.47	3.92	2.99	9.44	2.23	4.48	0.09	0.11	4.50
1970	5.00	3.77	9.15	14.05	6.03	3.01	3.76	1.81	0.69	0.09	0.00	2.15
1971	3.59	8.69	9.36	10.08	4.50	6.27	4.33	2.41	3.16	0.37	1.50	3.79
1972	4.37	7.66	10.25	9.17	6.71	6.53	4.81	2.87	0.73	0.50	0.71	4.41
1973	1.04	6.47	9.79	5.90	2.34	4.00	1.79	1.62	2.23	0.08	1.40	3.18
1974	4.00	14.21	11.93	9.57	6.70	8.04	2.81	2.63	1.18	2.82	0.06	0.40
1975	2.44	7.21	6.87	8.28	5.51	5.67	2.44	1.93	2.12	0.73	3.31	0.00
1976	6.25	5.53	7.79	6.33	8.11	3.64	3.55	2.12	0.67	0.87	2.30	1.25
1977	1.20	0.93	1.69	1.65	3.52	4.20	0.77	4.31	1.41	0.68	3.01	3.41
1978	2.92	7.17	11.49	5.96	4.53	1.88	5.84	4.45	1.71	1.53	2.36	2.88
1979	0.61	4.73	3.27	2.90	8.99	3.30	3.94	2.49	0.70	0.52	0.98	3.14
1980	5.70	3.75	7.73	11.38	4.38	3.71	3.91	1.30	3.79	0.18	0.22	1.65
1981	1.56	7.60	12.61	1.84	4.51	3.13	2.55	1.83	4.52	0.28	0.00	2.84
1982	4.79	5.49	11.42	7.76	8.22	5.18	4.37	1.66	1.05	0.22	1.27	3.76
1983	4.25	5.42	10.39	8.70	8.93	7.87	2.50	2.11		4.24	2.57	0.53
1984	2.16	9.82	6.78	3.29	5.53		3.82	5.19	4.60	0.00	0.03	
1985	6.24	12.34	4.27	0.46	3.64	4.39	1.38	0.93	2.51	0.43	0.52	2.65
1986	3.59	6.47	3.05	6.56	7.99	3.19	2.40	2.89	0.57	1.92		
1987	2.08	6.93		7.92	4.44	6.00	2.71	2.11	0.49	1.62	0.23	0.84
1988	0.29	2.25	10.77	9.17	2.04	4.91	5.85	3.58	1.94	0.59	0.08	1.51
1989	0.18	11.24	3.43	5.18	3.18	7.08	2.02	2.23	1.05	0.58	1.45	1.10
1990	2.25	3.69	3.98	9.65	4.58	2.78	2.59	1.92	2.46	0.48	1.00	0.47
1991	5.94	4.94	3.31	3.50	4.26	3.71	4.63	4.40	2.32	0.06	1.61	0.15
1992	2.98	7.65	5.99	5.24	4.48	1.12	5.10	0.16	0.41	0.26	0.76	1.86
1993	4.19	4.46	6.51	3.74	1.11	5.24	6.15	4.24	1.73	2.23	0.23	0.00
1994	1.43	1.91	6.48	5.38	6.33	4.12	2.14	1.71	1.53	0.08	0.00	1.10
1995	7.22	8.74	6.62	7.61	5.44	4.23	3.88	1.54	1.97	0.76	1.62	2.93
1996	4.82	11.00	8.36	9.17	12.05	3.86	5.63	5.00	0.91	0.63	0.11	2.25
1997	5.33	9.96	16.13	8.45	2.20	8.63	4.91	2.37	2.38	1.01	1.54	4.02

MONTHLY TOTAL PRECIPITATION (inches) — ORCP (continued)

