Mid-Coast Water Resources Characteristics

Water Quantity

Version 2

Mid-Coast Water Planning Partnership

February 2018

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2.2 Water Quantity

2.2.1. Introduction

This report describes the water quantity in the Mid-Coast, and includes an overview of the amount of water that is available in surface water and groundwater systems. This report also describes factors that influence water quantity, changes in streamflow throughout different seasons, and different groundwater resources and how much water they yield.

Water resources in the Mid-Coast support multiple uses, including providing drinking water; supporting fisheries and wildlife; supporting industry and commercial operations; providing recreational opportunities, such as rafting and fishing; and supporting estuaries that are habitat for a diversity of species. Water uses have changed over time. For instance, streams in the Mid-Coast were historically used to move timber from harvest sites to market. Today, water resources in the Mid-Coast and throughout many parts of the western United States are increasingly valued for providing recreational opportunities and habitat for aquatic species.

The Mid-Coast Place Based Planning Partnership (Partnership) created this report to help develop a common understanding of water resources characteristics, uses, and needs in the Mid-Coast region. The contents of this report are based on best readily available information. This report is part of a larger report that builds a foundation of understanding of the ecology, water quality, water quantity, and water-related built systems in the Mid-Coast with the purpose of helping balance the instream and out-of-stream water needs in the region.

Given that many aspects of water quantity are directly tied to other natural and human-made systems, readers are encouraged to read the Ecology and Built Systems reports of the Mid-Coast Water Resources Characteristics report for additional information. Water Quantity also influences water quality; therefore, readers are also encouraged to read the Water Quality report of the Mid-Coast Water Resources Characteristics report. Several examples of activities that affect water quantity include surface water withdrawals, groundwater pumping, stream channel morphology (shape), land cover and land use, geology, and precipitation. For example, altering stream channel shape can change the interactions between surface water and groundwater as well as the functions of floodplain habitat, which changes when and where water is available.

Overall, the water quantity characteristics of the Mid-Coast can be summarized as follows:

- Streams in the Mid-Coast have high streamflow during the winter and low streamflow during the summer as a result of seasonal precipitation patterns.
- The Mid-Coast has eight active streamflow gage locations.
- The Oregon Water Resources Department (OWRD) uses information from river gages and water availability models to help determine whether to issue new water rights. The water availability models take into account existing surface water and groundwater uses, and the amount of water available instream.
- Generally, Mid-Coast groundwater is not very productive because of low permeability and low storage capacity of the regional rock formations.

2.2.2. Water Quantity Overview

2.2.2.1. Surface Water Characteristics

Surface water resources in the Mid-Coast vary drastically from season to season. According to *Water Resources of Lincoln County Coastal Area,* a report prepared for the U.S. Geological Survey (USGS) (Frank & Laenen, 1976) streamflow is highest during the winter months (January through March) and lowest during the late summer/fall months (August through October). About 85 percent of the annual streamflow volume in Lincoln County occurs from November through April, corresponding with high levels of precipitation (Frank & Laenen, 1976). Other factors influencing the timing and discharge of streamflow include groundwater-surface water interactions, soil type, geology, channel morphology (shape), water withdrawals, natural storage and human-made storage, and vegetation. Historical land use patterns and current land use patterns affect these factors, with the exception of precipitation and underlying geologic conditions.

Winter streamflow can be tens or hundreds of times greater than summer streamflow. Streams in the Mid-Coast are rain-dominated and responsive to precipitation, reaching high flows during rainstorms. During the late summer and-fall months, when the Mid-Coast receives very little precipitation, groundwater inputs maintain the base flows in streams (USGS, 2017). Given the poor water-bearing properties of Mid-Coast geology, base flows can be quite low, especially as the size of the drainage area decreases. In addition to precipitation from rainfall, coastal areas receive a marine layer of fog in later summer months called "fog drip" that plays a beneficial role in the drainage area. Coastal fog can contribute to available moisture for vegetation, reduce evapotranspiration, and assist in fire protection.

All of the major river drainages in the Mid-Coast, with the exception of the Yachats River, originate at the crest of the Coast Range in Polk and Benton Counties and extend to the coast. The landscape in the Mid-Coast is generally steep and erosional, which leads to dense drainage networks with numerous small streams. There are numerous small streams along the coast that drain directly into the Pacific Ocean. Many of these streams (with the exception of Beaver Creek, near Ona Beach) are relatively short and drain small areas of land (less than 20 square miles).

There are eight major river drainages in the Mid-Coast: the Salmon River, Siletz Bay-Ocean Tributaries, Siletz River, Depoe Bay-Ocean Tributaries, Yaquina River, Beaver Creek-Ocean Tributaries, Alsea River, and Yachats River. Salmon River, Siletz River, Yaquina River, Beaver Creek, Alsea River, and Yachats River all have estuaries at their mouth where freshwater and saltwater meet (see the Ecology report). These major rivers are tidally influenced and during high tides saltwater reaches miles upstream. This creates productive estuarine habitats, but makes some portions of the streams too salty for drinking water supply. Because of tidal influences, stream gages in the Mid-Coast are intentionally located upstream from the river mouth and above the tidal influence.

Many streams in the Mid-Coast are ocean tributaries, meaning that they drain directly into the ocean rather than draining to a river, and are tidally influenced. The zone of tidal influence in these streams depends on the discharge of the stream and the type of tide (neap tide, spring tide, etc.). Some streams have tidal influence several miles upstream from the ocean, but site-specific information is not available for all tidally influenced streams in the Mid-Coast. In the zone of tidal influence, water has elevated salt content and may be unsuitable for drinking. Head of tide (the farthest point upstream where a river is affected by tidal fluctuations) can be found on the interactive Estuary Data Viewer (http://www.coastalatlas.net/estuarymaps/) by checking the "Head of Tide" layer under the Estuarine Resources Folder labeled "Physical."

2.2.2.2. Groundwater Characteristics

Geology in the Mid-Coast limits available groundwater resources. Mid-Coast geology is generally characterized by low permeability and low storage capacity. According to a *Geologic Sketch of Northwestern Oregon,* a report prepared for the USGS (Snavely & Wagner, 1964), the Siletz River Volcanics aquifer is one of the more productive aquifers in the region, producing an average of 5 to 10 gallons per minute (gpm), which is generally sufficient for domestic purposes (Snavely & Wagner, 1964). In the Salmon River and Devil's Lake drainage areas, wells tend to yield slightly more than other areas in the Mid-Coast (between 10 and 50 gpm in some wells); however, there is great variability in well production throughout the region.

2.2.2.3. Instream Water Rights

In 1987, the State of Oregon legally recognized instream uses as beneficial uses of water. This allowed for the creation of instream water rights that authorize the use of water instream to protect aquatic ecosystems, and out-of-stream water rights to be transferred instream. Instream water rights protect a specified amount of flow be kept instream within a certain reach or at a specific point along a stream. They have a priority date, place of use, and rate just like any other water right. Typically, instream water rights allocate specified flows for each month in the year (OWRD, 2013).

Oregon has three "families" of instream water rights. First, there are instream water rights that are based on minimum perennial streamflows that OWRD administratively established in the 1950s and 1960s. Some of these have been converted into instream water rights, receiving the priority date of the date when the minimum perennial streamflow was established, whereas others have remained as a minimum perennial streamflow without an associated water right. Second, there are instream water rights that state agencies, primarily the Oregon Department of Fish and Wildlife (ODFW), applied for after the passage of the Instream Water Rights Act, which have priority dates later than 1987 and are typically junior to many existing water rights. The beneficial use for these water rights is typically for maintaining flows for fish species, spawning, and migration. The Oregon Parks and Recreation Department (OPRD) and the Department of Environmental Quality (DEQ) are the other two agencies that can file for instream water rights for recreational purposes or pollution abatement. Finally, there are instream rights that have been created through transferring an out-of-stream water right instream (such as an irrigation water right) or through the Allocation of Conserved Water Program. These instream rights are typically for small amounts of flow (1 cubic foot per second [cfs] or less), but may have senior priority dates.

2.2.3. Water Quantity in the Mid-Coast

2.2.3.1. Approach

2.2.3.1.1. Report Objectives

- To gain a general understanding of water quantity in the planning area
- To have an understanding of water quantity conditions such as:
  - The amount of surface water in major streams and tributaries
  - The monthly timing of flow in major streams and tributaries
  - The general characteristics of groundwater in the planning area
- To identify data gaps
- To ensure that potential water management solutions consider the amount and timing of surface water and groundwater resources

2.2.3.1.2. Report Organization

Information is organized into the eight major drainage basins in the planning area; some additional information on tributaries and small streams is provided in Appendix C. The first half of this report describes surface water characteristics and groundwater characteristics, including the discharge and timing of surface water in the planning area and groundwater availability. For surface water, the rate of flow (discharge) is typically expressed in cubic feet per second (cfs).

The second half of this report introduces how OWRD determines whether water is available for new water uses. It also describes OWRD's process for determining whether water is available for new groundwater uses. Using data tables, potential water availability for new surface water rights and new storage water rights then is described for the planning area. General characteristics of groundwater availability are included, followed by a discussion of data gaps and funding needs for continued water quantity measurement.

2.2.3.1.3 Data Sources (see Appendix A)

2.2.3.1.4 Terminology (see Appendix B)

2.2.3.1.5 Planning Area

The Partnership defines the Mid-Coast as eight major drainage areas. From north to south, these major areas include the Salmon, Siletz Bay-Ocean Tributaries, Siletz, Depoe Bay-Ocean Tributaries, Yaquina, Beaver Creek-Ocean Tributaries, Alsea, and Yachats drainage areas. In addition to spanning most of Lincoln County, the planning area extends eastward into portions of Benton County and Linn County to the crest of the Coast Range to include the upper Salmon River, upper Siletz River, and upper Alsea River Drainage Areas. Given the large number of tributaries and small streams in the Mid-Coast, information is provided for streams that serve as source waters for public water systems. Tools and links are provided so that the reader can access additional information (see **Appendix A**).

This report provides additional information on select streams in **Appendix C.**

2.2.3.1.6 Major Rivers in the Mid-Coast and Streams that Serve as Current Supply for Public Water Systems

Salmon River Drainage Area

- Panther Creek

Siletz Bay – Ocean Tributaries

- Schooner Creek (Siletz Bay)
- Drift Creek (Siletz Bay)

Siletz River Drainage Area

- Siletz River
- Tangerman Creek

Depoe Bay – Ocean Tributaries

- Rocky Creek (near Cape Foulweather)
- Johnson Creek (near Otter Rock)
- Wade Creek (near Beverly Beach)
- Spencer Creek (near Beverly Beach)
- Big Creek (in Newport)
- North and South Depoe Bay Creeks (near Depoe Bay)

Yaquina River Drainage Area

- Yaquina River

Beaver Creek – Ocean Tributaries

- Beaver Creek (near Ona Beach)

Alsea River Drainage Area

- Alsea River
- North Fork and South Fork Weist Creek, tributaries to Eckman Slough (Alsea Bay)
- Eckman Creek, tributary to Eckman Slough (Alsea Bay)

Yachats River Drainage Area (and Ocean Tributaries)

- Yachats River
- Dicks Fork Creek, tributary to Big Creek (Pacific Ocean) near Yachats
- Starr Creek
- Vingie Creek

2.2.3.2. Surface Water Characteristics

This section describes variability in precipitation and streamflow in the Mid-Coast, the major drainage areas, and surface water characteristics for tributaries of the major rivers that are source waters for drinking water providers. Graphs, known as hydrographs showing streamflow timing and discharge are represented in water years (a water year is from October 1 to September 30, to correspond with the rainy season). Using water years is the standard practice for the USGS and OWRD. Hydrographs and basic drainage area information are provided for all streams with drinking water intakes where information was readily available from OWRD.

The hydrographs in this report show the 80 percent exceedance flow based on measured mean daily flow when data are available from a stream gage. Where no stream gage data are available, this report uses the 80 percent exceedance flow from OWRD's modeled natural streamflow for drainage areas that have been modeled[1]. Exceedance is a statistical measure used to describe how often a certain condition is met. Eighty percent exceedance describes the flows that are met 80 percent of the time (see **Appendix B**). Methods are described further in Section 2.2.3.2 (Streamflow Characteristics by Major Drainage Basins).

Appendix C includes streamflow characteristics for streams not included in the main body of this report, as well as a list of other streams identified as important by the Partnership. For information on all streams with OWRD natural streamflow estimates and information on the potential availability of water for new appropriations, sorted by drainage areas, see **Appendix D.**

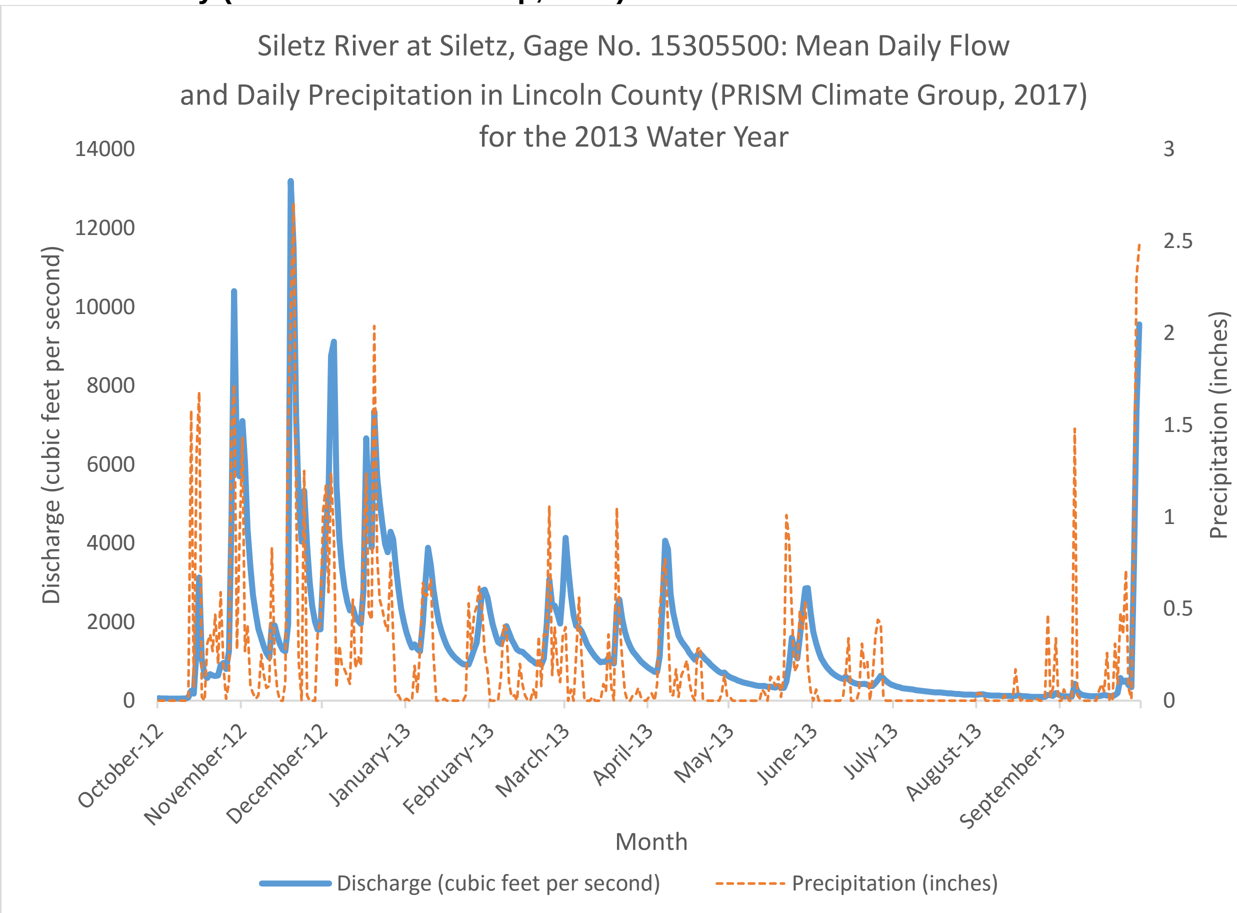
2.2.3.2.1 Variability in Precipitation and Streamflow

Streamflow in the Mid-Coast is extremely variable. Topography, soil conditions, ground cover, forest cover, geology, and land use all influence the discharge and timing of streamflow. Urbanization affects the amount and timing of streamflow by decreasing the ability of the land to absorb rainfall and causing runoff to reach streams quicker. During individual precipitation events, streamflow can increase quickly and significantly in some streams. Streams also exhibit *diurnal fluctuations,* where streamflow varies between daytime and nighttime as the amount of evapotranspiration increases and decreases (Albright et al., 2010).

Exhibit 1 shows measured daily discharge for the Siletz River near the City of Siletz and precipitation in Lincoln County for the 2013 water year. The 2013 water year was chosen as a simple example of variability in streamflow and precipitation because precipitation during that water year was similar to the 30-year normal (PRISM Climate Group, 2017). The graph highlights the variability in streamflow and precipitation as well as the strong response in streamflow from precipitation. The large variability in Mid-Coast streams generally is caused by two main factors: precipitation and groundwater. The Mid-Coast streams are rain-dominated, so precipitation enters streams quickly via runoff, as opposed to slowly melting and entering streams in a snow-dominated or mixed rain-snow system or through groundwater recharge and discharge. Since the local geology generally does not have high storage capacity, less water recharges the groundwater and instead enters the stream via runoff.

[1] These watersheds are called "Water Availability Basins." For more information, go to the Water Availability section of this report.

Exhibit 1. Siletz River Mean Daily Flow, Gage No. 15305500 and Daily Precipitation in Lincoln County (PRISM Climate Group, 2017) for the 2013 Water Year



Sources: OWRD[1], 2017; PRISM Climate Group, 2017

Streamflow also varies on a daily basis as a result of precipitation events. Shortly after rain begins, streamflow begins to increase. There is lag time between when rainfall is greatest and when streamflow is greatest because it takes time for rain to reach the stream. On the hydrograph this is called the "rising limb." Instantaneous peak flow is the maximum discharge (flow) at a given time. Peak flows can be much higher than the 80 percent exceedance flows, which are the flows that can be expected 80 percent of the time based on a base period of record. Peak flows generally show the high degree of variability in the system, whereas 80 percent exceedance flows tend to smooth-out the hydrograph. This report does not provide descriptions of instantaneous peak flows. More information about peak flows can be found at: Peak Discharge Estimation Mapping Tool.
http://apps.wrd.state.or.us/apps/sw/peak_discharge_map/

2.2.3.2.2 Water Quantity Monitoring Networks

Streamflow Monitoring Locations

The OWRD website provides access to data from USGS and OWRD stream gages. The most recent data is available in OWRD's Near Real Time Hydrographics Database[2] (OWRD[1,] 2017) and historic data, including discontinued gage data, are available in OWRD's Historical Streamflow and Lake Level Database (OWRD[5], 2017). **Exhibit 2** below shows the active stream gaging stations located in the planning area. The map in **Exhibit 3** shows the locations of active gages maintained by OWRD and USGS, discontinued gages and miscellaneous streamflow measurements (OWRD[1], 2017).

At active gage stations, mean daily flow is available for the time period that the gage has been in commission. Each gage has a different period of record (the amount of time that a gage has been collecting data). For example, the gage located on the Siletz River near the City of Siletz has been collecting streamflow measurements since 1905, while the gage on the Yachats River above Clear Creek has been active only since 2013. Data for the associated gages can be found by clicking the gage number below.

Exhibit 2. Active Gage Locations and Period of Record in the Mid-Coast

Gage Location	Gage Number	Period of Operation
Salmon River below Slick Rock Creek	14303730	Unknown - present
Siletz River at Siletz	14305500	1905 - present
Sunshine Creek near Valsetz	14304350	1974 - present
Yaquina River near Chitwood	14306030	1972 - present
Alsea River near Tidewater	14306500	1939 - present
Drift Creek near Waldport	14306820	1930 – present*
East Fork Lobster Creek	14306340	1983 - present
Yachats River above Clear Creek near Yachats	14306872	2013 - present

Source: OWRD[1], 2017
*This gage has many years with missing data online.

Miscellaneous measurements are spot measurements of streamflow made at one location at a single point in time by OWRD staff. Miscellaneous measurements are available for many streams in the study area, however these measurements are sparse and generally not adequate to describe characteristics of discharge and timing of flows. Miscellaneous measurements can be found online.