WATER YEAR*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1998	5.70	3.97	3.47	8.91	4.86	4.68	1.19	4.99	1.03	0.43	0.02	1.13
1999	4.21	11.32	9.74	9.14	10.01	5.60	3.43	3.41	1.78	0.20	0.84	0.19
2000	2.70		5.01		6.29	3.08	2.26		1.41	0.46	0.02	0.48
2001	3.88		2.98		1.33	5.02		1.60		0.73	1.05	0.80
2002	2.85	6.52	9.54		3.96	5.55	3.58	1.50	2.09	0.37	0.29	
2003	0.47	2.81	10.18		3.86		5.58	0.52	0.70	0.00		1.02
2004	3.02	6.20	9.30	5.98	3.33		1.74	2.38	2.15	0.15	3.20	2.27
2005	5.62	1.89	4.35	2.15	0.78	5.43	2.88		2.06	0.57		1.58
2006	3.19	6.73	9.91	13.20	2.60	3.70	6.28		1.01	0.08	0.00	1.25
2007				1.01	2.13		1.39	0.61		0.32	0.00	0.32
2008					3.08				0.40		1.53	0.25
2009		7.13		6.86	3.06	4.88	1.38	0.98	1.05	0.17	0.69	1.60
2010	2.74	6.35	5.05	5.39	3.65	5.06		2.85		0.22	0.17	2.24
2011	5.73	7.91	11.43	5.35	5.17	8.25	5.58	3.32	1.48	1.10	0.00	1.04
2012		9.14	4.30	9.24	3.11		4.84	3.16	3.54			0.09
2013		9.00	9.74	3.56	2.48	1.95		2.69	0.12	0.00		5.56
2014	1.05	3.94	2.08		3.83	9.02	3.93	2.59	1.33	0.91	0.77	1.56
2015	6.86	3.39	5.08	3.28	3.99	5.52	2.35	1.00	0.32	0.26	0.80	0.96
2016	4.31	7.50	14.15	7.35	3.43	5.47	3.45	1.12	1.49	0.43	0.10	0.82
2017	11.24	7.56	5.98	3.75	9.17	18.65	5.16	1.29	1.38	0.00	0.23	3.22
2018	6.51	7.72	4.18	6.98	2.85	4.32	7.08	0.12	1.73	0.00	0.05	0.52
2019	2.85	3.99	7.26	4.43	8.12	2.03	4.67	1.19	0.80	0.23	0.46	3.07
2020	2.70	1.57	3.68	*Data in this row are not included in statistics because water year is incomplete.*								
MIN	0.18	0.93	1.69	0.46	0.78	1.12	0.68	0.12	0.09	0.00	0.00	0.00
MAX	11.24	14.21	16.13	16.77	13.09	18.65	9.44	5.80	4.60	4.24	4.95	5.56
MEDIAN	3.78	6.92	7.26	6.86	4.50	4.94	3.50	2.26	1.50	0.43	0.54	1.56
MEAN	3.95	6.74	7.55	7.02	5.03	5.12	3.51	2.45	1.72	0.60	0.94	1.84