More Information:

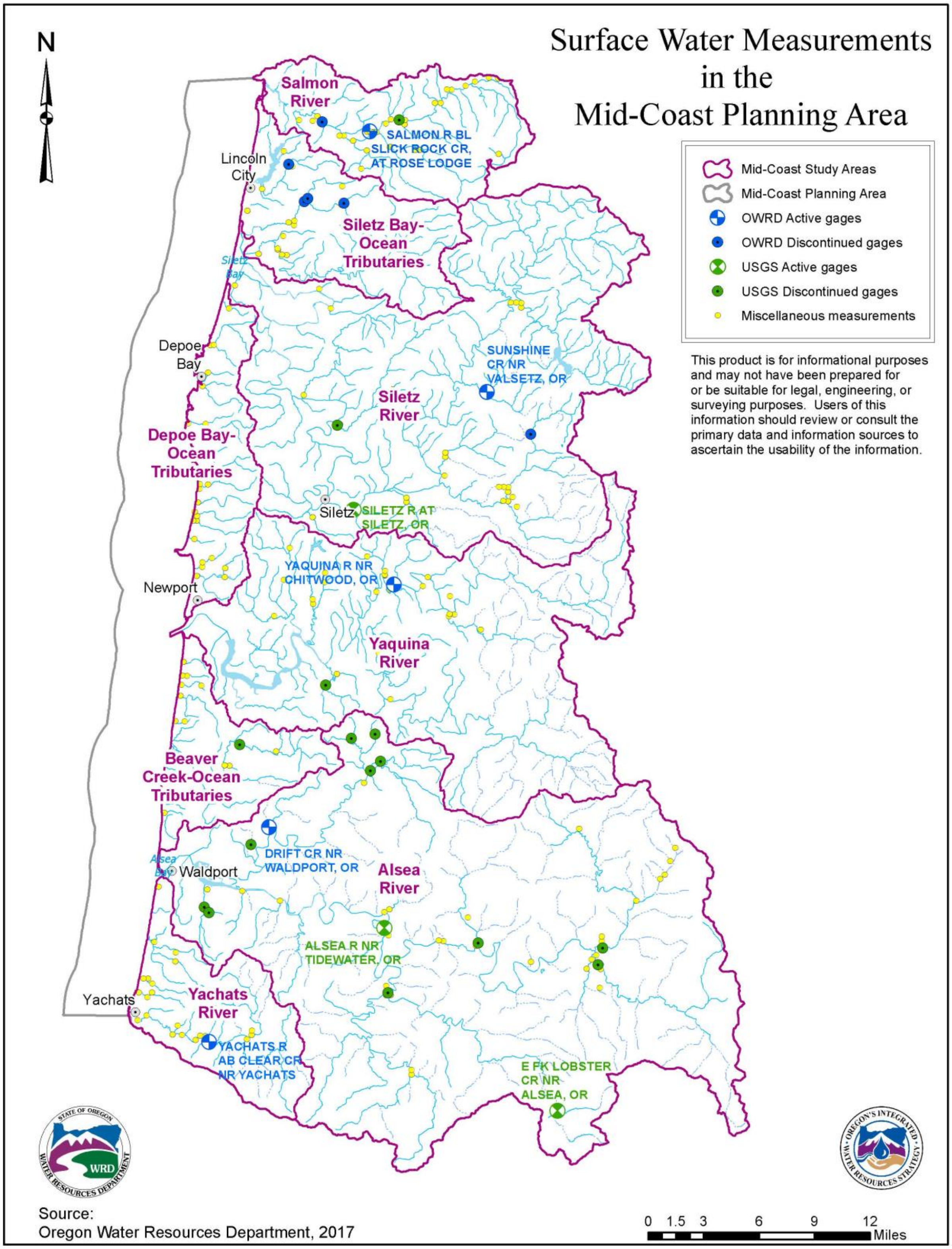
- OWRD's Near Real-Time Streamflow Database
  http://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/

[2] OWRD has a process for reviewing streamflow measurements to ensure data quality. Not all recent data from the Real Time Hydrographics Database has been reviewed. This data is labeled in the database as "raw data" or "provisional data" that is user beware data.

- OWRD's Historical Streamflow and Lake Level Database
  http://apps.wrd.state.or.us/apps/sw/hydro_report/

- OWRD's Miscellaneous Streamflow Measurements Query
  http://apps.wrd.state.or.us/apps/sw/misc_measurements_view_only/

Exhibit 3. Surface Water Measurements in the Mid-Coast



2.2.3.2.3 Streamflow Characteristics by Major Drainage Basins

The following section describes general streamflow characteristics in each of the eight major drainage areas.

Methods/Sources

Stream discharge data were obtained from active OWRD and USGS stream gages. These data can be downloaded from OWRD's Near Real Time Hydrographics Database. **The 80 percent exceedance flow reported here was calculated in Microsoft Excel using mean daily streamflow data.** For the purposes of this report the 80 percent exceedance flow is the mean daily streamflow recorded at the gage that is exceeded 80 percent of the daily streamflow measurements within a given time period. For example, a gage with a complete thirty year period of record would have 900 mean daily streamflow measurements for the month of April (30 days in April x 30 years of data). If those mean daily flow records were arranged from lowest to highest, the 80 percent exceedance flow would be the flow exceeded by 80 percent (720 out of 900) of recorded mean daily streamflow.

The 80 percent exceedance flow statistic was used to provide a conservative representation of the magnitude and timing of water moving through streams in the Mid Coast and shows annual streamflow patterns. For those gages, the graphs below show streamflow at the 80 percent exceedance by month over the period of record. For the Siletz River, Yaquina River, Alsea River, and Yachats River, streamflow data came from gage data downloaded from OWRD's Near Real-Time Streamflow Database between June 1, 2017 and August 1, 2017 (OWRD[1], 2017).

In order to maintain a consistent period of record across all gages, a 30-year period of record was chosen (1987 to 2016). All stream gages in the study area, except for a new gage on the Yachats River, have data available for this time period. All available data, including provisional and raw data were included in the calculation of the 80 percent exceedance flow in order to have sufficient data and to allow comparisons between gages.

With the exception of the Salmon River, where a stream gage was installed in October, 2017, the remaining streams described in this section do not have active stream gages. Because gage data were not available, **80 percent exceedance natural streamflow estimates for these streams were downloaded from OWRD's Water Availability Report System (WARS) between June 1, 2017 and August 1, 2017.** These natural streamflow estimates were created by OWRD by selecting a base period of time (1958 to 1987), using miscellaneous measurements of streamflow, if available, estimated drainage area characteristics, and statistical modeling techniques, such as a regression analysis from a similar drainage area with gage data.

The graphs below developed using OWRD's 80 percent exceedance natural streamflow estimates represent the magnitude and timing of water moving through streams in the Mid Coast and shows annual streamflow patterns; they do not represent actual observed streamflow.

Finally, drainage area characteristics provided (drainage area, average annual precipitation from 1961-1990) were downloaded from WARS between June 1, 2017 and August 1, 2017 (OWRD[2], 2017).

More Information: OWRD's Water Availability Reporting System (WARS) (Estimated Natural Streamflow Information):
http://apps.wrd.state.or.us/apps/wars/wars_display_wa_tables/search_for_WAB.aspx

Salmon River Drainage Area

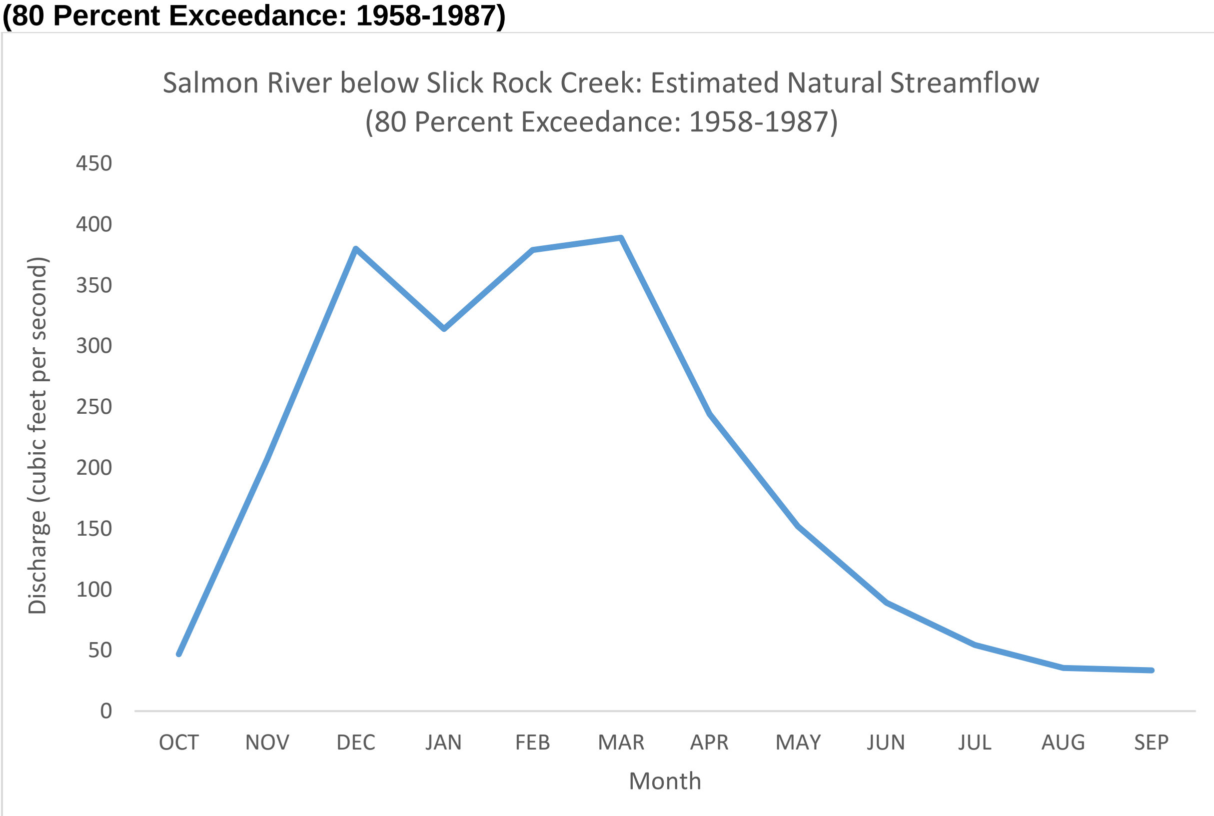
The Salmon River drains 75 square miles (OWRD[2], 2017) and has numerous tributaries, including Crowley Creek, Panther Creek, Bear Creek, Little Salmon River, Salmon Creek, Slick Rock Creek, Treat River, and Trout Creek (SDCWC, n.d.).

Average annual precipitation is 118 inches across the drainage area with some areas of the drainage area receiving higher average annual precipitation (OWRD[2], 2017). Fog drip contributes as much as 20 inches of precipitation during the dry summer/fall months (SDCWC, n.d.). Panther Creek, tributary to the Salmon River, is a drinking source water for Panther Creek Water District (DEQ, 2017).

Gage Station Locations. There is one active OWRD gage on the Salmon River, and it is located below Slick Rock Creek at Rose Lodge. Currently, only raw data from October 30, 2017 to the present are available (OWRD[1], 2017).

Discharge and Timing. The estimated 80 percent exceedance natural streamflow modeled by OWRD through the Water Availability Reporting System (WARS) at the mouth of the Salmon River shows that streamflow is highest in February and March, declines in late March through late July, and is lowest in August, September, and early October, and increases sharply from mid-to late October into January (see **Exhibit 4**) (OWRD[2], 2017).

Exhibit 4. Salmon River below Slick Rock Creek: Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

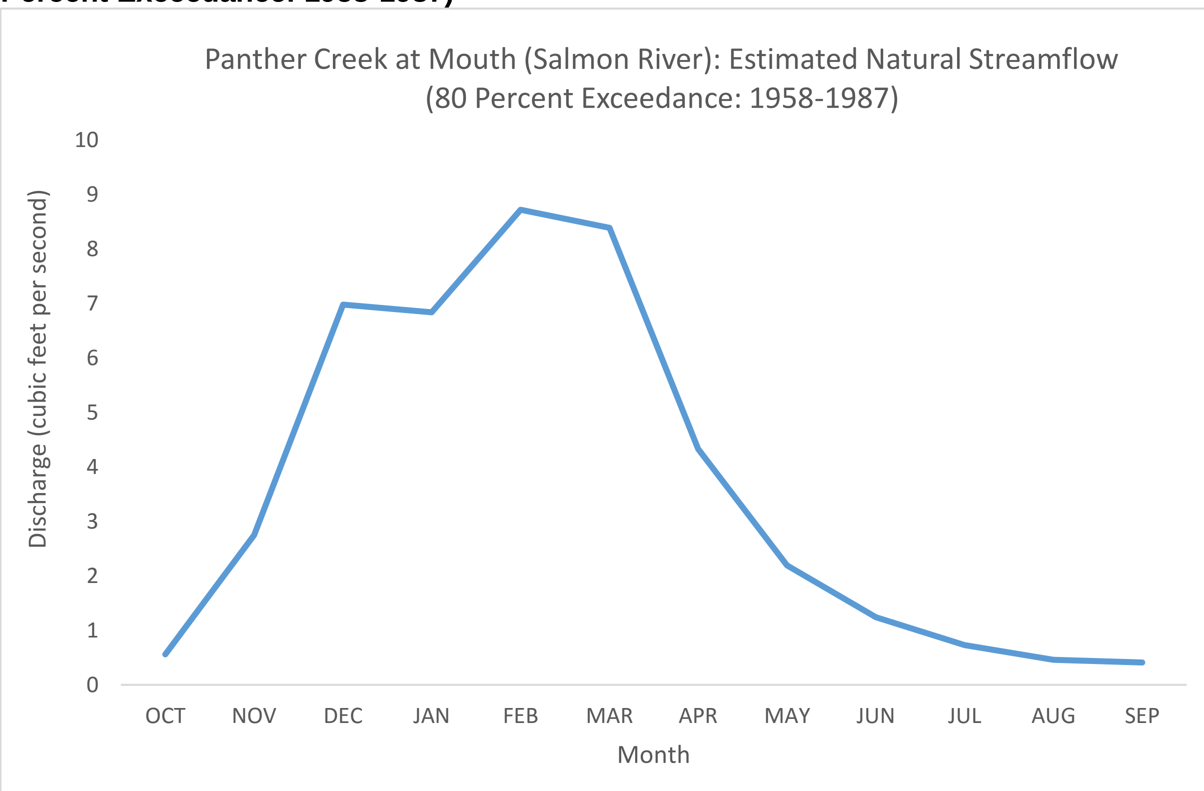
Panther Creek

Panther Creek is a tributary to the Salmon River and is a source of water for Panther Creek Water District, which serves rural communities in and around the unincorporated community of Otis (DEQ, 2017).

Gage Station Locations. There are no active OWRD or USGS stream gages on Panther Creek (OWRD[1], 2017).

Discharge and Timing. Annual streamflow patterns on Panther Creek are similar to the Salmon River, but streamflow is considerably lower since it drains a much smaller area. OWRD's estimated 80 percent exceedance natural streamflow show Panther Creek high flows occur in February and low flows in August, September, and early October (OWRD[2], 2017). See **Exhibit 5.**

Exhibit 5. Panther Creek at Mouth (Salmon River): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

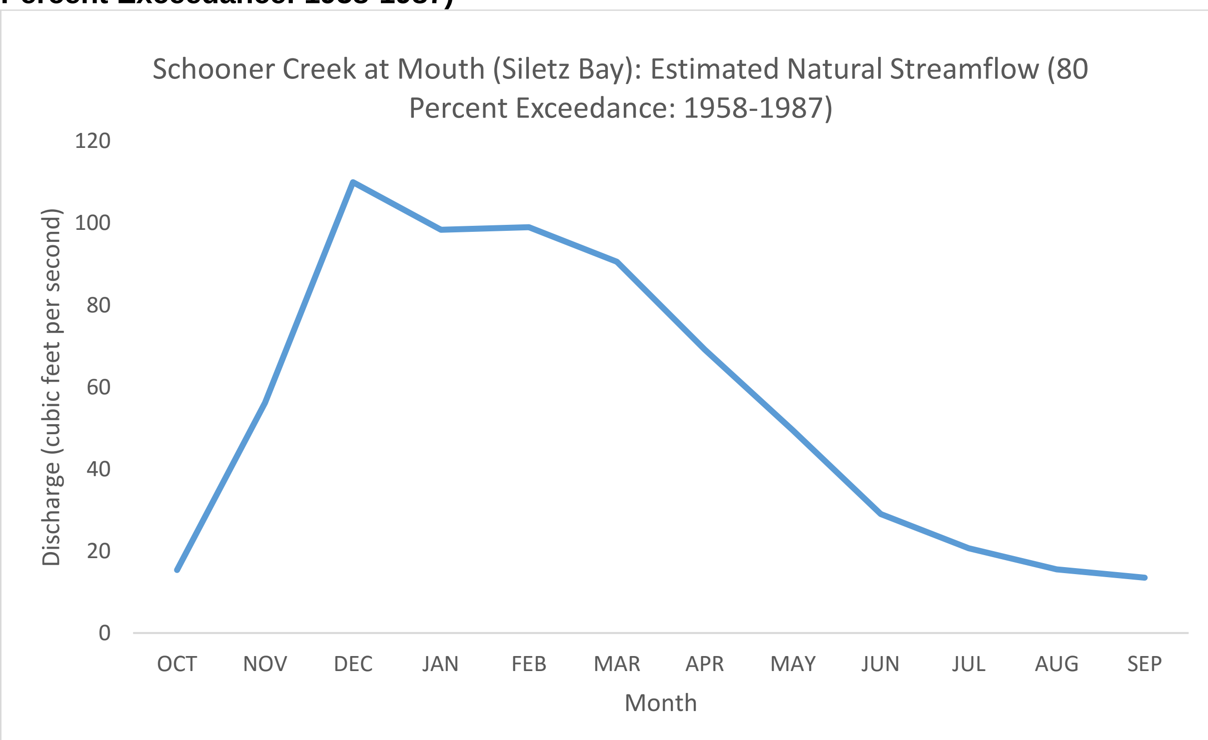
Siletz Bay- Ocean Tributaries

Schooner Creek (Pacific Ocean)
Schooner Creek is a tributary of Siletz Bay in Northwest Lincoln County. Schooner Creek is a water source for Lincoln City (DEQ, 2017). The Schooner Creek drainage area drains approximately 18 square miles above Lincoln City's water intake located at the water treatment facility (OWRD[2], 2017).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Schooner Creek (OWRD[1], 2017). Lincoln City provided raw streamflow data for Schooner Creek; however, the data were not analyzed or used in this report.

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow shows high streamflow in Schooner Creek occurs in December and declines gradually between March and October (see **Exhibit 6**) (OWRD[2] 2017). Lincoln City has measured flows at their water intake, upstream of the mouth of Schooner Creek.