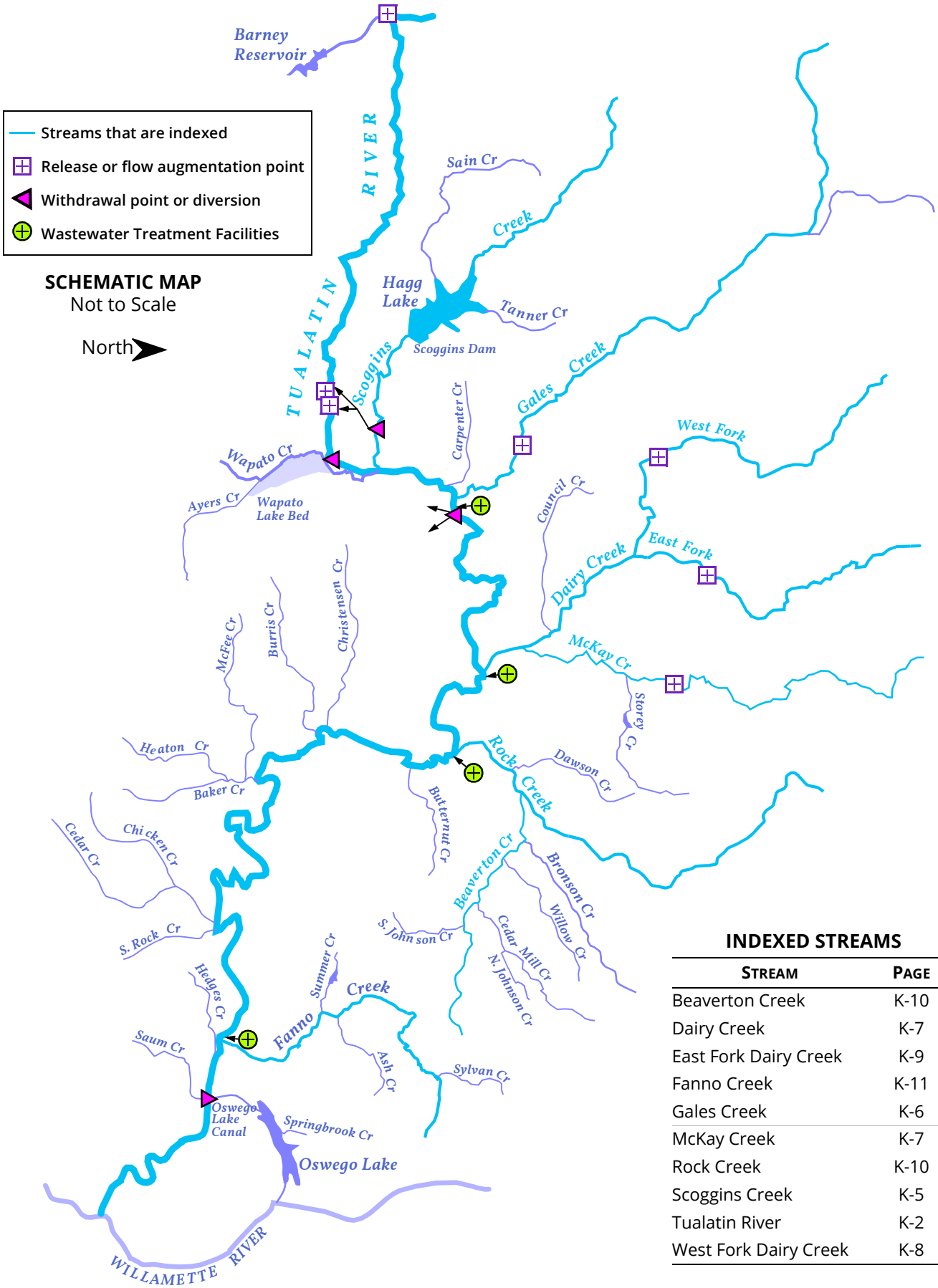
*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


Oregon City Precipitation Station — ORCP
Monthly Precipitation (inches)
0
4
8
12
16
20
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record:
1948–2019)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2019
WY 2020


Oregon City Precipitation Station — ORCP
Total Annual Precipitation (inches/water year)
0
20
40
60
80
median
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
Water Year
Missing data: 0–3 days per month
Missing data: >3 days in any month, ≤36 days per year

this page intentionally blank

APPENDIX H
River Mile Indices



INDEXED STREAMS

TUALATIN RIVER – RIVER MILE INDEX

[Abbreviations: RB= right bank, LB= left bank]

RIVER MILE	BANK	DESCRIPTION	DRAINAGE AREA (square miles)	ELEVATION (feet)
0.00		Mouth of Tualatin River at Willamette River (LB of Willamette River @ River Mile 28.5)	712	
0.20		Weiss Bridge – Petes Mtn Rd.		
1.60	RB	Fields Creek		
1.69		State Hwy 212 Bridge (Fields Bridge)		
1.75	LB	USGS Gage #14207500: Tualatin River at West Linn	706	85.61
2.40	LB	Tate Creek		
3.45		Lake Oswego Corp. Diversion Dam		
4.25		Interstate 205 Bridge		
4.56	LB	Wilson Creek		
5.34	LB	Boat Launch		
5.36	LB	Shipley Creek		
5.38		Shipley Bridge– Stafford Rd NWS Wire Weight Gage		
5.62	LB	Pecan Creek		
6.02	RB	Athey Creek		
6.70	RB	Saum Creek		
6.70	LB	Oswego Canal Diversion River Elevation Recording Gage #14206990 Headgate and Canal Recording Gage #14207000		
7.36	LB	Boat Launch – Dogwood Drive		
7.67	RB	Browns Ferry Park Canoe Launch		
7.83		Clackamas County – Washington County Boundary (Underground Cable Crossing Sign)		
8.18		Interstate 5 Bridge		
8.60		Boones Ferry Road Bridge		
8.64	RB	Hedges Creek		
8.90	RB	Tualatin Park Boat Launch		
8.91	RB	Southern Pacific RR Bridge Tualatin River at Tualatin Elevation Recording Station #14206956 (formerly #14206960)		
9.32	LB	Fanno Creek *[Index on page I-13]*	26.8	
9.33	LB	Durham Wastewater Treatment Plant Outfall (9.2 on NPDES permit)		
9.34		Oregon Electric RR Bridge		
9.80	LB	Cook Park Boat Launch		
11.50	LB	US Hwy. 99W Bridge (Pacific Highway) Canoe Launch(access from southeast of bridge)		
12.68		Overhead BPA Transmission Line; Vancouver–Eugene		
12.80	LB	Rivermeade Boat Launch (Private)		
15.20	RB	Rock Creek–South	13.7	
15.50	RB	Chicken Creek		
16.09	RB	Chicken Creek Drainage Ditch		
16.22	RB	Shamberg Bridge (Elsner Road) Rated Staff Gage for Stream Flow		

TUALATIN RIVER – RIVER MILE INDEX

[Abbreviations: RB= right bank, LB= left bank]

RIVER MILE	BANK	DESCRIPTION	DRAINAGE AREA (square miles)	ELEVATION (feet)
21.12		Overhead BPA Transmission Line; Big Eddy–Keeler		
26.90		State Hwy. 210 bridge (Scholls)		
28.20	RB	McFee Creek		
30.76	LB	Unnamed Stream (Jacktown)		
31.62	RB	Burris Creek		
31.92	RB	Christensen Creek		
33.30	LB	Harris Bridge (State Highway 208) Farmington Recording Stream Gage #14206500	568	100.42
35.68	LB	Butternut Creek		
37.38	LB	Gordon Creek		
38.08	LB	Rock Creek Wastewater Treatment Plant Outfall (37.7 on NPDES permit)		
38.09	LB	Rock Creek Beaverton Creek	74.6 36	
38.44	LB LB	Rood Bridge Small Watercraft Launch Rood Bridge Road Bridge Recording Stream Gage #14206295		105.16
40.44	RB	Davis Creek		
41.64		Minter Bridge Road Bridge		
43.88	LB LB	Jackson Slough Jackson Bottom Wetlands Hillsboro Wastewater Treatment Plant Effluent Outfall (42.9 and 43.3 on NPDES permit)		
44.40	RB	State Highway 219 Bridge Recording Stream Gage #14206241		
44.73	LB	Dairy Creek *[Index on page I-9]* McKay Creek (LB) *[Index on page I-10]* East Fork Dairy Creek *[Index on page I-11]* West Fork Dairy Creek *[Index on page I-12]*	226 63.4	
51.54	RB	Golf Course Road Bridge Golf Course Recording Stream Gage #14204800		
53.74		LaFollett Road (Bridge removed)		
55.24	LB	Forest Grove Wastewater Treatment Plant Outfall (53.8 on NPDES permit) Fern Hill Wetlands and CWS Natural Treatment System		
55.32		Fernhill Road Bridge		
56.10		Springhill Pump Plant Intake		
56.80	LB	Gales Creek *[Index on page I-8]*	78.6	
57.38	LB	Carpenter Creek		
57.84	LB	Dilley Creek		
58.04	LB	Johnson Creek		
58.82	LB	Springhill Road Bridge USGS Gage #14203500: Tualatin River at Dilley	125	147.57
59.02	LB	O'Neil Creek		
60.00	LB	Scoggins Creek *[Index on page I-7]*		
60.80	RB	Wapato Creek Wapato Creek Improvement District Return Flow		