Exhibit 6. Schooner Creek at Mouth (Siletz Bay): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

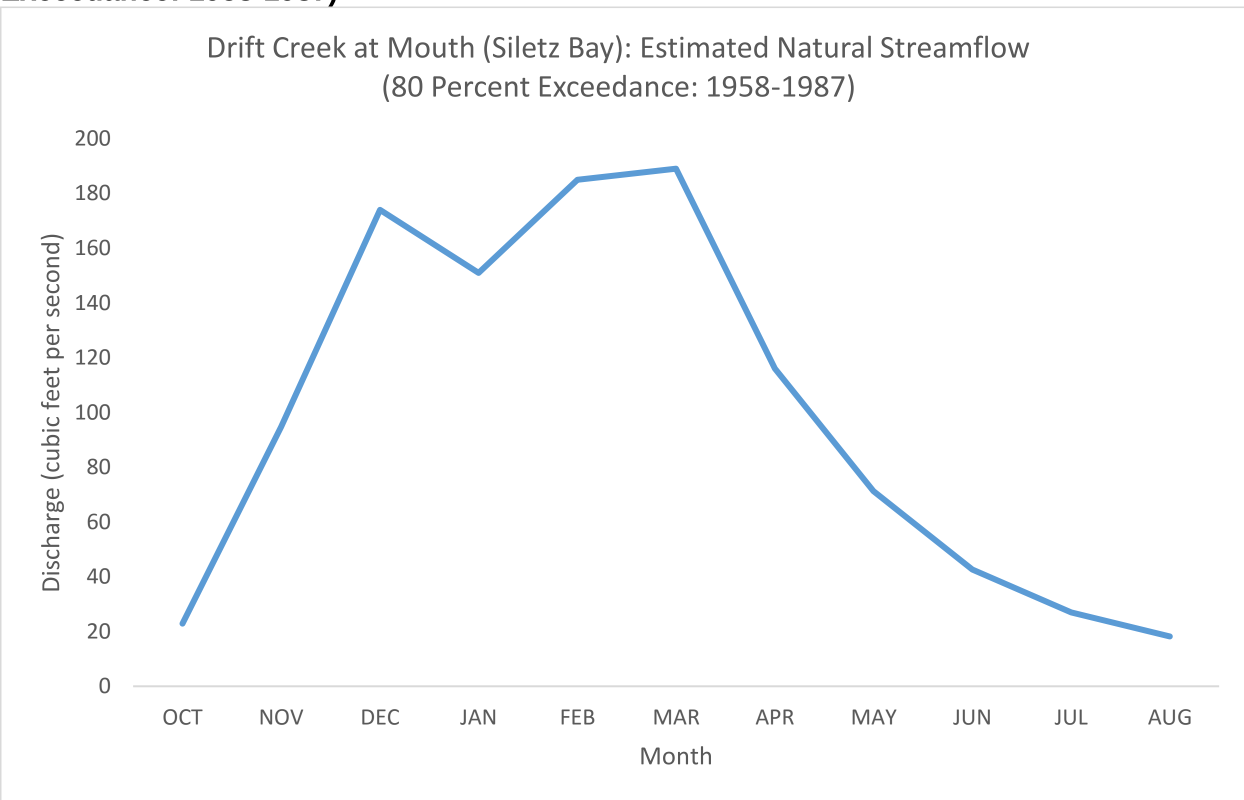
Drift Creek (Pacific Ocean)

Drift Creek drains approximately 41 square miles (OWRD[2], 2017) and is a water source for Kernville-Gleneden-Lincoln Beach Water District (DEQ, 2017). The District also has an intake on Side Creek, however there are no active OWRD or USGS gaging stations on Side Creek (OWRD[1], 2017) and OWRD does not have natural streamflow estimates for Side Creek (OWRD[2], 2017). The City of Lincoln City has an emergency intake on Drift Creek (DEQ, 2017).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Drift Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow is highest in March and decreases through July, reaching low flows in August and September (see **Exhibit 7**) (OWRD[2], 2017). Lincoln City provided raw streamflow data for Drift Creek; however, the data were not analyzed or used in this report.

Exhibit 7. Drift Creek at Mouth (Siletz Bay): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

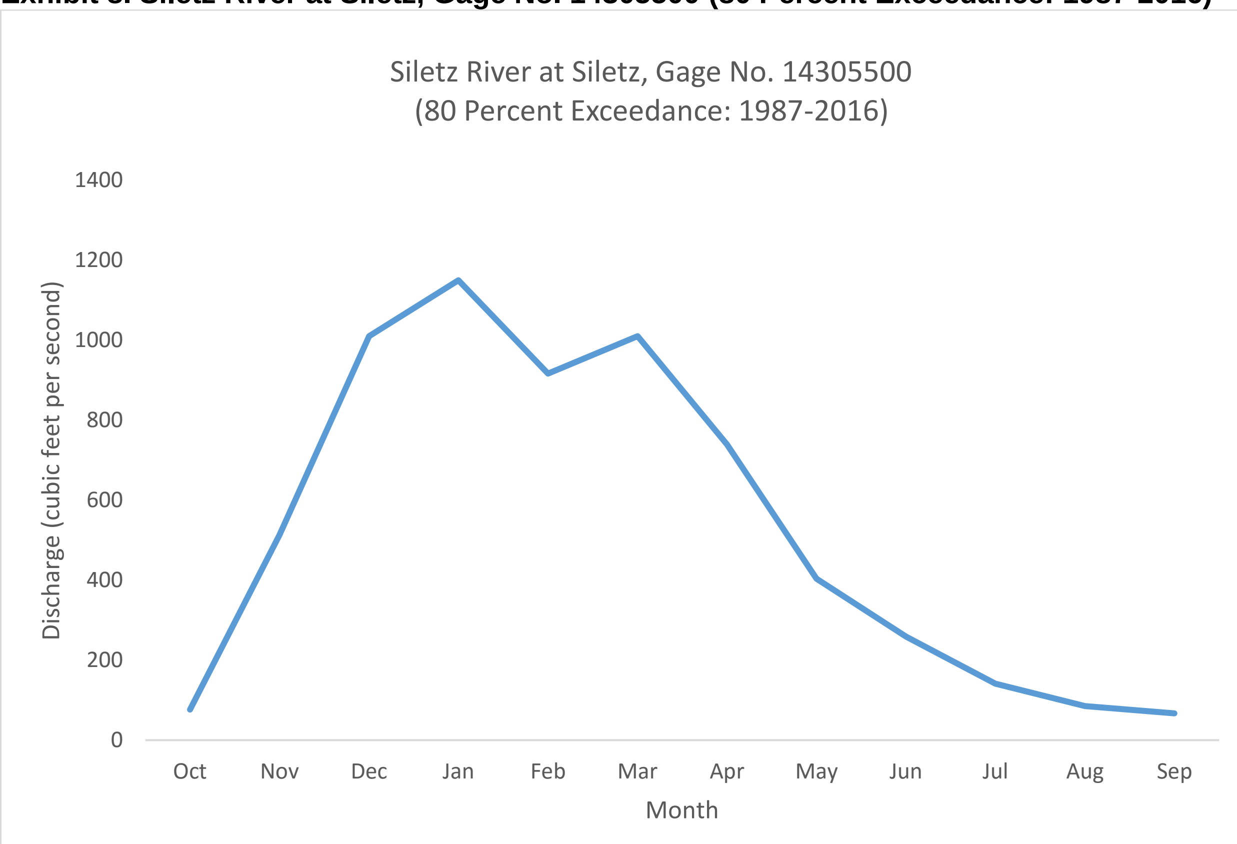
Siletz River Drainage Area

The Siletz River drains 305 square miles (OWRD[2], 2017) with numerous tributaries, including Schooner Creek, Drift Creek, Cedar Creek, Euchre Creek, Gravel Creek, North and South Fork Siletz, Rock Creek, and Sunshine Creek (LSWCD, 2017). The average annual precipitation is 104 inches (OWRD[2], 2017). The Cities of Siletz, Toledo, and Newport, the Seal Rock Water District, and the Georgia Pacific Mill all share the Siletz River as a drinking water source, with intakes near the City of Siletz. The City of Siletz also has an emergency intake on Tangerman Creek, which is in the Siletz River drainage area. There are no active OWRD or USGS gaging stations on Tangerman Creek (OWRD[1], 2017) and OWRD does not have natural streamflow estimates for Tangerman Creek (OWRD[2], 2017).

Gaging Station Locations. There are two active gaging stations on the Siletz River: one USGS gage on the Siletz River mainstem near the City of Siletz and one OWRD gage on Sunshine Creek, which originates in Polk County (OWRD[1], 2017).

Discharge and Timing. The measured 80 percent exceedance flow for the Siletz River, measured at the USGS gage near the City of Siletz, is lowest in September and highest during December and January (OWRD[1], 2017). See **Exhibit 8**.

Exhibit 8. Siletz River at Siletz, Gage No. 14305500 (80 Percent Exceedance: 1987-2016)



Source: OWRD[1], 2017

Depoe Bay- Ocean Tributaries

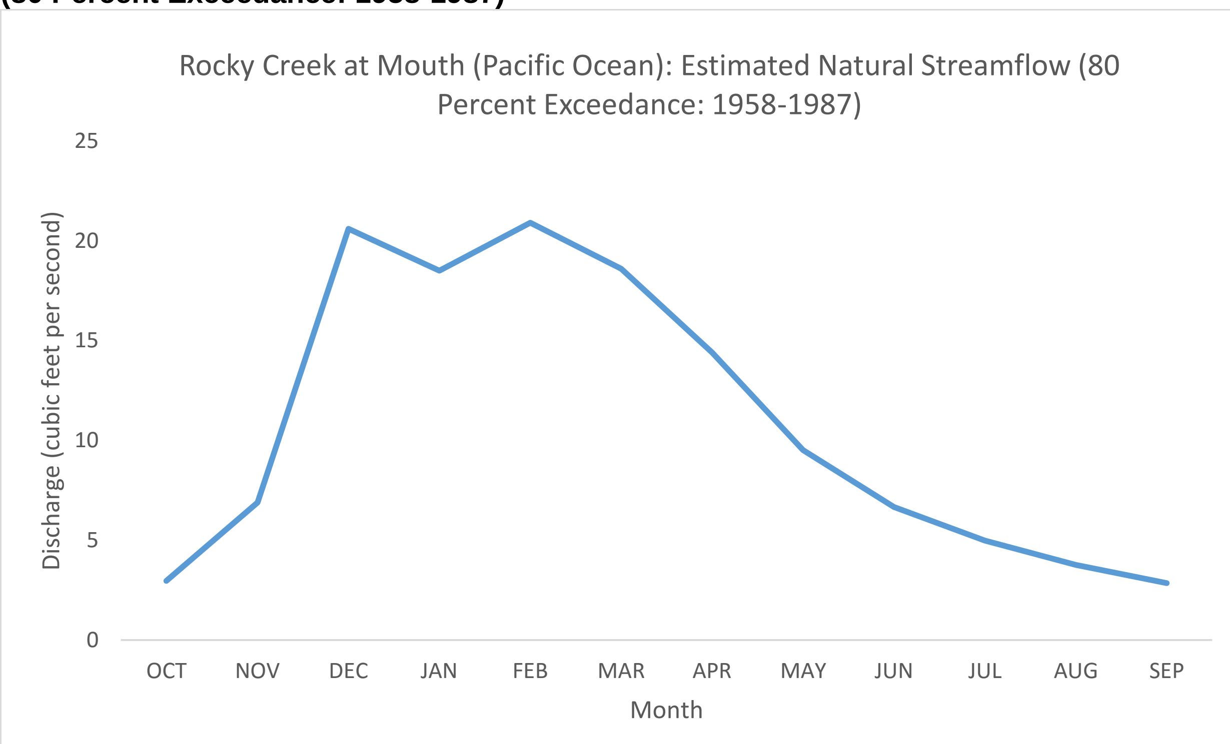
Rocky Creek (near Cape Foulweather)

Rocky Creek drains directly into the Pacific Ocean just north of Cape Foulweather and has four unnamed tributaries. The creek is a source water for the City of Depoe Bay and has no stream gage. Rocky Creek drains just over 5 square miles and the average annual precipitation is 80 inches (OWRD2, 2017). OWRD's estimated 80 percent exceedance natural streamflow shows streamflow in Rocky Creek is highest in February and declines March through August. Low streamflow occurs from late July to late October (OWRD[2], 2017).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Rocky Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow in Rocky Creek is highest in late November and February and declines through the spring and summer. Low streamflow occurs in August, September, and October (OWRD[2], 2017) (see **Exhibit 9).**

Exhibit 9. Rocky Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



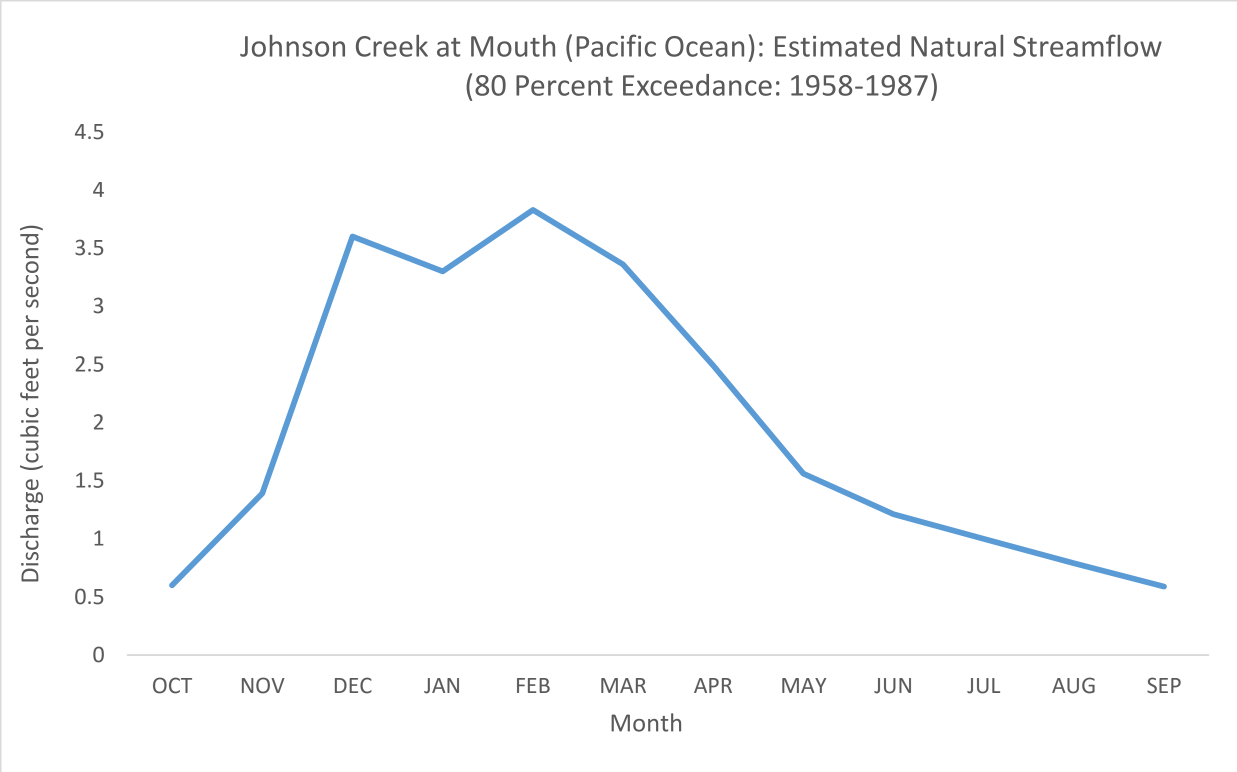
Source: OWRD[2], 2017

Johnson Creek (near Otter Rock)
Johnson Creek drains into the Pacific Ocean between Newport and Depoe Bay. The creek drains only 1 square mile and is just over 2 miles long. The average annual precipitation is 81 inches (OWRD[2], 2017). Johnson Creek is a source of water for Johnson Creek Water Service, Sea Crest Water System, and the Inn at Otter Crest (DEQ, 2017).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Johnson Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow in Johnson Creek is highest in February then declines through the spring and summer. Low streamflow occurs in August, September, and October (OWRD[2], 2017) (see **Exhibit 10).**

Exhibit 10. Johnson Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

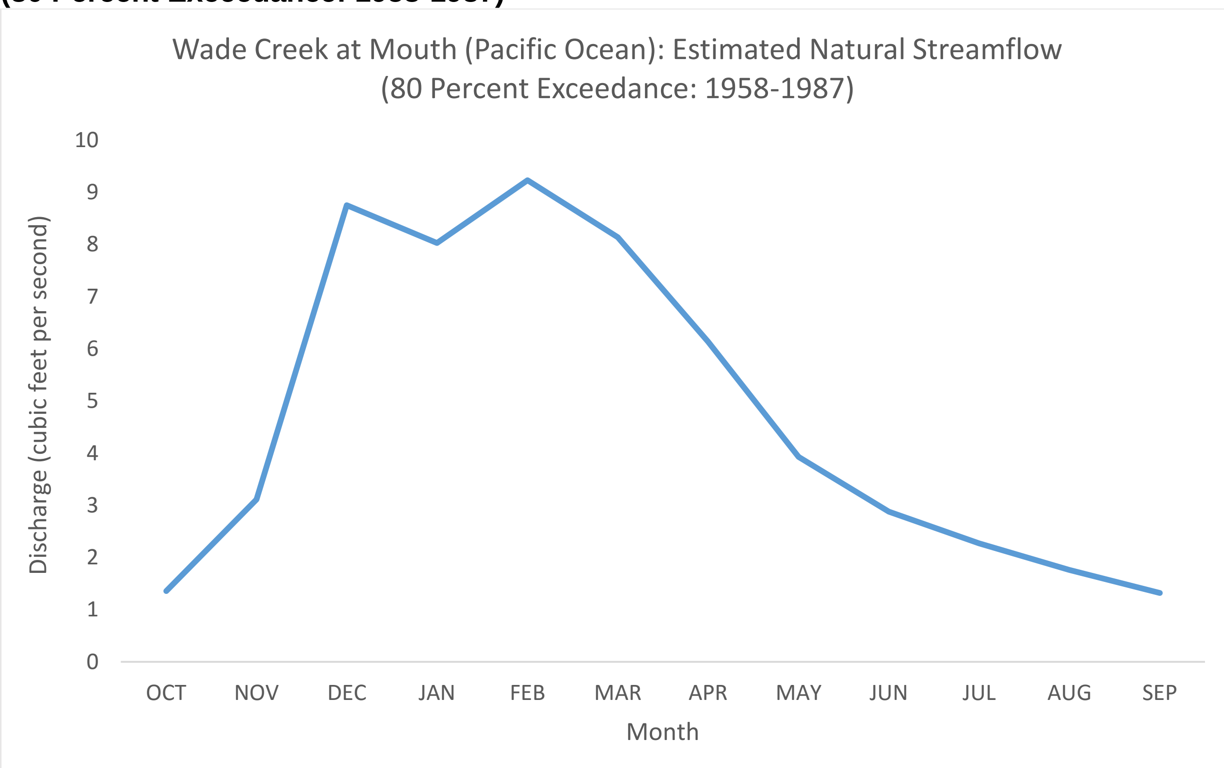
Wade Creek (near Beverly Beach)

Wade Creek is a small creek that flows into the Pacific Ocean near Beverly Beach and serves as a source of water for Beverly Beach Water District (DEQ, 2017). The creek has one unnamed tributary, drains 2.4 square miles, and has 4 miles of stream length (OWRD[2], 2017). Average annual precipitation is 79 inches (OWRD[1], 2017). There are ten miscellaneous measurements on Wade Creek (see **Exhibit 11**).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Wade Creek (OWRD[1], 2017).

Discharge and Timing. Streamflow patterns in Wade Creek are similar to those in Johnson Creek. OWRD's estimated 80 percent exceedance natural streamflow show streamflow is highest in February then declines until September. Low streamflow occurs in August, September, and October (OWRD[1], 2017). See **Exhibit 11.**

Exhibit 11. Wade Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)

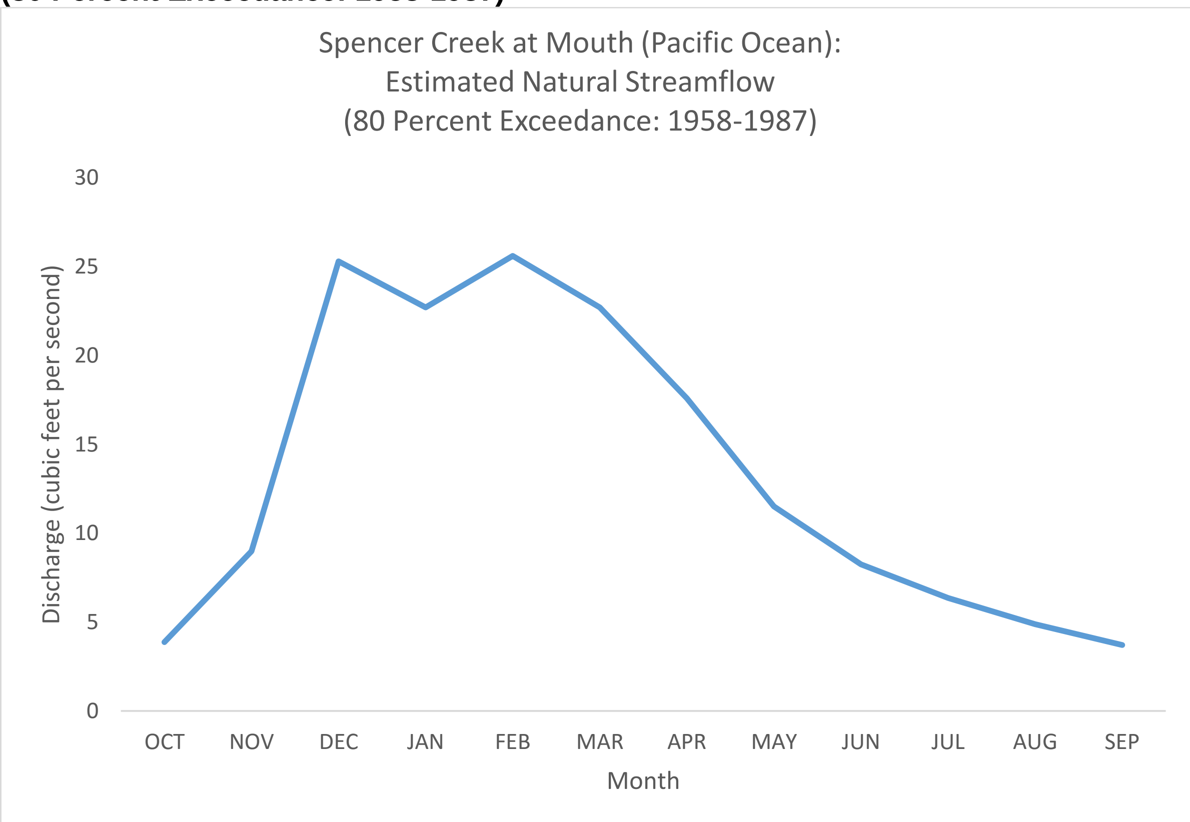


Source: OWRD[2], 2017

Spencer Creek
Spencer Creek is a source water for the Beverly Beach Water District (DEQ, 2017). The Creek drains 6 square miles and drains directly into the Pacific Ocean. Spencer Creek drainage area has 8 miles of streams and receives an average annual precipitation of 82 inches (OWRD[2], 2017).
Gaging Station Locations. There are no active OWRD or USGS gaging stations on Spencer Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow is highest in Spencer Creek from December through mid-February and lowest July through mid-October (OWRD[2], 2017). See **Exhibit 12.**

Exhibit 12. Spencer Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



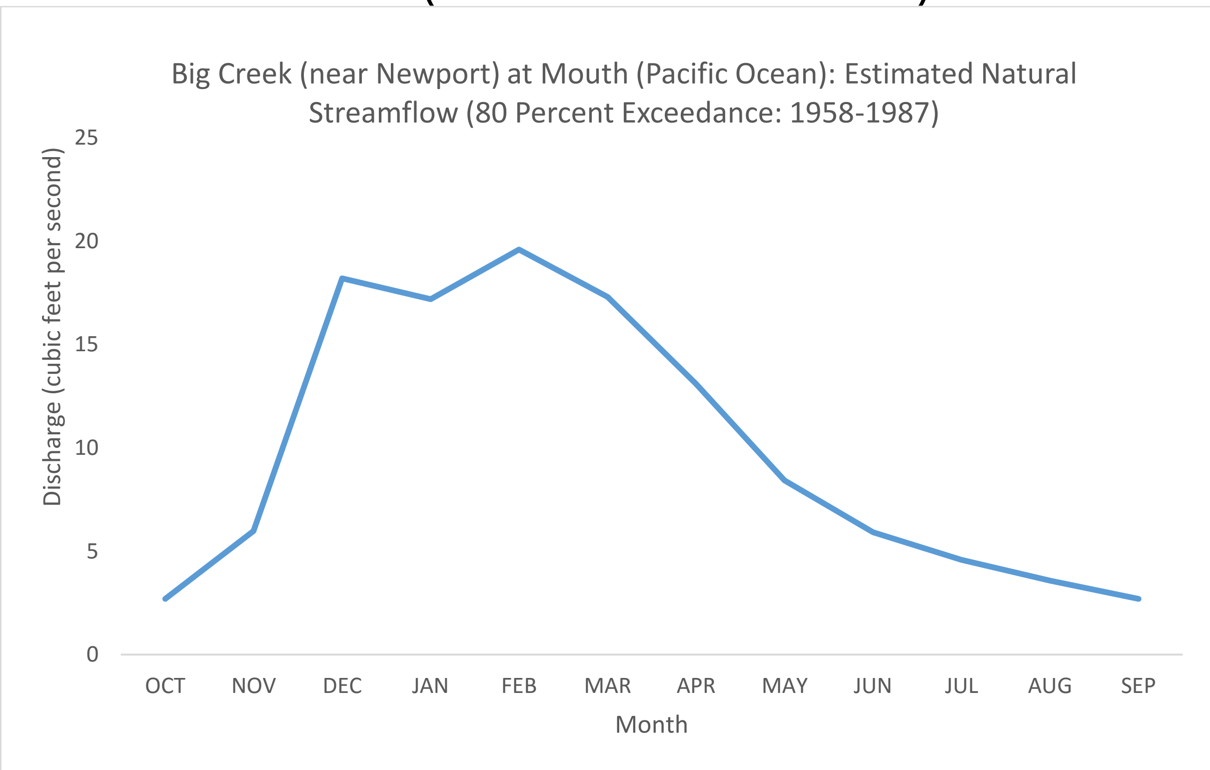
Source: OWRD[2], 2017

Big Creek (Pacific Ocean) near Newport
Big Creek is a dammed tributary to the Pacific Ocean and also serves as a water source for the City of Newport (DEQ, 2017). Big Creek has three tributaries: Jeffries, Anderson, and Blattner Creeks. Big Creek drains just over 5 square miles; average annual precipitation is 75 inches (OWRD[2], 2017).

Gaging Station Locations. There are no active OWRD or USGS gaging stations on Big Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow is highest in February and declines through July. Low streamflow occurs from late July through mid-October (OWRD[2], 2017). See **Exhibit 13.** OWRD has miscellaneous flow measurements for Big Creek that can be accessed online.

Exhibit 13. Big Creek (near Newport) at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

North and South Depoe Bay Creeks (near Depoe Bay)
The City of Depoe Bay uses water from North and South Depoe Bay Creeks as a source of supply (DEQ, 2017).

Gaging Station Locations/Discharge and Timing. There are no active OWRD or USGS gaging stations on North or South Depoe Bay Creeks (OWRD[1], 2017). OWRD does not have natural streamflow estimates for North or South Fork Depoe Bay Creeks (OWRD[2], 2017).

Yaquina River Drainage Area

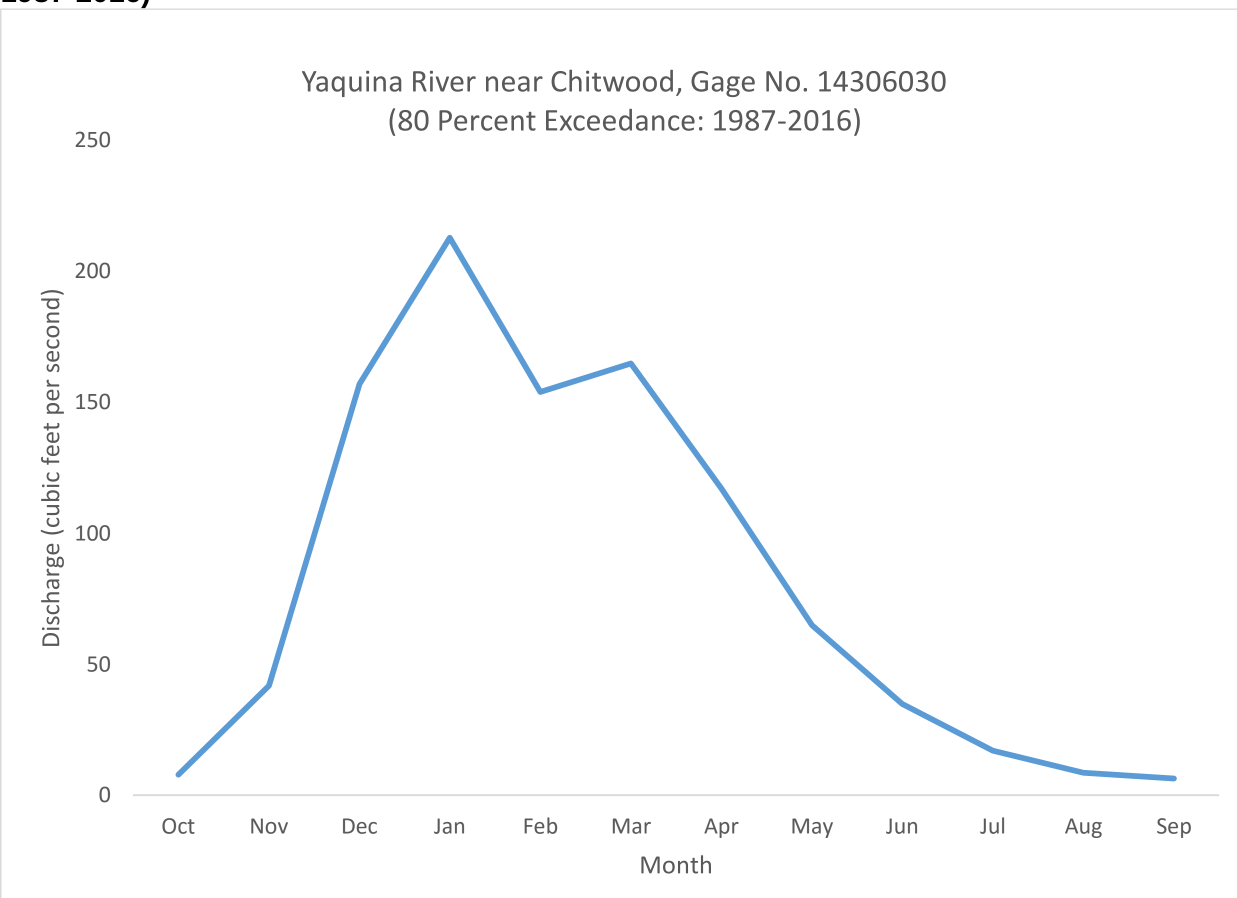
Yaquina River

The Yaquina River drains 210 square miles. The drainage area receives a mean annual precipitation of 80 inches (OWRD[2], 2017). The Yaquina River has several tributaries including, Depot Creek, Big Elk Creek, Little Elk Creek, Mill Creek, Olalla Creek, and Thornton Creek (LSWCD, 2017). Mill Creek is used as source water by the City of Toledo (DEQ, 2017).

Gaging Station Locations. The Yaquina River has an active OWRD gage located near the unincorporated community of Chitwood (OWRD[1], 2017).

Discharge and Timing. The measured 80 percent exceedance flow for the Yaquina River, measured at the OWRD gage near Chitwood, shows high flows occur between December and March. Streamflow declines in May, June, and July, with lowest flows in late August through early October (OWRD[1], 2017). See **Exhibit 14**.

Exhibit 14. Yaquina River near Chitwood, Gage No. 14306030 (80 Percent Exceedance: 1987-2016)



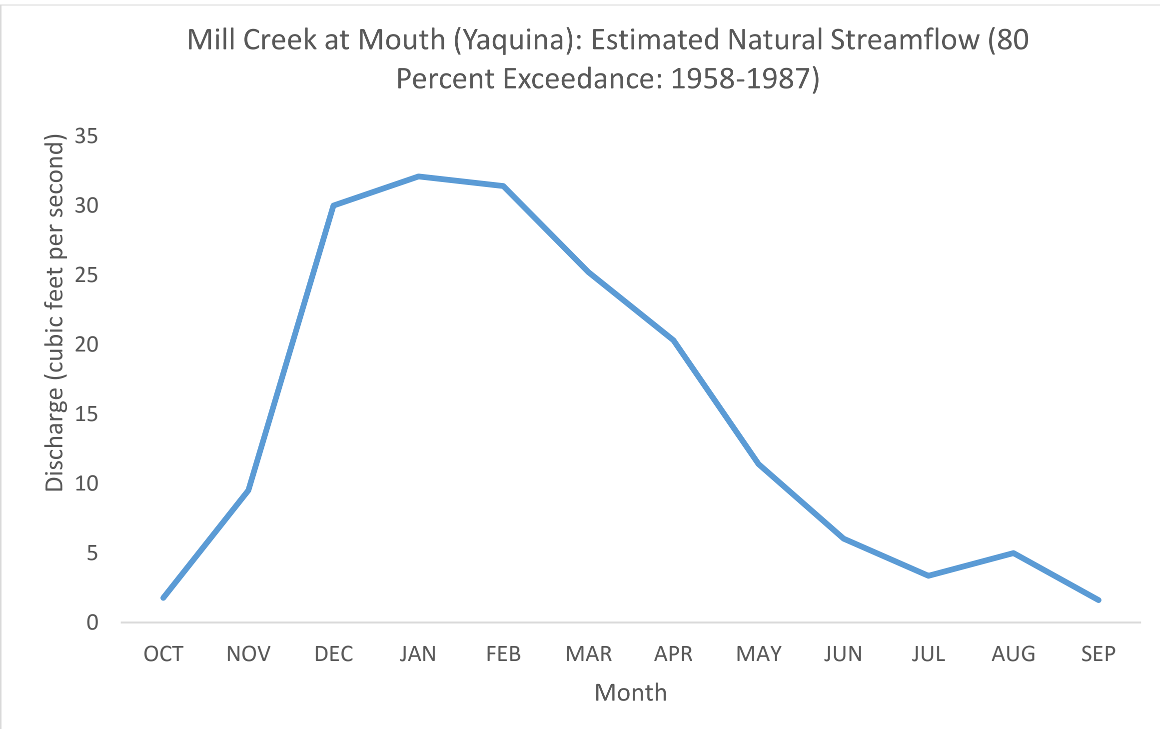
Source: OWRD[1], 2017

Mill Creek
Mill Creek is a tributary to the Yaquina River that drains approximately 8 square miles and has 11 miles of streams. The drainage area has an average slope of 19 degrees and an average elevation of 619 feet. The drainage area receives an average annual precipitation of 80 inches (OWRD[2], 2017). Mill Creek is used as source water by the City of Toledo (DEQ, 2017).

Gaging Station Locations. There are no active stream gages on Mill Creek (OWRD[1], 2017). There is a discontinued gage on Mill Creek that recorded measurements between 1959 and 1973 (OWRD[5], 2017). The data from the gage is published on OWRD and can be found on the Historical Streamflow and Lake Level Database by searching for station 14306036.

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow shows streamflow is highest in January and declines in March through August. Low streamflow occurs from late July through mid-October (OWRD[2], 2017). See **Exhibit 15.**

Exhibit 15. Mill Creek at Mouth (Yaquina): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987



Source: OWRD[2], 2017

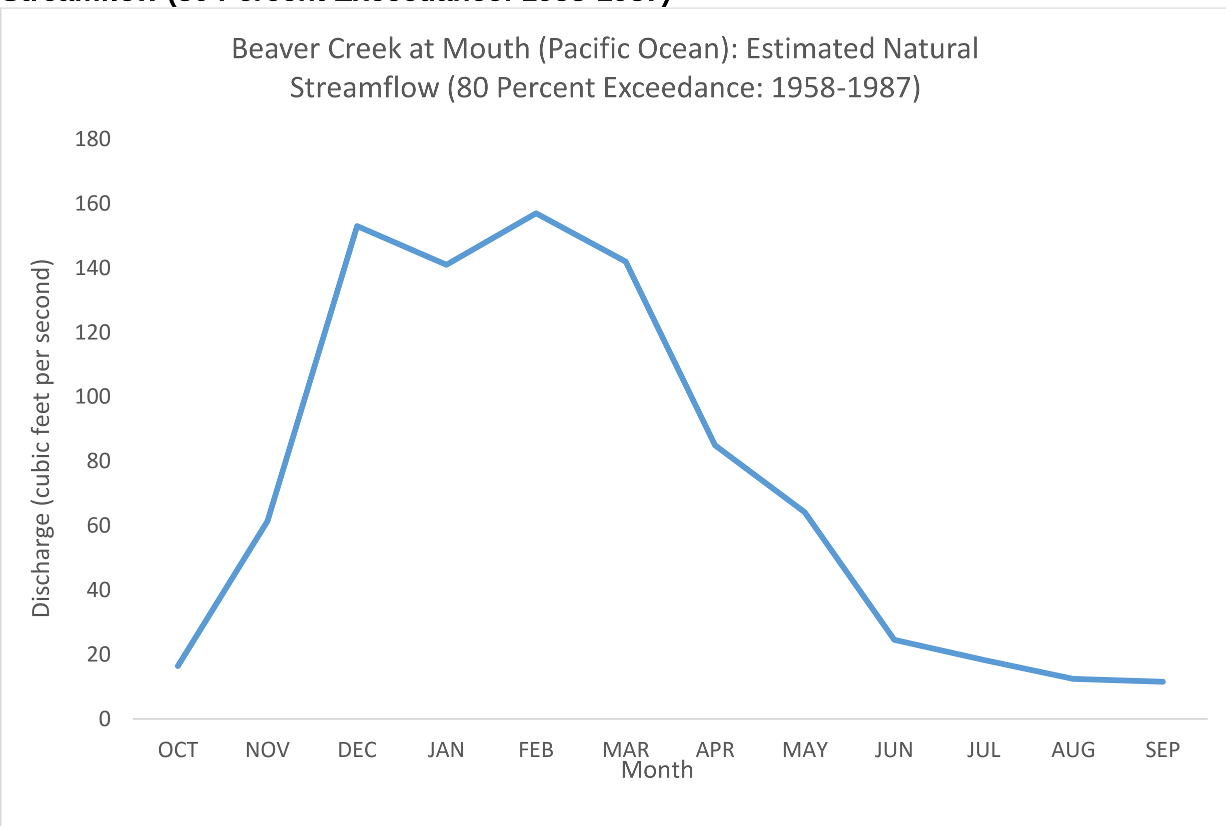
Beaver Creek- Ocean Tributaries

Beaver Creek drains 64 square miles of land and receives average annual precipitation of 78 inches (OWRD[2], 2017). Beaver Creek flows into the ocean at Ona Beach, north of Alsea Bay. Tributaries to Beaver Creek include North Fork and South Fork Beaver Creek, Oliver Creek, Elkhorn Creek, Bowers Creek, and Peterson Creek (LSWCD, 2017).

Gaging Station Locations. There are no active OWRD or USGS stream gages on Beaver Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow shows streamflow is highest between February and March, then declines in late March through July. Low streamflow occurs from late July through mid-October (OWRD[2], 2017). See **Exhibit 16**.