TUALATIN RIVER – RIVER MILE INDEX

[Abbreviations: RB= right bank, LB= left bank]

RIVER MILE	BANK	DESCRIPTION	DRAINAGE AREA (square miles)	ELEVATION (feet)
62.00	RB	Wapato Improvement District Headgate)		
62.24		Southern Pacific RR Bridge		
62.25		State Highway 47 Bridge (Gaston) New Tualatin River at Gaston Recording Stream Gage #14202510		
62.30		Bates Road Bridge		
62.80	LB	Black Jack Creek		
62.90		Overhead BPA Transmission Line; Forest Grove–McMinnville		
63.13		TVID Patten Valley Pump Station Outfall #1		
63.87	RB	Discontinued Tualatin River at Gaston Recording Stream Gage	48.5	
64.26		TVID Patten Valley Pump Station Outfall #2		
65.34	RB	Williams Canyon		
65.90		Mt. Richmond Road Bridge		
67.30	LB	Hering Creek		
67.83		South Road Bridge (Cherry Grove)		
68.44	RB	Roaring Creek		
69.42		Little Lee Falls		
70.70	LB	Raines Bridge– Tualatin River below Lee Falls Rated Staff Gage for Stream Flow		
71.07		Lee Falls		
73.28		Haines Falls		
73.30	LB	City of Hillsboro Haines Falls Intake		
74.00	LB	Lee Creek		
74.05	RB	Patten Creek		
75.70	LB	Sunday Creek		
76.60	LB	Maple Creek		
76.95		Ki–A–Cut Falls		
78.00	RB	Barney Reservoir Aqueduct Outfall		
79.3+		Headwaters of Tualatin River		

SCOGGINS CREEK — STREAM MILE INDEX

[Abbreviations: RB= right bank, LB= left bank]

RIVER MILE	BANK	DESCRIPTION
0.00		Confluence with Tualatin River @ River Mile 60.00
0.94		RR Bridge
1.00		State Highway 47 Bridge
1.70		Old State Highway 47 Bridge
1.71		USGS Gage #14203000: Scoggins Creek near Gaston, OR (10/1940 – 9/1974) Drainage Area = 43.3 square miles
4.80		USGS Gage #14202980: Scoggins Creek below Henry Hagg Lake, near Gaston, OR (1/1975 –present) Drainage Area = 38.8 square miles
5.10		Scoggins Dam
7.00	RB	Sain Creek
7.62	LB	Tanner Creek
8.40	LB	Wall Creek
9.70		Lake Loop Road Bridge
9.30		Scoggins Creek above Henry Hagg, near Gaston, OR – Gage #14202850 (10/1972 – present) Drainage Area = 15.9 square miles
10.52	LB	Parson Creek
15.50	LB	Fisher Creek
15.5+		Headwaters

GALES CREEK — STREAM MILE INDEX

[Abbreviations: RB= right bank, LB= left bank, ISWR= Instream Water Right]