Exhibit 16. Beaver Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

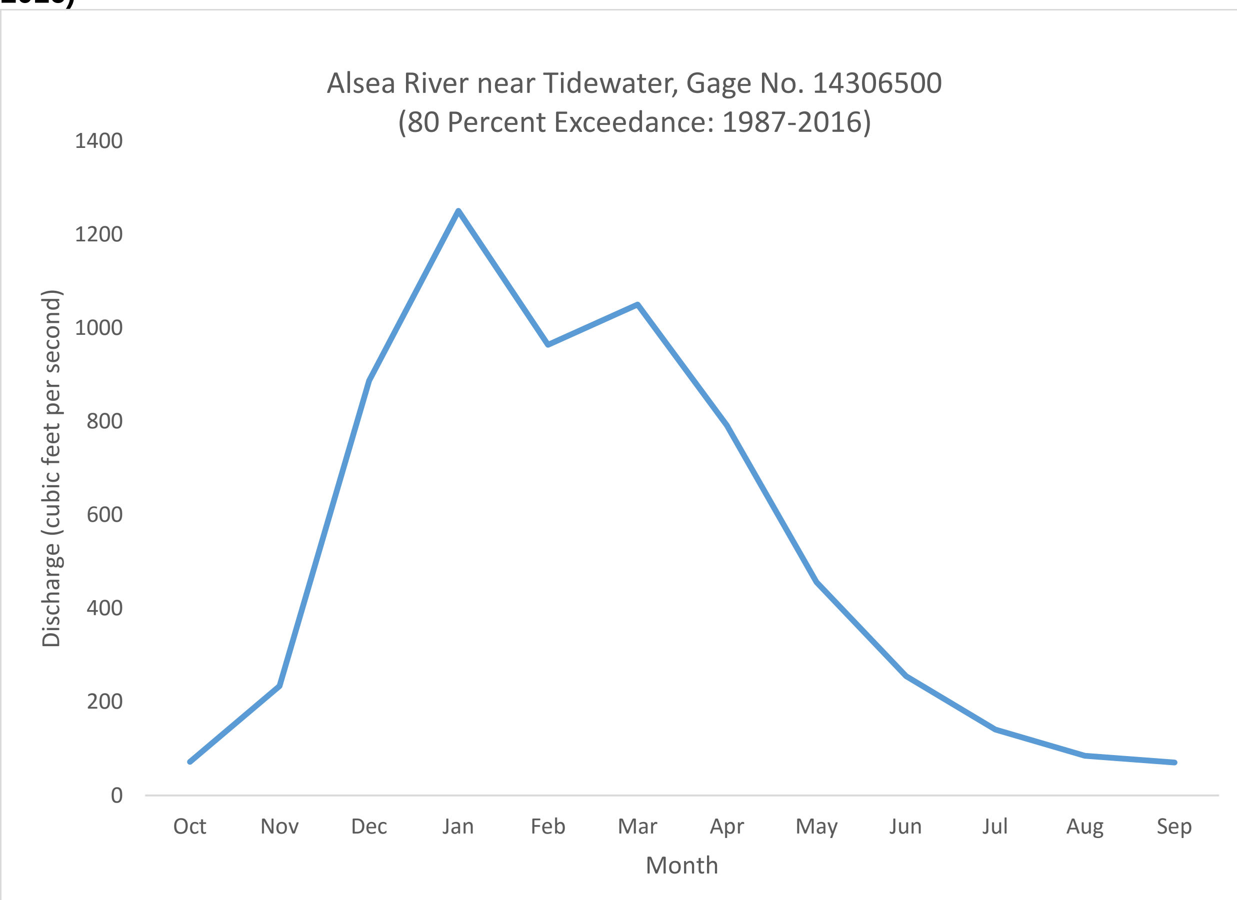
Alsea River Drainage Area

The Alsea River drains 459 square miles and receives average annual precipitation of 87 inches (OWRD[2], 2017). Tributaries to the Alsea River include Canal Creek, Drift Creek, Scott Creek, Fall Creek, Five Rivers, Lobster Creek, and the South Fork Alsea (LSWCD, 2017). The City of Waldport uses Eckman Creek, a tributary to Alsea Bay, as one of its drinking water sources (DEQ, 2017).

Gaging Station Locations. There are three active gages in the Alsea River drainage area: a USGS gage on the mainstem Alsea River located near the unincorporated community of Tidewater, an OWRD gage on Drift Creek about five miles Northeast of the confluence of Drift Creek and Alsea Bay, and a USGS gage on the East Fork Lobster Creek several miles south of the unincorporated community of Alsea (OWRD[1], 2017).

Discharge and Timing. The Alsea River is a similar size to the Siletz River and has similar flow patterns (see **Exhibit 17**). The measured 80 percent exceedance flow for the Alsea River, measured at the USGS gage near Tidewater, shows high streamflow occurs in December and January with the highest flows typically occurring in late December. Streamflow decreases steadily in April, May, June, July, and August. Streamflow is at its lowest in late August and September. (OWRD[1], 2017).

Exhibit 17. Alsea River at Tidewater, Gage No. 14306500 (80 Percent Exceedance: 1987-2016)



Source: OWRD[1], 2017

North Fork and South Fork Weist Creek, tributaries to Eckman Slough (Alsea Bay)
The City of Waldport uses water from North Fork and South Fork Weist Creek as a source of supply (DEQ, 2017).

Gaging Station Locations/Discharge and Timing. There are no active OWRD or USGS stream gages on North or South Fork Weist Creeks (OWRD[1], 2017). OWRD does not have natural streamflow estimates for these creeks (OWRD[2], 2017).

Eckman Creek, tributary to Eckman Slough (Alsea Bay)
The City of Waldport uses water from Eckman Creek as a source of supply (DEQ, 2017).

Gaging Station Locations/Discharge and Timing. There are no active OWRD or USGS stream gages on Eckman Creek (OWRD[1], 2017). OWRD does not have natural streamflow estimates for Eckman Creek (OWRD[2], 2017).

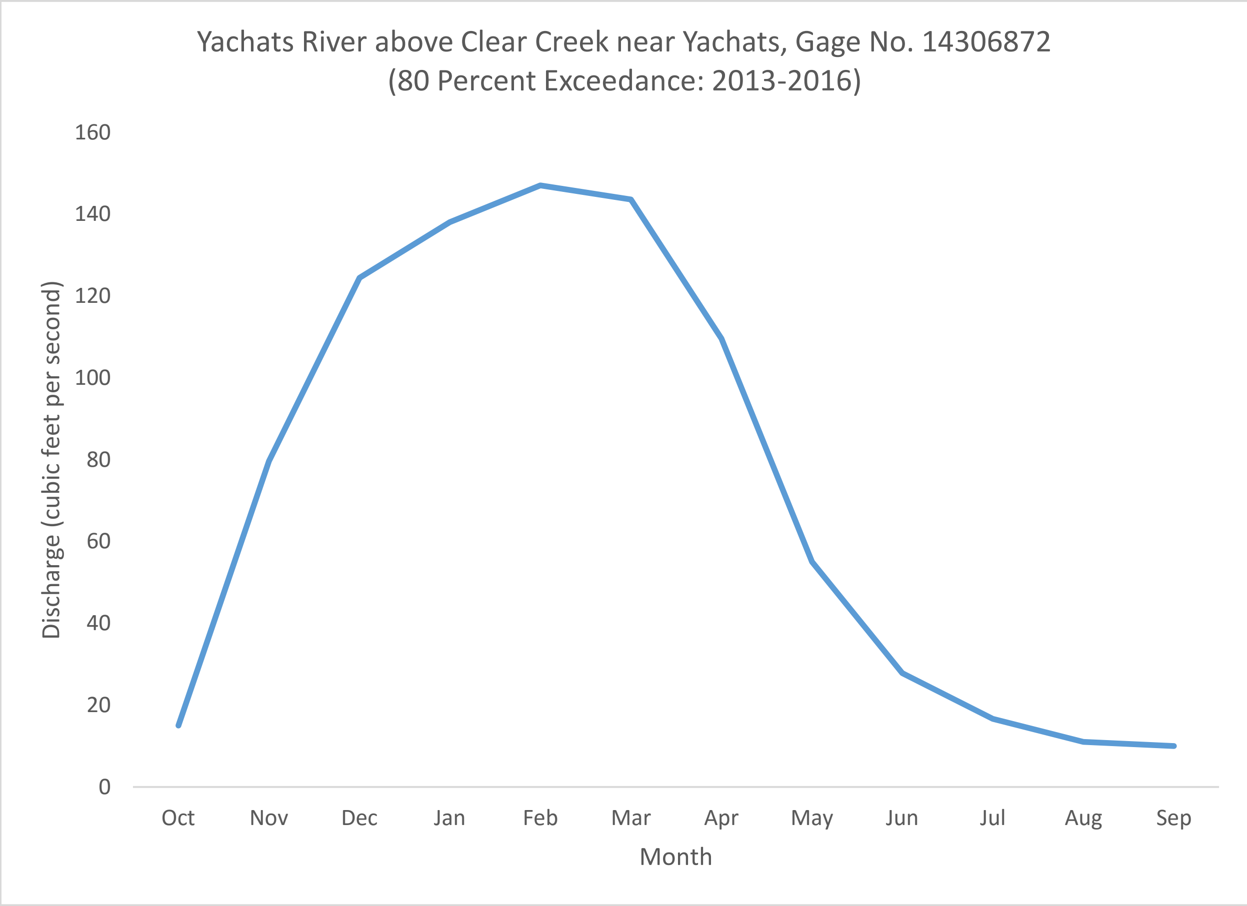
Yachats River Drainage Area

The Yachats River drains 43 square miles and receives an average annual precipitation of 91 inches, which does not vary significantly throughout the drainage area (OWRD[2], 2017). Tributaries to the Yachats River include the North Fork Yachats, School Fork, and Stump Creek (LSWCD, 2017). The City of Yachats receives its water supply from Salmon Creek and Reedy Creek, but has an emergency intake on the Yachats River (DEQ, 2017).

Gaging Station Locations. OWRD has an active gage on the Yachats River above Clear Creek near the City of Yachats. This gage has been active for five years, since 2012 (OWRD[1], 2017).

Discharge and Timing. The measured 80 percent exceedance flow for the Yachats River, measured at the OWRD gage the City of Yachats, shows high flows usually occurs in late December (see **Exhibit 18**). Streamflow decreases in January, then increases again in late February. Streamflow gradually decreases throughout April, May, June, and July, reaching the lowest flows in late August and September (OWRD[2], 2017).

Exhibit 18. Yachats River Above Clear Creek Gage No. 14306872 (80 Percent Exceedance: 2013-2016)



Source: OWRD[1], 2017

Dicks Fork Creek, tributary to Big Creek (Pacific Ocean) near Yachats
SW Lincoln County Water District uses Dicks Fork Creek as a water source.

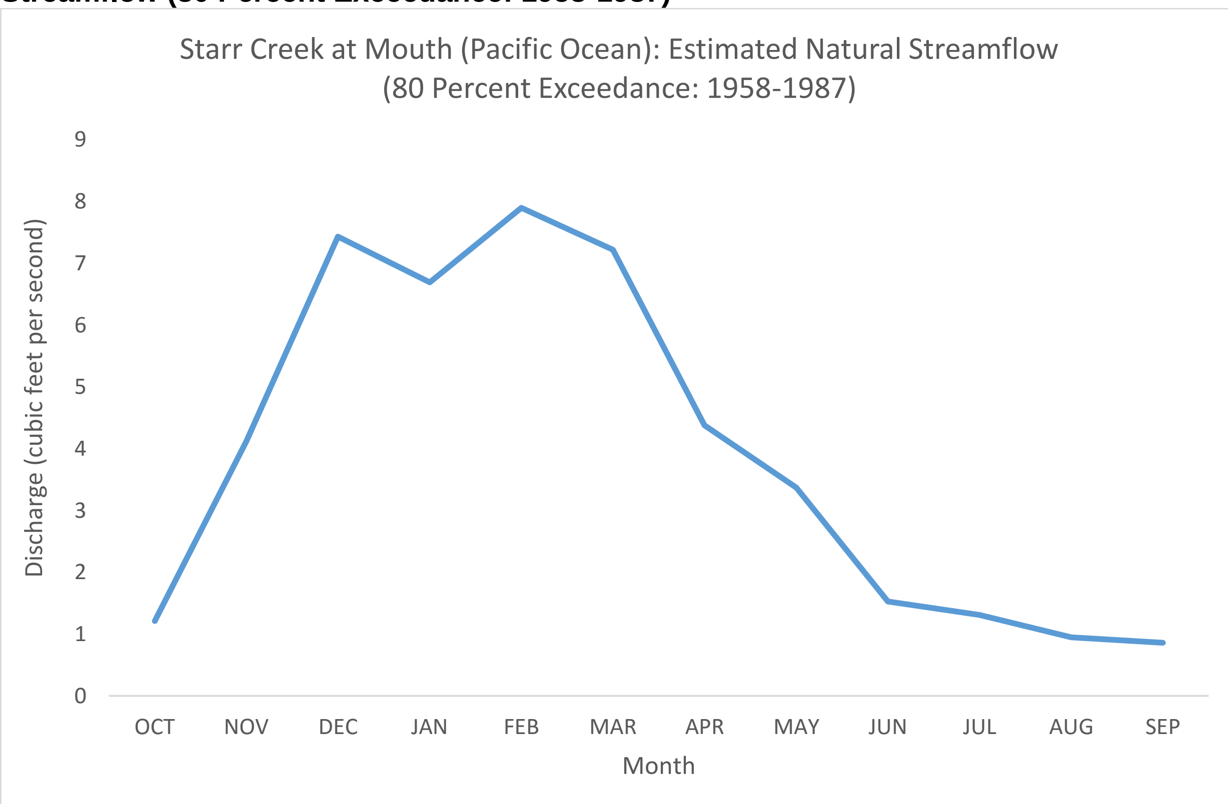
Gaging Station Locations/Discharge and Timing. There are no active OWRD or USGS stream gages on Dicks Fork Creek (OWRD[1], 2017). OWRD does not have natural streamflow estimates for this creek (OWRD[2], 2017).

Starr Creek (near Yachats)
Starr Creek (Star Creek) drains into the Pacific Ocean just north of the City of Yachats and is a source of water for SW Lincoln County Water District (DEQ, 2017). Starr Creek drains 1.8 square miles and the average annual precipitation is 82 inches. (OWRD[2], 2017).

Gaging Station Locations. There are no active OWRD or USGS stream gages on Starr Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow is highest in February, then declines gradually until August (see **Exhibit 19**). Low streamflow occurs in August and September.

Exhibit 19. Starr Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



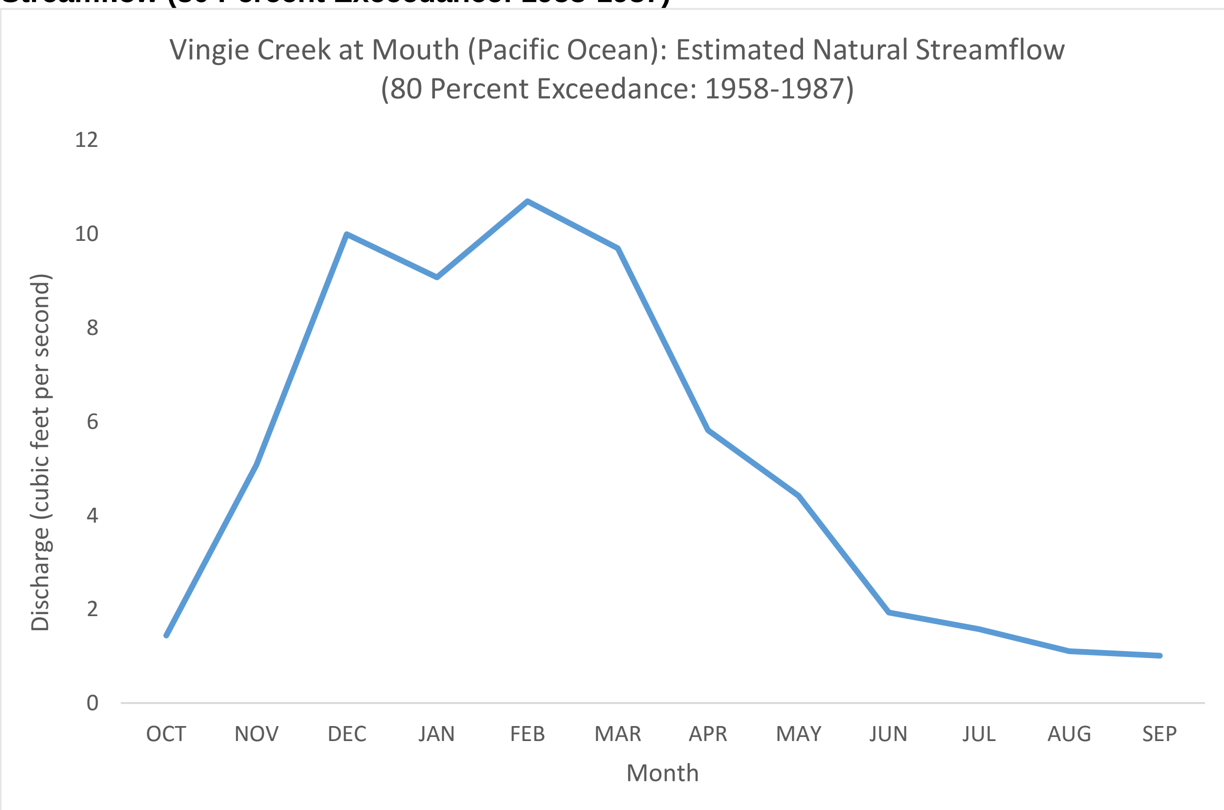
Source: OWRD[2], 2017

Vingie Creek (near Yachats)
Vingie Creek drains directly into the Pacific Ocean just north of the City of Yachats and is used as source water for SW Lincoln County Water District (DEQ, 2017). The creek drains 2.4 square miles and has an average annual precipitation of 82 inches. (OWRD[2], 2017**).**

Gaging Station Locations. There are no active OWRD or USGS stream gages on Vingie Creek (OWRD[1], 2017).

Discharge and Timing. OWRD's estimated 80 percent exceedance natural streamflow show streamflow patterns in Vingie Creek are similar to those in Starr Creek, with high flows in February and low streamflow in August and September. See **Exhibit 20.**

Exhibit 20. Vingie Creek at Mouth (Pacific Ocean): Estimated Natural Streamflow (80 Percent Exceedance: 1958-1987)



Source: OWRD[2], 2017

2.2.3.2.4 Surface Water Availability

Water Availability Overview

Oregon law pertaining to water appropriation is found in ORS Chapter 537. Before issuing a permit to use surface water, OWRD reviews permit applications according to the following criteria:

- Whether water is available
- Whether the proposed use is consistent with "basin program" rules
- Whether the proposed use would cause injury to an existing water right

- Whether the proposed use is consistent with other rules of the Oregon Water Resources Commission

Water availability is calculated in select drainage areas called Water Availability Basins. Water availability calculations are based on a 30-year period of record. Streamflow records between 1958 and 1987 are used as a base period that represents long-term average conditions. While the base period selected is the best representation of average conditions, it is important to note that precipitation and long-term climate trends also influence "average" streamflow conditions.

OWRD uses 80 percent exceedance to determine if water is available for new out-of-stream uses of surface water. The 80 percent exceedance streamflow is the streamflow that occurs at least 80 percent of the time. OWRD generally uses the 50 percent exceedance flows to determine if surface water is available for a new storage right. Instream water rights are limited to no more than the 50 percent exceedance natural streamflow. The 50 percent exceedance streamflow is the streamflow that occurs at least 50 percent of the time.

For a full description of OWRD's water availability model, refer to OWRD's Open File Report SW 02-002 titled, Determining Surface Water Availability in Oregon, and prepared by Richard M. Cooper (Cooper, 2002).

Mid-Coast Surface Water Availability. There are several small drainage areas in the planning area that do not have any water available for new surface water rights during any month of the year. Among these are the Yaquina River above Bales Creek, Salmon Creek (tributary to Salmon River), Panther Creek, and Johnson Creek (ocean tributary). Generally, water is not available for new surface water appropriations during the summer months in the upper portions of the eight main planning drainage areas. **Exhibit 21** shows water availability for new appropriations in the Mid-Coast Planning Area during the month of August, when streamflow is low. Near the mouth of major streams there is generally some water available for new surface water rights.

Exhibit 22 shows water availability for new storage in the Mid-Coast Planning Area. With a few exceptions, water is generally available for new storage rights during the winter months when streamflow is higher. During the summer and fall months, water generally is not available for new storage rights except at the mouth of major streams. However, the mouths of Salmon, Siletz, Yaquina, Alsea, and Yachats Rivers all have estuaries, where a storage facility is not feasible or practical.

Other Factors that Affect the Ability to Obtain a "New" Water Use Permit. When OWRD reviews applications for permits there are numerous other considerations in addition to water availability (see ORS 537.153, OAR 690-310, OAR 690-033, OAR 690-500). These factors are described in detail in the Context report, but generally include an examination of the following questions:

- *Instream water rights.* Are instream water rights currently being met?
- *Reserved water rights.* Are there reservations for future water uses?
- *Watermaster review.* Is there likely to be injury to existing groundwater or surface water users?
- *ODFW review.* Are there flow requirements needed for listed fish in the area? Are there habitat restoration priorities within the area?

- *Department of Environmental Quality (DEQ) review.* Are there water quality concerns that would be impacted by the appropriation of new water in the stream?
- Do other planning documents or administrative rules, such as the Mid-Coast Basin Plan, limit the opportunity for new appropriations? (see OAR 690-518)
- Public comment on the proposed use of water.