RIVER MILE	BANK	DESCRIPTION
0.00	RB	Confluence with Tualatin River@ River Mile 56.80 ***ISWR:*** C–59523 5/25/66
1.63		Southern Pacific RR Bridge
1.75		Forest Grove Bypass Bridge – State Highway 47 to State Highway 8
2.36		State Highway 47 Bridge Gales Creek Recording Stream Gage #14204530
3.66		Ritchey Road Bridge (County Road 461)
6.53	RB	Prickett Creek
6.98		Stringtown Road Bridge (County Road A–176)
7.70	RB	Roderick Creek
8.56		Roderick Road Bridge (County Road 395) USGS Gage #14204500: Gales Creek near Forest Grove Oregon (10/1940–9/1956, 10/1970–9/1981)
8.94	RB	Godfrey Creek
9.22	LB	Kelly Creek
10.68	RB	Clear Creek
11.44	RB	Iler Creek
11.46		NW Gales Creek Road (County Road 1312) Community of Gales Creek
11.47	RB	Fir Creek
12.00		***ISWR:*** C–59509 5/25/66 above this point
12.36		Clapshaw Hill Road Bridge (County Road 2037) Rated Staff Gage for Stream Flow
12.40	LB	Little Beaver Creek ***ISWR:*** C–59512 5/25/66
12.92		Parson Road Bridge
14.44	RB	White Creek
14.68		NW Wilson River Highway Bridge (State Highway 6)
15.74	RB	Lyda Creek
16.26	RB	Bateman Creek
17.50		USGS Gage #1420400: Gales Creek near Gales Creek, OR – (10/1935–9/1945 & 10/1963–9/1970)
18.00	LB	Beaver CreekCommunity of Glenwood ***ISWR:*** C–59524 5/25/66
18.45		NW Timber Road Bridge (County Road 374)
18.65		Wilson River Highway Bridge (State Highway 6)
19.70		Wilson River Highway Bridge (State Highway 6)
19.88	LB	Coffee Creek
20.07	LB	Finger Creek
20.70	RB	South Fork Gales Creek ***ISWR:*** C–59514 5/25/66
21.60	LB	North Fork Gales Creek ***ISWR:*** C–59513 5/25/66
22.76	RB	Low Divide Creek
		Gales Creek Forest Park
23.20		USGS Gage #14203750: Gales Creek near Glenwood, OR (7/94 – present)
23.2+		Headwaters

Dairy Creek — Stream mile index

[Abbreviations: RB= right bank, LB= left bank]

River Mile	Bank	Description
0.00		Confluence with Tualatin River @ River Mile 44.73
1.65		Southern Pacific RR Bridge
2.06		State Highway 8 Bridge USGS Gage #14206200: Dairy Creek at TV Hwy
2.20		Oregon Electric RR Bridge
2.26	LB	McKay Creek
3.53	RB	Council Creek
6.02		Susbauer Road Bridge (County Road 196)
7.39		BPA Power Line Crossing
8.51		Cornelius–Schefflin Road Bridge (County Road 2161) Rated Staff Gage for Stream Flow
10.55		Confluence of East Fork Dairy Ck & West Fork Dairy Ck

McKay Creek — Stream mile index

[Abbreviations: RB= right bank, LB= left bank]

River Mile	Bank	Description
0.00		Confluence with Dairy Creek @ River Mile 2.26
1.31		Padgett Road Bridge (County Road 2245)
2.25		Hornecker Road Bridge (County Road 2393) Rated Staff Gage for Stream Flow
2.30		Southern Pacific RR Crossing
4.32		Glencoe Road Bridge (County Road A–146½) Rated Staff Gage for Stream Flow
4.46		BPA Transmission Line Crossing
5.34	LB	Waible Creek
6.30		NW Old Scotch Church Road Bridge (County Road A–66)
8.00		US Hwy 26 Bridge – Sunset Highway
9.36		NW West Union Road Bridge (County Road 2496) City of North Plains to West
9.38		Southern Pacific RR Crossing
10.94	LB	Jackson Creek
12.80		NW Shadybrook Road Bridge (County Road A–110)
15.56		NW Collins Road Bridge (County Road 1889) Rated Staff Gage for Stream Flow
16.56	RB	Brunswick Canyon
16.66	LB	East Fork McKay Creek
24.0+		Headwaters

West Fork Dairy Creek — Stream mile index

[Abbreviations: RB= right bank, LB= left bank]