Exhibit 21. Water Available for New Surface Water Rights in the Mid-Coast

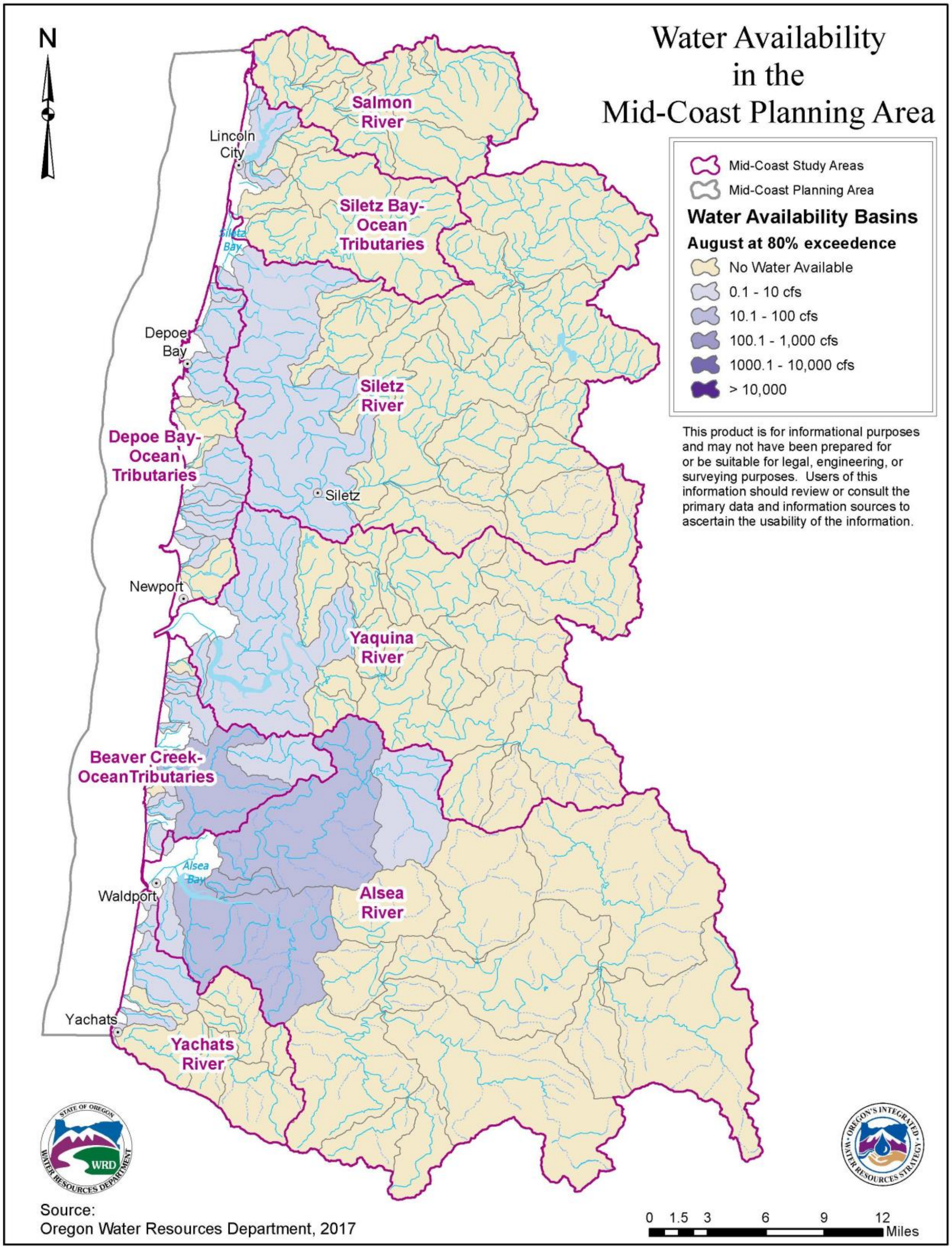
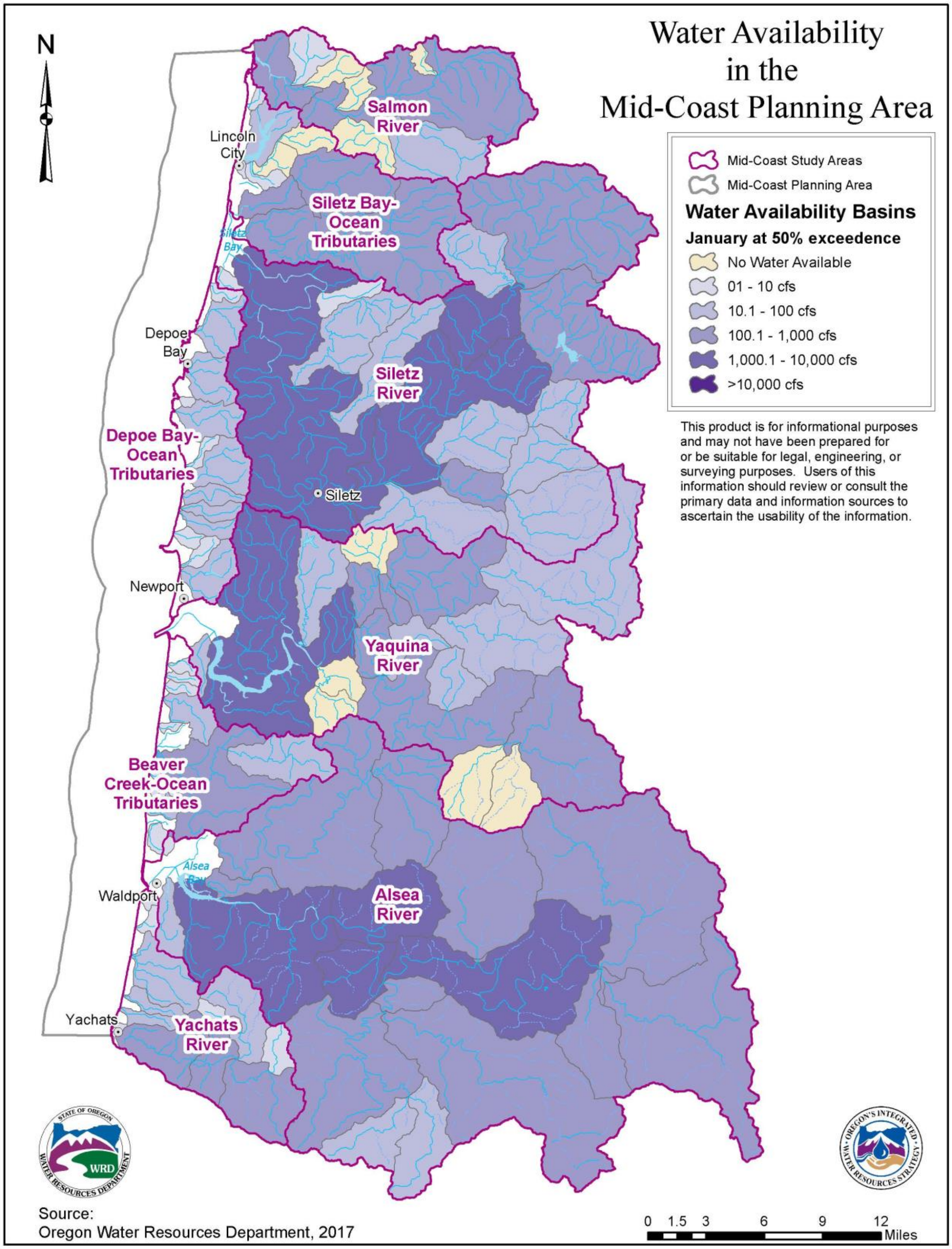


Exhibit 22. Water Available for New Storage Rights in the Mid-Coast



Some uses of water in Oregon do not require formal authorization from OWRD, these are called "exempt uses." While these water uses are exempt from the requirement to obtain a water right, the use is only allowed if water is available and used for a beneficial purpose without waste. For more information about exempt surface water uses, refer to ORS 537.141 and http://www.oregon.gov/owrd/pubs/docs/infosheet6.pdf

Potential Storage Sites. OWRD has compiled a list of potential above ground storage sites using information from OWRD personnel; other state, local, and federal agencies; and the general public. The Above Ground Potential Storage Project Search allows a search for potential sites and view of information about the sites, including maps, capacity curves, and reservoir inundation data, when these data are available (OWRD[6], 2017). OWRD has identified 35 potential above ground storage sites in the Mid-Coast (See **Appendix F).**

Water Availability by Drainage Area

The following water availability tables were downloaded from OWRD's WARS online program in July 2017 (OWRD[2], 2017).

Salmon River Drainage Area. There are several instream water rights in the drainage area including in Salmon Creek, Deer Creek, Sulphur Creek, Panther Creek, Bear Creek, and Slick Rock Creek, and in the Salmon River mainstem (OWRD[2], 2017).

80 percent exceedance (new out-of-stream water rights). Water availability for new surface water rights varies considerably by reach in the drainage area (**Exhibit 23).** Water is available at the mouth of the Salmon River in all months except August and October, and is not available at all in Salmon Creek or in Panther Creek (OWRD[2], 2017).

Exhibit 23: Salmon River Drainage Area: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water by Month (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Salmon River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes
Salmon River above Deer Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Salmon Creek	No	No	No	No	No	No	No	No	No	No	No	No
Panther Creek	No	No	No	No	No	No	No	No	No	No	No	No
Salmon River above Slick Rock Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is generally available for new storage rights in the Salmon River in all months except for October. In Salmon Creek, water for storage is available only from November through February. In Panther Creek, water is available only in November (see **Exhibit 24)** (OWRD[2], 2017).

Exhibit 24. Salmon River Drainage Area: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Salmon River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Salmon River above Deer Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Salmon Creek	Yes	Yes	No	No	No	No	No	No	No	No	Yes	Yes
Panther Creek	No	No	No	No	No	Yes	Yes	No	No	No	Yes	
Salmon River above Slick Rock Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Source: OWRD[2], 2017

<u>**Siletz Bay-Ocean Tributaries.**</u> There is one instream water right on Schooner Creek and two instream water rights on Drift Creek (OWRD[2], 2017). Other Siletz Bay-Ocean Tributaries were not examined.

80 percent exceedance (new out-of-stream water rights). Water is only available for new surface water rights seasonally. Water is available December through March in Schooner Creek and December through April in Drift Creek (OWRD[2], 2017). See **Exhibit 25.**

Exhibit 25. Siletz Bay-Ocean Tributaries: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water Rights by Month (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Schooner Creek near mouth	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Schooner Creek above Abrams Creek	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Drift Creek near mouth	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is available for storage in Schooner Creek November through March and in Drift Creek November through April (OWRD[2], 2017). See **Exhibit 26**.

Exhibit 26. Siletz Bay-Ocean Tributaries: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Schooner Creek at Mouth	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
Schooner Creek above Abrams Creek	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes
Drift Creek at Mouth	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes

Source: OWRD[2], 2017

<u>Siletz River Drainage Area.</u> There are instream water rights in the North Fork Siletz, South Fork Siletz, Bear Creek, Cedar Creek, Euchre Creek, Gravel Creek, Mill Creek, Rock Creek, Sam Creek, and Drift Creek, and in the Siletz River mainstem. The primary instream water right on the mainstem has a July 12, 1966, priority date (OWRD[2], 2017).

80 percent exceedance (new out-of-stream water rights). Water is generally available for requesting a new water right during the late fall, winter, and spring in the Siletz River. During September and October, streamflow is not adequate to meet existing instream water rights (OWRD[2], 2017). See **Exhibit 27**.

Exhibit 27. Siletz River Drainage Area: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water Rights by Month (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Siletz River near mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Siletz River above Mill Creek (at USGS gage 14305500)	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Siletz River above Sunshine Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Siletz River above Gravel Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Mill Creek at Mouth	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is available for new storage in the Siletz River near the mouth year-round. In the Siletz River above Mill Creek, above Sunshine Creek, and above Gravel Creek, water is available November through June. In Mill Creek, water is available in winter and spring months. (OWRD[2], 2017). See **Exhibit 28.**

Exhibit 28. Siletz River Drainage Area: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Siletz River near mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Siletz River above Mill Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Siletz River above Sunshine Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Siletz River above Gravel Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Mill Creek at Mouth	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes

Source: OWRD[2], 2017

<u>**Depoe Bay – Ocean Tributaries.**</u> There are no instream water rights on Johnson Creek, Spencer Creek, Big Creek, or Depoe Bay Creek (OWRD[2], 2017). Other creeks were not examined.

80 percent exceedance (new out-of-stream water rights). There is no water available for new surface water rights in Johnson Creek. Spencer Creek has water available for new surface water rights year-round, Big Creek has water available for new surface water rights seasonally (December through April). Water is available in select months in Rocky Creek (OWRD[2], 2017). See **Exhibit 29**.

Exhibit 29. Depoe Bay-Ocean Tributaries: Potential Water Available for New Surface Water Rights

Water Available for New Water Rights (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Johnson Creek near mouth	No	No	No	No	No	No	No	No	No	No	No	No
Spencer Creek near mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Big Creek near mouth	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes
Rocky Creek at Mouth	No	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	No
Wade Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is available in Rocky Creek, with the exception of October. Water is available in Johnson Creek December through March and in Big Creek November through May (OWRD[2], 2017). See **Exhibit 30.**

Exhibit 30. Depoe Bay-Ocean Tributaries: Potential Water Available for New Storage

Water Available for New Storage (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Johnson Creek (near Otter Rock) at Mouth	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Big Creek (near Newport) at Mouth	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Rocky Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Wade Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: OWRD[2], 2017

<u>Yaquina River Drainage Area.</u> There are several instream water rights in the drainage area, including on the Yaquina River and Big Elk Creek. During late summer and fall months, streamflow is often not adequate to meet existing instream water rights (OWRD[2], 2017). ODFW has proposed several additional instream water rights in the drainage area, including on Olalla Creek, Simpson Creek, Bear Creek, Big Elk Creek, Deer Creek, and Little Elk Creek.

80 percent exceedance (new out-of-stream water rights). Water is generally available for new surface water rights in the drainage area between December and May. The Yaquina River above Bales Creek and Mill Creek have no water available for new appropriation (OWRD[2], 2017). See **Exhibit 31.**

Exhibit 31. Yaquina River Drainage Area: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water by Month (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Yaquina River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Yaquina River above Elk Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Yaquina River above Simpson Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Yaquina River above Trapp Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Yaquina River above Bales Creek	No	No	No	No	No	No	No	No	No	No	No	No
Mill Creek at Mouth	No	No	No	No	No	No	No	No	No	No	No	No

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is generally available for new storage in the drainage area between November and June. The Yaquina River above Bales Creek has storage available between November and May. No water is available for new storage in Mill Creek (OWRD[2], 2017). See **Exhibit 32**.

Exhibit 32. Yaquina River Drainage Area: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Yaquina River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yaquina River above Elk Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Yaquina River above Simpson Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Yaquina River above Trapp Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Yaquina River above Bales Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Mill Creek at Mouth	No	No	No	No	No	No	No	No	No	No	No	No

Source: OWRD[2], 2017

<u>**Beaver Creek-Ocean Tributaries**</u>

80 percent exceedance (new out-of-stream water rights). Beaver Creek, at the mouth, has water available year round. (OWRD[2], 2017).

50 percent exceedance (new storage rights). Beaver Creek, at the mouth, has water available for new storage year round. (OWRD[2], 2017).

<u>Alsea River Drainage Area.</u> There are several instream water rights in the drainage area, including in lower Drift Creek, Fall Creek, North Fork Alsea, South Fork Alsea, Bummer Creek, Five Rivers, Lobster Creek, Green River, and the Alsea River mainstem (OWRD[2], 2017**)**.

80 percent exceedance (new out-of-stream water rights). Water is generally available for new surface water rights winter and spring months (OWRD[2], 2017**)**. See **Exhibit 33**.

Exhibit 33. Alsea River Drainage Area: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water by Month (80 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Alsea River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Alsea River above Line Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes
Alsea River above Hellion Can	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes
Alsea River above Five Rivers	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is available for new storage during all months of the year in the Alsea River, with the exception of August, September and October in the upper drainage area (OWRD[2], 2017**)**. See **Exhibit 34**.

Exhibit 34. Alsea River Drainage Area: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent exceedance)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Alsea River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Alsea River above Line Creek	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Alsea River above Hellion Canyon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Alsea River above Five Rivers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes

Source: OWRD[2], 2017

Yachats-Ocean Tributaries. There are several instream water rights in the drainage area, including in Williamson Creek, North Fork Yachats River, School Fork, and in the Yachats River mainstem (OWRD[2], 2017).

80 percent exceedance (new out-of-stream water rights). In the Yachats River, water is generally available for new surface water rights during the winter months. Ocean tributaries Wade Creek, Starr Creek and Vingie Creek have water available several months of the year. (OWRD[2], 2017). See **Exhibit 35**.

Exhibit 35. Yachats River Drainage Area: Potential Water Available for New Surface Water Rights

Water Available for New Surface Water by Month (80 percent)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Starr Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vingie Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Yachats River at Mouth	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Yachats River above Beamer Creek	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Yachats River above North Fork Yachats	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes

Source: OWRD[2], 2017

50 percent exceedance (new storage rights). Water is available for new storage in the Yachats River from November through June. Ocean tributaries Wade Creek, Starr Creek and Vingie Creek generally have water available for new storage each month. (OWRD[2], 2017). See **Exhibit 36**.

Exhibit 36. Yachats River Drainage Area: Potential Water Available for New Storage

Water Available for Storage by Month (50 percent)												
Stream Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Starr Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vingie Creek at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Yachats River at Mouth	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Yachats River above Beamer Creek	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Yachats River above North Fork Yachats	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes

Source: OWRD[2], 2017

Funding, Expenditures, and Funding Needs

River Gage Network. OWRD maintains a statewide monitoring network that includes river gages and observation wells. According to OWRD, any decisions it makes about modifying the network must take into account statewide needs and objectives; funding alone does not drive the decisions, although it affects the ability to maintain and expand the network. Gages are maintained for water right distribution or verification of water rights (e.g., managing water rights) as well as for monitoring and describing natural functions (e.g., monitoring for scientific reasons). OWRD recently produced a Monitoring Strategy to help prioritize sites for locating new gaging stations.

More Information: Oregon Water Resources Monitoring Strategy: http://www.oregon.gov/owrd/LAW/docs/IWRS/MonitoringStrategy.pdf

According to OWRD, the usefulness of the data increases with the length of the record. There needs to be an ongoing commitment to a gage (i.e., a minimum of 10 to 20 years of data) in order to justify investments. Field observations are made every 6 to 8 weeks through onsite measurements of streamflow (by watermasters or hydrologic technicians [hydrotechs]). This helps ensure that the stage discharge relationship (the relationship between the height of the river and the flow of the river) is established and maintained even as the geomorphology (the shape of the river) changes. Currently, there is not a dedicated hydrotech for the Northwest Region of OWRD, which includes the Mid-Coast Planning Area. In addition, OWRD has identified the need for additional staff members to keep up with data processing and allow for expansion of the monitoring network.

Installation of a new gage costs approximately $15,000. The annual operation and maintenance cost ranges from $12,000 to $20,000 and includes staff time and travel time to measure discharge, maintain the gage, calibrate and troubleshoot equipment, conduct/undergo training, and process and publish data. Each gage is funded differently. OWRD has funding to maintain the existing network and install new gages, but does not have funding or position authority to hire additional staff members to maintain those gages or process the data. OWRD had a cooperative program with USGS so that the agencies processed records together and co-published data; there is no longer funding for this approach.

2.2.3.2.5 Surface Water Data Gaps

Discontinued Gaging Stations

Several streamflow gages in the Mid-Coast have been discontinued (see **Exhibit 37**). As described in the introduction, streamflow records are available for some of these gages for limited periods of time and can be accessed at OWRD's Historical Streamflow and Lake Level Database.

Gaging station sites are discontinued for a number of reasons that vary from site to site, including, but not limited to:

- The gage was a part of a study that ended.
- The funding for that gage ran out and was not renewed.
- The site was determined to be problematic.
- OWRD determined that an alternate site better met the project needs.