River Mile	Bank	Description
0.00		Confluence with East Fork Dairy Creek @ River Mile 10.56 of Dairy Creek
1.96		Evers Road Bridge (County Road A–187) Rated Staff Gage for Stream Flow
2.09	RB	Lousignant Canal
2.82		State Highway 47 Bridge
5.28		Greenville Road Bridge (County Road A–159)
6.20		State Highway 6 Bridge
6.22	RB	Cedar Canyon Creek
7.53		Cedar Canyon Road Bridge (County Road 1938) City of Banks to SE
7.70		State Hwy 47 Bridge – Rated Staff Gage for Stream Flow USGS Gage #14205000: West Fork Dairy Creek at Banks, OR (10/1940 – 9/1943) Drainage Area = 47.5 square miles
7.72		Port of Tillamook Bay RR Bridge
9.30		US Highway 26 Bridge
10.60		NW Green Mountain Road Bridge (County Road 127)
11.02	LB	Garrigus Creek
12.19		NW Turk Road Bridge (County Road 233)
12.36	RB	Kuder Creek
12.90		NW Pihl Road Bridge (County Road 1045) Community of Manning
13.33		Port of Tillamook Bay RR Bridge
13.48		Port of Tillamook Bay RR Bridge
13.58	LB	Witcher Creek
14.37		Port of Tillamook Bay RR Bridge
14.50		US Highway 26 Bridge
15.00		NW Fisher Road Bridge (County Road 394)
15.11	LB	Mendenhall Creek
15.58	RB	Burgholzer Creek
15.60		US Highway 26 Bridge
16.00		Community of Buxton – ½ mile east
17.02	LB	Williams Creek
17.98	RB	Cummings Creek
18.10		State Highway 47 Bridge
18.85		Port of Tillamook Bay RR Bridge
22.0+		Headwaters

EAST FORK DAIRY CREEK — STREAM MILE INDEX

[Abbreviations: RB= right bank, LB= left bank, ISWR= Instream Water Right]

RIVER MILE	BANK	DESCRIPTION
0.00		Confluence with West Fork Dairy Creek @ River Mile 10.56 of Dairy Creek
1.24		Roy Road Bridge (County Road A–159) Rated Staff Gage for Stream Flow
2.34		Port of Tillamook Bay RR Bridge
3.04	RB	Bledsoe Creek
3.20		Harrington Road Bridge (County Road 1989)
4.80		SP&S RR Bridge
5.56		US Highway 26 Bridges
6.91		Mountaindale Road Bridge (County Road 12)
6.97	LB	Baker Creek
8.44		Dairy Creek Road Bridge (County Road 2067) Rated Staff Gage for Stream Flow
8.55		USGS Gage #14205500: East Fork Dairy Creek at Mountaindale, OR – (10/1940–9/1951) Drainage Area = 43.0 square miles
9.62		NW Uebel Road Bridge (County Road 304)
12.50		Murphy Lane Bridge (Private) Rated Staff Gage for Stream Flow
12.82	RB	Big Canyon
13.00		***ISWR:*** C–59525 5/25/66
13.95	RB	Murtaugh Creek
14.04	LB	Meadow Brook Creek
14.17		Meacham Road Bridge (County Road 742)
15.55	LB	Plentywater Creek ***ISWR:*** C–59527 5/25/66
16.52	RB	Denny Creek ***ISWR:*** C–59526 5/25/66
16.56		Bacona Road Bridge (County Road 422) Snooseville Corner
17.21		Greener Road Bridge (County Road 1990)
17.34	LB	Rock Creek
17.50		Little Bend Park
17.60		Fern Flat Road Crossing (County Road 241)
18.15	LB	Panther Creek
18.31		Fern Flat Road Crossing (County Road 241)
18.84	RB	Roundy Creek
19.10	RB	Campbell Creek
21.30		Washington County – Columbia County Boundary
21.48		BPA Power Line Crossing
22.0+		Headwaters

Rock Creek — Stream mile index

[Abbreviations: RB= right bank, LB= left bank

River Mile	Bank	Description
0.8		River Road Bridge
1.2		Southern Pacific RR Bridge
1.2+		State Highway 8 Bridge – Rated Staff Gage for Stream Flow
2.4		SW Brookwood Avenue Bridge
3.1	RB	Dawson Creek
4.4	LB	Beaverton Creek
4.5		Baseline Road Bridge
4.9		NW Quatama Road Bridge – Rated Staff Gage for Stream Flow
5.5		Oregon Electric RR Bridge
5.7		NW 216th Avenue Bridge
6.7		NW Cornell Road Bridge
7.8		US Highway 26 Bridge
9.0		West Union Road Bridge – Rated Staff Gage for Stream Flow
9.3	RB	Holcomb Creek
10.0		NW 185th Avenue Bridge
10.9	LB	Abbey Creek
11.0		Germantown Road Bridge
11.9		Cornelius Pass Road Bridge
13.0		Old Cornelius Pass Road Bridge
14.1		Burlington Northern RR Bridge
15.1		Rated Staff Gage for Stream Flow
16.4		Rock Creek Road Bridge
16.5		Van Raden Reservoir
19.1		Headwaters

Beaverton Creek — Stream mile index

[Abbreviations: RB= right bank, LB= left bank

River Mile	Bank	Description
0.00		Confluence with Rock Creek @ River Mile 4.3
0.40		Southwest Baseline Road
1.16		Southwest 216th Avenue Road Bridge– Rated Staff Gage for Stream Flow
2.20	RB	Bronson Creek
3.32	RB	Willow Creek
4.90		Southwest 170th Avenue Road Bridge– Rated Staff Gage for Stream Flow
5.47	LB	Unnamed Stream
6.06	LB	Johnson Creek
6.30	LB	Unnamed Stream
6.66		Oregon Electric Railroad
7.45		Cedar Hills Boulevard
7.90	RB	Reasoners Creek
8.75+		Headwaters

FANNO CREEK – RIVER MILE INDEX

[Abbreviations: RB= right bank, LB= left bank]

RIVER MILE	BANK	DESCRIPTION
0.00		Confluence with the Tualatin River at River Mile 9.32
0.86		Oregon Electric RR Bridge
1.19		Durham Road Bridge USGS Gage #14206950: Fanno Creek at Durham
2.00	LB	Ball Creek
2.12		Bonita Street Bridge – Rated Staff Gage
3.28		SW Hall Blvd Bridge
3.95		SW Ash Avenue Bridge
4.28		SW Main St Bridge
4.30		State Hwy 99W Bridge
4.49		SW Grant Ave Bridge
5.07		SW Tiederman Ave. Bridge
5.08	RB	Summer Creek Rated Staff Gage at Fowler School
5.32		SW Tigard Ave Bridge
5.53		SW North Dakota St Bridge
5.54	LB	Ash Creek Rated Staff Gage at Greenburg Road
6.38		Scholls Ferry Road Bridge
7.30		Tuckerwood – Rated Staff Gage
7.66		SW Hall Blvd Bridge
8.40		SW Denny Rd Bridge
8.60		Oregon Electric RR Bridge
8.70		State Hwy 217 Bridge
9.42		Scholls Ferry Road Bridge Rated Staff Gage
9.66		SW 92nd Ave Bridge
9.90		SW Bohmann Parkway Bridge
10.16		SW 86th Ave Bridge
10.78		SW Nicol Road Bridge
11.76		Olson Road Bridge
11.96	RB	Sylvan Creek
11.98		SW Beaverton–Hillsdale Hwy (State Hwy 10)
12.10		Washington County – Multnomah County Line
12.58		SW 56th Ave Bridge USGS Gage #14206900: Fanno Creek at 56th
12.81		SW Shattuck Road Bridge
13.22		SW 45th Ave Bridge
13.23	RB	Ivey Creek
13.32		SW 43rd Ave Bridge
13.38		SW 42nd Ave Bridge
13.48		SW 39th Ave Bridge
13.98		SW Beaverton–Hillsdale Hwy (State Hwy 10)
14.10		SW 30th Ave Bridge
14.1+		Headwaters