Exhibit 37. Mid-Coast Discontinued Gages

Mid-Coast Discontinued Gages	
Alder Brook near Rose Lodge	Depot Creek near Toledo
Salmon River at Otis	North Fork Creek near Seal Rock
Salmon River near Otis	Thiel Creek near Newport
Rock Creek near Lincoln City	Beaver Creek near Ona
North Fork Schooner Creek near Lincoln City	South Fork Creek near Seal Rock
Erickson Creek near Lincoln City	North Fork Alsea at Alsea
Schooner Creek near Taft	South Fork Alsea near Alsea
Schooner Creek near Lincoln City	Fall Creek near Alsea
Drift Creek near Lincoln City	East Fork Lobster Creek near Alsea
Drift Creek below Grody near Kernville	Five Rivers near Fisher
South Fork Siletz at Valsetz	Drift Creek near Salado
Siletz at Logsden	Needle Branch near Salado
Big Rock Creek near Valsetz	Flynn Creek near Salado
Rock Creek near Logsden	Deer Creek near Salado
Siletz near Siletz	Lyndon Creek near Waldport
Euchre Creek near Siletz	South Fork Weiss Creek near Waldport
Rocky Creek near Depoe Bay	Eckman Creek near Waldport
Moolock Creek near Beverly Beach	Yachats River near Yachats
Elk Creek near Elk City	Mill Creek near Yachats
Mill Creek near Toledo	

Source: OWRD[5], 2017

Limited Streamflow Data

Several streams in the Mid-Coast serve as water supply sources, but do not have gages, estimates of natural flow, or estimates of water availability. Miscellaneous measurements are available for many streams in the study area, however these measurements are sparse and not adequate to describe characteristics of discharge and timing of flows. Miscellaneous measurements are spot measurements of streamflow made at one location at a single point in time by OWRD staff. **Exhibit 38** shows the streams, the water providers that use the creeks as a source, and the number of miscellaneous measurements taken on the creeks. This only includes miscellaneous measurements in the OWRD Miscellaneous Measurements Database and does not include measurements made by other entities.

Exhibit 38. Source Water Streams with Limited Streamflow Data

Source Water Streams With Limited Streamflow Data		
Creek	**Water Provider**	**# Miscellaneous Measurements**
Bear Creek (Salmon River Drainage Area)	Hiland Water Company	0
Callow Creek (Salmon River Drainage Area))	Hiland Water Company	1
Boulder Creek (Salmon River Drainage Area)	Hiland Water Company	0
Crowley Creek (Salmon River Drainage Area)	Cascade Head Ranch	0
Side Creek (Siletz Bay-Ocean Tributaries Drainage Area)	Kernville-Gleneden-Lincoln Beach Water District	0
North Depoe Bay Creek (Siletz River Drainage Area)	City of Depoe Bay	2
Tangerman Creek (Siletz River Drainage Area)	City of Siletz (emergency intake)	0
South Depoe Bay Creek (Depoe Bay-Ocean Tributaries)	City of Depoe Bay	3
Unnamed Creek; tributary to Yaquina Bay (Yaquina River Drainage Area	Bay Hills Water Association	0
North Fork Weist Creek* (Alsea River Drainage Area)	City of Waldport	0
South Fork Weist Creek (Alsea River Drainage Area)	City of Waldport	0
Eckman Creek (Alsea River Drainage Area)	City of Waldport	3
Dicks Fork Creek; tributary to Big Creek (Yachats River Drainage Area)	SW Lincoln County Water District	0
Salmon Creek (Yachats River Drainage Area)	City of Yachats	1
Reedy Creek (Yachats River Drainage Area)	City of Yachats	1

Notes: *There are four miscellaneous measurements on Weist Creek, tributary to Eckman Slough.
Source: OWRD[2], 2017 and OWRD[7], 2017

Exhibit 39 shows streams that were identified as important by the Partnership, but do not have any streamflow information.

Exhibit 39. Streams Identified as Important by the Partnership, without Any Streamflow Information

Streams Identified as Important by the Partnership, without Any Streamflow Information
Treat River
Crowley Creek (Salmon River Drainage Area)
Wright Creek (Yaquina River Drainage Area)
Big Elk Creek (Yaquina River Drainage Area)
Spencer Creek
Deer Creek
Sudan Creek
Canal Creek (Alsea River Drainage Area)
Little Salmon River
Thornton Creek (Yaquina)
Stump Creek (Yachats)

2.2.3.3. Groundwater Characteristics and Availability

2.2.3.3.1 Mid-Coast Groundwater Availability

Geology in the Mid-Coast limits available groundwater resources. Mid-Coast geology is generally characterized by low-permeability and low-storage capacity bedrock aquifers. This section contains basic information about geology and groundwater in the Mid-Coast, observation well data from OWRD's observation well network, and an overview of well yields across the region.

According to a USGS report on the water resources of Lincoln County conducted in 1976 (Frank & Laenen, 1976):

> The Lincoln County coastal area is underlain by Tertiary volcanic and sedimentary rocks of low permeability that store only a small volume of the annual precipitation […].Consequently, the Tertiary units yield small quantities of water to wells and furnish little ground-water discharge to maintain the base flow of streams. Although streamflow is normally abundant during the wet season, flow decreases greatly during summer when needed most.
>
> Quaternary marine terrace deposits of semi-consolidated sand border the western part of the area and are the most productive aquifers. Several wells drilled into the Quaternary deposits are among the highest producing wells of the area, with yields of 25 to 60 gallons per minute (1.6 to 3.8 liters per second). The Siletz River Volcanics is one of the better aquifers in the area and generally yields water in volumes sufficient for domestic use. The average well drilled into these rocks yields 5 to 10 gallons per minute (0.3 to 0.6 liters per second). Locally, this formation is quite permeable and has a producing well in the study area, with a yield of 120 gallons per minute (7.6 liters per second). Other volcanic rocks of small areal extent and largely untested, are the basalts near Depoe Bay, Cape Foulweather, Yachats, and Cape Perpetua.

The USGS Water Resources of Lincoln County Coastal Area Report (Frank & Laenen, 1976) summarized groundwater in the table below (**Exhibit 40).** The Siletz River Volcanics are the dominant geology of the northern portion of the Mid-Coast while the Tyee Formation rocks make up the majority of the middle and southern portions. "Basalt", "Intrusive Rocks", and "Marine Terrace Deposits" comprise only a small portion of the rocks in the Mid-Coast (Snavely & Wagner, 1964)

Exhibit 40. Mid-Coast Aquifer Properties from (Frank & Laenen, 1976)

Formation Name/Type	Geology	Well Yields	Aquifer Thickness
Siletz River Volcanics	Fine-grained to porphyritic basaltic flows, pillow basalt, lapilli tuff, and tuff breccia; interbedded siltstone, sandstone, and shale.	Variable. Some areas inadequate for domestic use, other areas 25-30 gpm, other areas 120 gpm	Approximately 10,000 ft.
Tyee Formation	Micaceous and arkosic sandstone and siltstone.	1-5 gpm	Approximately 6,000 ft.
Siltstone and Sandstone*	Tuffaceous siltstone and fine-grained sandstone, interbedded with arkosic, basaltic, and glauconitic sandstone.	Variable. Generally <5 gpm. No usable quantities near Toledo. Near Lincoln City yields 20-100 gpm.	200-5,000 ft.
Basalt	Basaltic and andesitic flows, fine-grained basaltic breccia, lapilli tuff, and pillow flow, interbedded with siltstone.	20-125 gpm.	12-20 ft in some areas, 2,000 ft total thickness (at Cape Perpetua)
Intrusive Rocks	Basalt, gabbro, nepheline, syenite, dacite, and camptonite.	Unknown, minimal yields expected.	N/A
Marine Terrace Deposits	Semi-consolidated fine-grained sand, silt, and clay wit interbedded loose sand.	25-30 gpm.	20-50 ft.

*Includes Whale Cove, Astoria Formation, Yaquina Formation, Nye Mudstone, siltstone of Alsea, Nestucca Formation, and Yamhill Formation. ft = feet; gpm= gallons per minute

Recharge and Discharge

Aquifers in the area are recharged by precipitation with the majority of recharge occurring during late autumn and winter, when precipitation is highest. Groundwater is discharged (leaves the aquifer) through seeps, springs, and diffusion through the river bed which provides water to rivers, streams, estuaries, and wetlands. In general, fractured-rock aquifers in the Mid-Coast have such low storage capacity that groundwater flow paths are short and a large proportion of aquifer recharge (filling) and discharge (draining) occurs seasonally, without providing significant, long-term water to streams (OWRD, Personal communications with Groundwater Section Staff, July 2017 through February 2018).

Natural Storage Potential

Natural storage potential refers broadly to the capacity of an aquifer or subsurface area to store water. One aspect of natural storage potential is bank storage along riparian corridors (streamside areas). Under natural hydrologic conditions, streams flood during high streamflow events. Flooding occurs when streamflow is no longer confined to the stream channel and spills onto the banks (floodplain) of the river. When this happens, flood water seeps into the floodplain and may become subsurface flow back to the river or recharge to groundwater. Thus, when a river or stream overtops its banks during high streamflow events, the energy of floodwaters is dissipated, making floods potentially less destructive since the timing of water flowing through the system is altered. A further advantage to these processes, is that water is stored longer in the banks and slowly recharged back into the main channel or the aquifer, depending on local geology and vegetation conditions (NHRAIC, 1992).

On some streams, beavers contribute considerably to natural storage potential by building dams that flood riparian areas and increase groundwater recharge potential. Beavers also can influence surface water processes during periods of high streamflow and low-flow periods, and encourage the persistence of wetlands, which also provide groundwater recharge and natural storage (Westbrook, Cooper, & Baker, 2006). Beaver populations declined in Oregon in the 1800s because of fur trapping, which significantly changed the hydrology of rivers and streams throughout the state.

Observation Wells and Hydrographs

OWRD Observation Wells are measured on a quarterly basis (four times per year) and some wells in other parts of the state that are dedicated observation wells may have a transducer that collects and records water level data at a much higher frequency (15 minutes to 2 hours). Most OWRD Observation Wells are existing wells used for other purposes (e.g., domestic use) and are not dedicated observation wells (i.e., dedicated only to measuring groundwater levels). Observation Well hydrographs show the measured water level in a well or wells over a period of time. Wells with longer periods of record can be used in a more thorough analysis of aquifer conditions and can show climate influence or drastic changes in water use.

There are three OWRD Observation Wells in Lincoln County that have been used to collect static water level data since the early 1960s. One well (LINC 1138) is located near the City of Toledo, a second (LINC 444) is located near the unincorporated community of Otis (**Exhibit 41** and **Exhibit 42**), and a third (LINC 820) is located near the City of Siletz. According to OWRD's website, the monitoring well near the City of Toledo is no longer being measured, but the other two wells are current.

Exhibit 41 and Exhibit 42 show the hydrographs for two observation wells in the Mid-Coast. The hydrographs generally show annual decline and recharge cycles. It should be noted that some of the data in the hydrographs below represent pumping levels (water levels that are measured when the well is on, or shortly after it has been turned off) rather than static water levels (water levels that are stationary and represent the water level in the aquifer). Data from LINC 444 show a period of decline in the 1980s and 1990s and a now stable trend, but both wells show little overall change in aquifer levels since monitoring has begun.

Exhibit 41. Water Levels: OWRD Observation Well LINC 1138

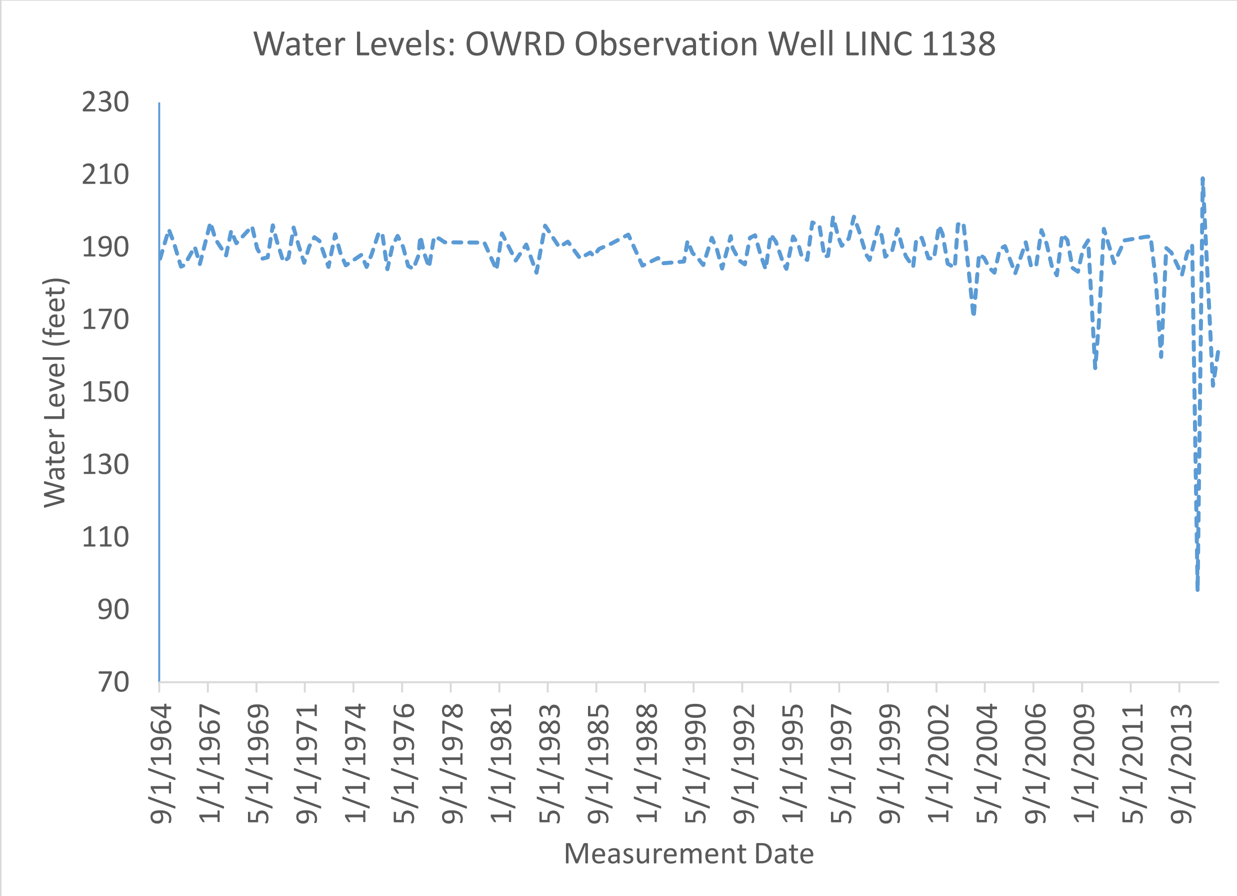
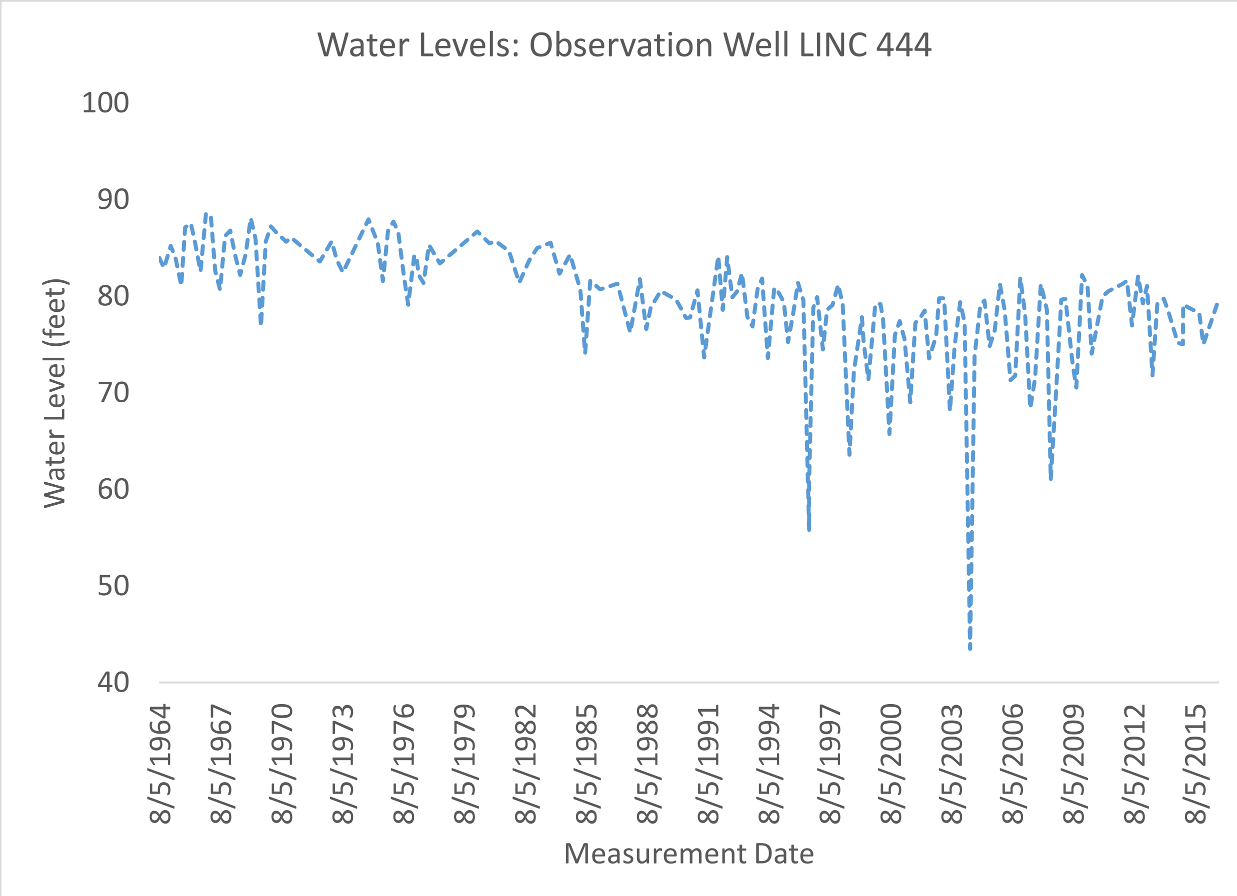


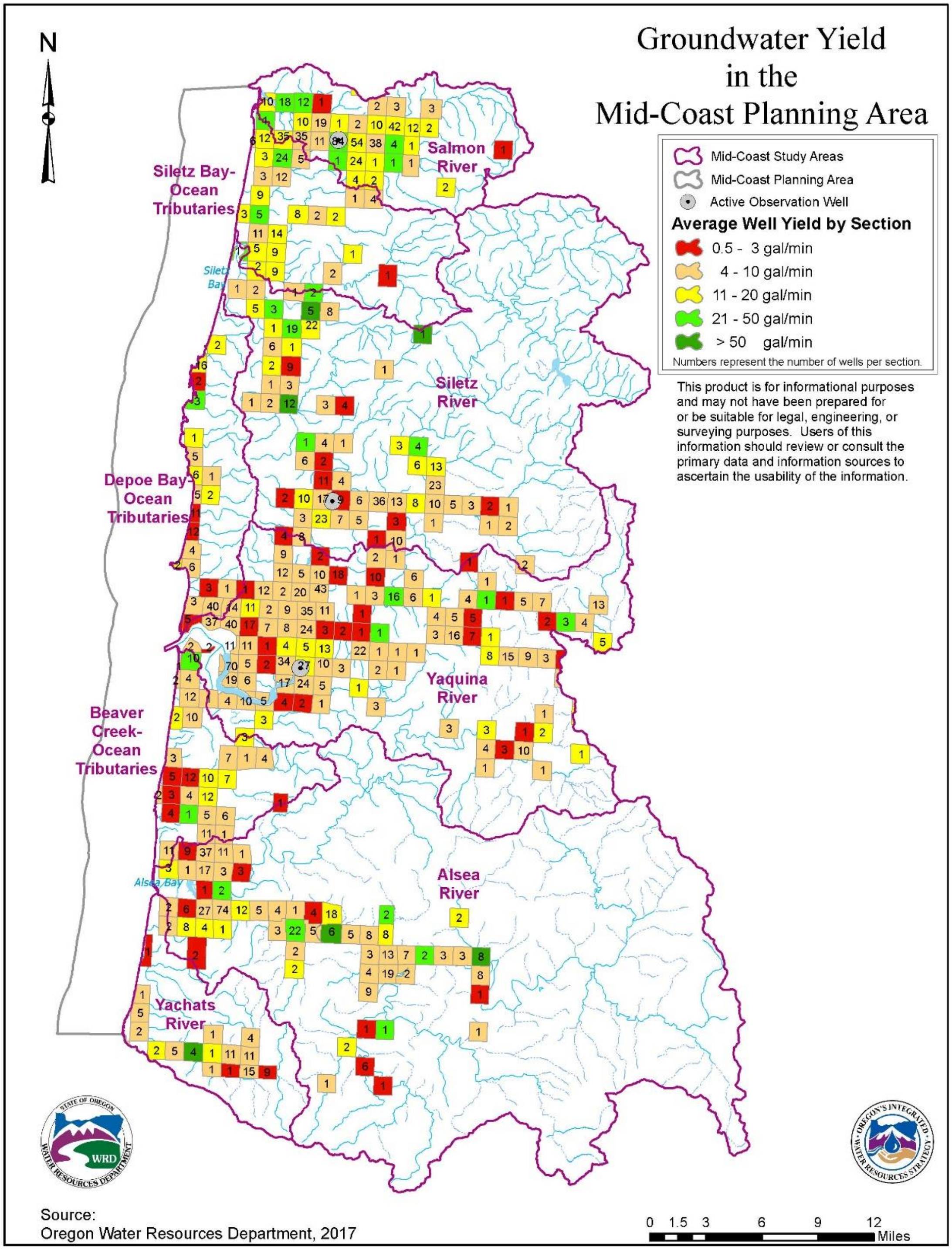
Exhibit 42. Water Levels: Observation Well LINC 444



Well Yields

Information about groundwater yields can be derived from pumping tests or well logs. After a well is drilled, a well log is submitted to OWRD by the well driller. Well logs contain descriptions of the location of the well, geologic material drilled through during well construction, the measured well yield (from a short pumping test), and other information. Well log information submitted to OWRD is stored electronically in OWRD's Well Log Database, which can be accessed online. **Exhibit 43** shows the average well yield by Section in the Mid-Coast Planning Area and the number of wells per section. This analysis shows that most wells in the Mid-Coast Planning Area produce less than 10 gpm. A few produce more than 50 gpm, and generally higher wells yields are found in the northern part of the study area.

Exhibit 43. Groundwater Yields and Well Density in the Mid-Coast Planning Area



Methods for Exhibit 43: The OWRD Well Log database was queried for wells in the Townships corresponding to the Mid-Coast Planning Area and the data were extracted into Excel. Using Excel, wells were grouped by Section (1 sq. mi.) and summary statistics were calculated (e.g., mean yield, mean/max depth, number of wells, etc.). This summary table was joined to Township-Range-Section layer files in ArcGIS and plotted as shown. "Number of wells per section" is the number of wells with reliable well yield information.

Underground Storage Potential

OWRD has compiled a list of identified potential underground storage sites where aquifers may have the capacity to store additional water through Aquifer Storage and Recovery (ASR) or Aquifer Recharge (AR). ASR is a process where water is injected into an aquifer and is stored for later use. AR involves injecting or infiltrating water into the groundwater for extraction and use by nearby wells. A major consideration for both ASR and AR is the cost-benefit ratio. In the Mid-Coast, Sedimentary Rocks and Siletz River Volcanics have been identified as potential future ASR sites, but current information suggests that overall aquifer conditions in the Mid-Coast do not provide good storage potential (Frank & Laenen, 1976; Woody, 2009). There are no existing ASR projects reported in the planning area.

2.2.3.3.2 Groundwater Gaps and Funding

There are only three groundwater monitoring wells in the Mid-Coast where OWRD collects and records static water level measurements. Well logs provide information regarding groundwater resources at one point in time, but do not provide a picture of change over time. There is also a lack of detailed information about the geology of the Mid-Coast because it is difficult to observe due to the lack of rock outcrops and the dense soil and vegetation cover (Snavely & Wagner, 1964).

A scoping level cost to drill an observation well is $10,000 for mobilization plus approximately $100 per foot of well depth. The cost associated with measuring and maintaining observation wells and processing groundwater data is approximately $500 - $1000 per well per year, depending largely on the distance to the well (which affects the costs associated with travel time and mileage).

2.2.4. Sources

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Appendix A

Data Sources

Useful Tools		
Topic	**Link to Tool**	**Purpose**
Climate	PRISM Climate Group	Find and download information on precipitation and temperature in the Northwest.
Climate, Surface Water, and more	Northwest River Forecast Center	Search for information and forecasts on precipitation, temperatures, streamflow and more.
Groundwater	Well Log Query.	Search well logs by location, tax lot number, owner name, well log number, and several other conditions.
Surface Water	Miscellaneous Streamflow Measurements Query.	Find miscellaneous streamflow measurements taken by OWRD staff.
Surface Water	Near Real Time Hydrographics Database,	Find and download current mean daily streamflow measurements from both USGS and OWRD stream gages.
Surface Water	Historical Streamflow and Lake Level Database.	Find and download historic mean daily streamflow measurements from both USGS and OWRD stream gages.
Surface Water	Peak Discharge Estimation Mapping Tool for Active Gages Peak Discharge Estimation Mapping Tool for Defined Watersheds	Provides information regarding the estimated peak flows in Oregon. These flows can be used to create flood map estimates.
Surface Water	USGS WaterWatch	Select a stream gage on the interactive map and find normal 7-day average streamflow compared to historical streamflow for the day of the year
Surface Water Availability	Water Availability Reporting System	Find information on water availability estimates for rivers and streams throughout the state, watershed characteristics, and information about instream and-out-of-stream flow requirements.
Surface Water and Groundwater	USGS Water Science School	Information on basics of hydrology.
Head of Tide and Estuary	Estuary Data Viewer	Provides spatial information on head of tide, wetlands, estuary habitats, and regulations.

Appendix B

Terminology

- **Aquifer:** A water-bearing body of naturally occurring earth materials that is sufficiently porous and permeable to yield usable quantities of water to wells and/or springs (OWRD & OHA, 2015).

- **Confined aquifers:** Aquifers that are covered and underlain by layers of sediments or rocks that only allow water to permeate very slowly. Water in these aquifers is under pressure, and can discharge without added pumping in what are called artesian wells (USGS, 2017).

- **Discharge:** The volume of water that passes a given location within a given period of time (USGS, 2017). Discharge is often measured in cubic feet per second (cfs).

- **Drought:** The word drought has many different definitions. In hydrology, a drought is an extended period of decreased precipitation and streamflow (USGS, 2017).

- **Exceedance:** This is the percentage of time that flows exceed a certain amount. Exceedance levels are used to understand how often a rate of flow is present in a stream. The Department uses 80 percent and 50 percent exceedance flows for determining water availability (Cooper, 2002). Low flows have high exceedance amounts because they are frequently exceeded. High flows, on the other hand, have low exceedance amounts because they are not frequently exceeded. The 80 percent exceedance flow is the amount of flow that is in a river or stream 80 percent of the time and the 50 percent exceedance is the amount of flow that is in a river or stream 50 percent of the time.

- **Flood:** A flood occurs when prolonged rainfall over several days or intense rainfall over a short period of time causes a river to overflow and flood the surrounding area (USGS, 2017).

- **Flood Return Interval:** A return interval, also known as a recurrence interval is an estimate of the likelihood of a flood or a river discharge flow to occur. The flood return interval for a stream is the probability that a flood of a given magnitude will be equaled or exceeded in a given year. A flood having a recurrence interval of 10 years has a 10 percent chance of recurring in any year; a 100-year flood has a 1percent chance of recurring each year (USGS, 2017).

- **Groundwater:** Water that is stored underground. Groundwater flows or seeps downward from the land surface and saturates soil or rock and supplies springs and wells (USGS, 2017).

- **Groundwater flow measurements:** Groundwater discharge in wells is typically measured in gallons per minute (gpm), which is also a measurement of a volume (x gallons) over a period of time (x minutes). Groundwater flow through aquifers is also referred to as discharge. Discharge areas are areas where water is leaving an aquifer and either entering a stream or coming up through the ground in a spring or wetland (USGS, 2017).

- **Groundwater level:** Ground water level, also known as static water level, is the depth to water below the land surface in a well when the well's pump is not operating (OWRD & OHA, 2015). Measurements of the ground water level represent the amount of water stored in the aquifer from which the measured well is drawing water. Water level declines can indicate seasonal fluctuations, variations in groundwater recharge or discharge, or overuse of the aquifer (USGS, 2017).

- **Hydrograph:** Describes the timing and amount of flow in a river or stream. It is a graph that shows discharge (cubic feet per second) over time (daily, monthly, yearly, etc.). Hydrographs are useful for showing high flow periods, often called peak flows, when a river or stream has high discharge, and low flow periods, when a river or stream has low discharge (Hornberger et al., 2014).

- **Instream flow requirement:** A requirement that a certain amount of streamflow be left instream. There are three main types of demands for water to be left instream: instream water rights, Indian treaty rights, and scenic waterway flows. The instream flow requirement used in OWRD's Water Availability Reporting System is the sum of these demands (OWRD, 2013).

- **Instream water right:** A water right that allows a certain amount of water to be protected instream. The water right protects water instream at a single point or along a reach of stream. Instream water rights specify how much water is protected instream and that amount may vary from month to month. Every instream water right has a priority date. During times of shortage, senior water rights get their water first and water rights that are junior to the instream water right can be shut off. Instream water rights are held by the Oregon Water Resources Department (OWRD, 2013).

- **Recharge:** Water enters the ground through recharge areas where water can *infiltrate* (soak into the ground). Aquifers have recharge rates, which are typically measured in inches or feet per year. Recharge rates depend on both the type of aquifer, the amount of precipitation, and the available recharge areas. Pavement and hard surfaces can cover recharge areas and allow water that would have infiltrated into the ground and recharged aquifers to instead flow into streams and rivers (Passero, n.d.).

- **River Mouth:** OWRD identifies the "mouth" as the lowest point in a watershed where all streams eventually drain. This definition does not account for tidal influence on discharge. (OWRD has discontinued gages that were in the zone of tidal influence).

- **Slope and Elevation:** Slope and elevation are important indicators of precipitation and stream characteristics. The slope of a watershed (how steep the hillsides are), combined with other factors, influences the amount and timing of runoff after precipitation events, the shape of the stream channel, and the movement of large wood and sediment from the hillslope to the stream channel (USGS, 2016; Lienkaemper & Swanson, 1987).

- **Stream flow measurements:** Water quantity in rivers and streams is typically measured in cubic feet per second (cfs). This is a measurement of a volume (x cubic feet) over a time (x seconds) and is referred to as a river's discharge (USGS, 2017).

- **Spring:** Groundwater that discharges to the surface, but does not form a natural channel. Springs are sometimes associated with wetlands or seeps (OWRD, 2013).

- **Unconfined aquifers:** Aquifers that are replenished by water infiltrating from the surface. These aquifers may interact with surface water, either receiving recharge from rivers or streams or discharging water into rivers and streams (USGS, 2017).

- **Volume measurements:** Water volumes (a fixed amount of water) in lakes, reservoirs, and sometimes groundwater are typically measured in acre feet (AF), which is equal to a one-foot depth of water covering one acre of area.

- **Water Year: A** water year is a 12-month period from October 1st to September 30th the following year. It is common to characterize water resources in the U.S. by the water year because the water year follows precipitation patterns, which tend to be wet during the winter and dry during the summer (USGS, 2017).

- **Well:** An artificial excavation for the purpose of withdrawing groundwater. Artesian wells are wells that drill into a confined aquifer, where water is under pressure. Artesian wells are also referred to as flowing wells because water flows out of the well without pumping (USGS, 2017).

<table>
<tr><th colspan="2">Useful Conversion Factors</th></tr>
<tr><td rowspan="2">Volume</td><td>1 ac-ft=325,850 gallons</td></tr>
<tr><td>1 m gall=3.07 acre-feet</td></tr>
<tr><td rowspan="2">Power</td><td>1 psi= 2.31 ft head</td></tr>
<tr><td>1 hp=746 watts= 1 cfs falling 8.81 ft</td></tr>
<tr><td rowspan="2">Length</td><td>1/4 mile = 1320 ft</td></tr>
<tr><td>1 mile = 5,280 ft</td></tr>
<tr><td rowspan="3">Rate</td><td>1 cfs = 448.8 gpm</td></tr>
<tr><td>1 cfs = 1.983471 ac-ft/day</td></tr>
<tr><td>1 mgd = 1.547 cfs = 695 gpm</td></tr>
</table>

Appendix C

Other Important Streams in the Mid Coast

Other Streams Identified as Important by the Mid-Coast Place-Based Planning Partnership

The Partnership has prioritized the understanding water resource characteristics of streams that flow directly into the ocean and that serve as current or potential public water systems. Information about these streams is provided in the main body of the report.

This appendix includes information about other streams with gage data and a list of other streams identified as important by the Partnership. This appendix does not include additional information about all other streams identified as important, with the exception of Rocky Creek, which is an identified potential future storage site.

The Partnership has not yet defined priority streams for future water supply, studies, or restoration. Therefore, this list does not represent defined Partnership priorities.

Salmon River Watershed

- Bear Creek
- Little Salmon River
- Salmon Creek
- Slick Rock Creek
- Treat River
- Trout Creek

Siletz Bay-Ocean Tributaries

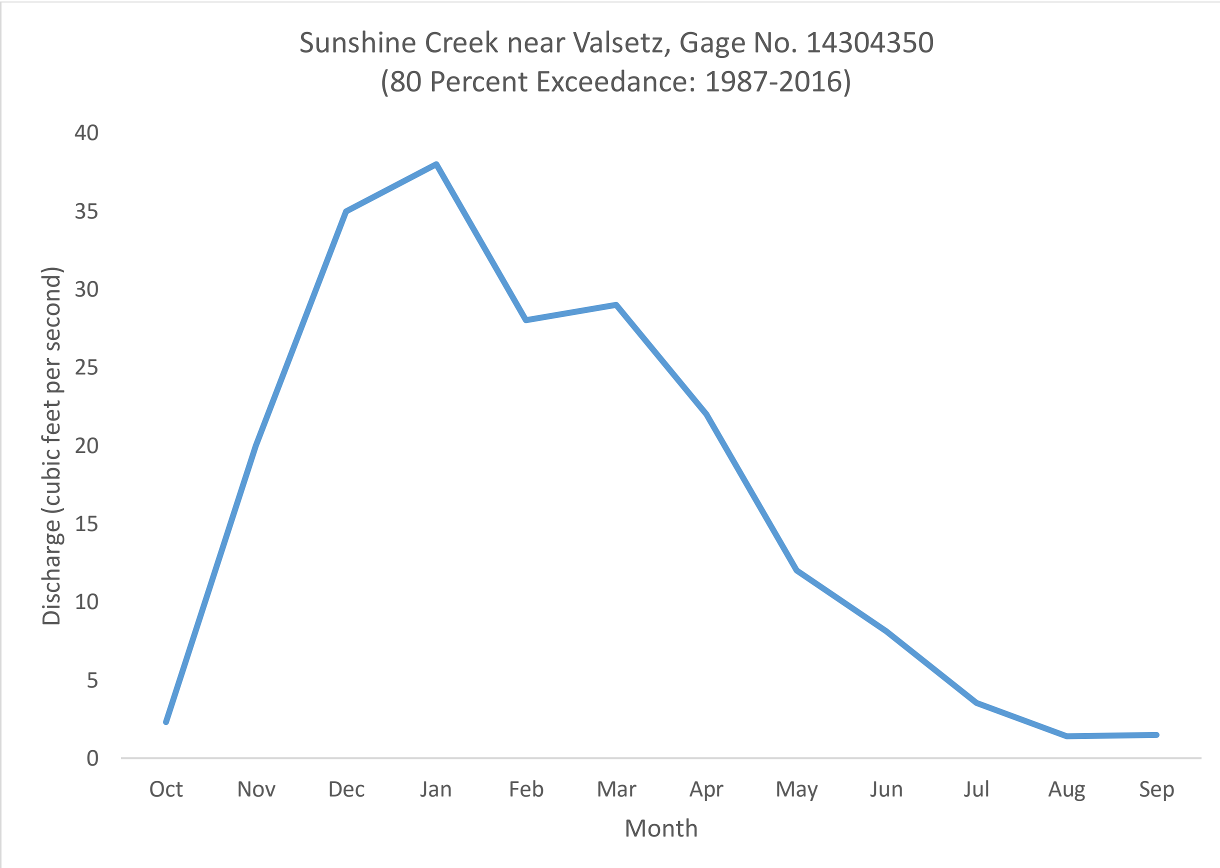
- Devil's Lake
- Side Creek

Siletz River Watershed

- Cedar Creek
- Euchre Creek
- Gravel Creek
- North and South Fork Siletz
- Rock Creek
- Sunshine Creek
- Mill Creek
- Tangerman Creek

Sunshine Creek

High streamflow in Sunshine Creek occurs in November and March and low streamflow occurs during August and early September. Streamflow is high throughout the winter, declining throughout April, May, June, and July, then increasing in October.



Source: OWRD[1], 2017

Depoe Bay-Ocean Tributaries

- Depoe Bay Creek

Yaquina River Watershed

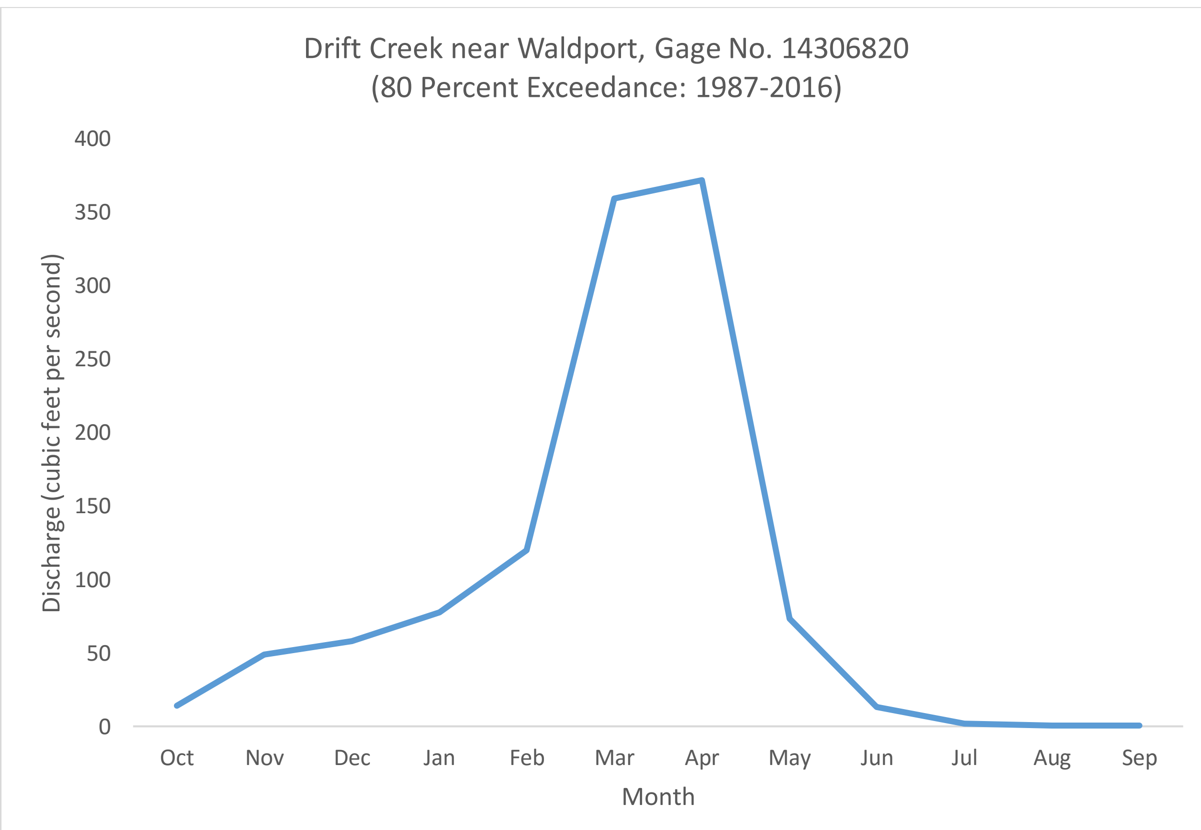
- Depot Creek
- Big Elk Creek
- Little Elk Creek
- Olalla Creek
- Thornton Creek
- Unnamed Creek (tributary to Yaquina Bay)

Alsea River Watershed

- Drift Creek
- East Fork Lobster Creek
- Canal Creek
- Fall Creek
- Five Rivers
- Lobster Creek
- South Fork Alsea
- North Fork Weist Creek
- South Fork Weist Creek
- Eckman Creek

Drift Creek

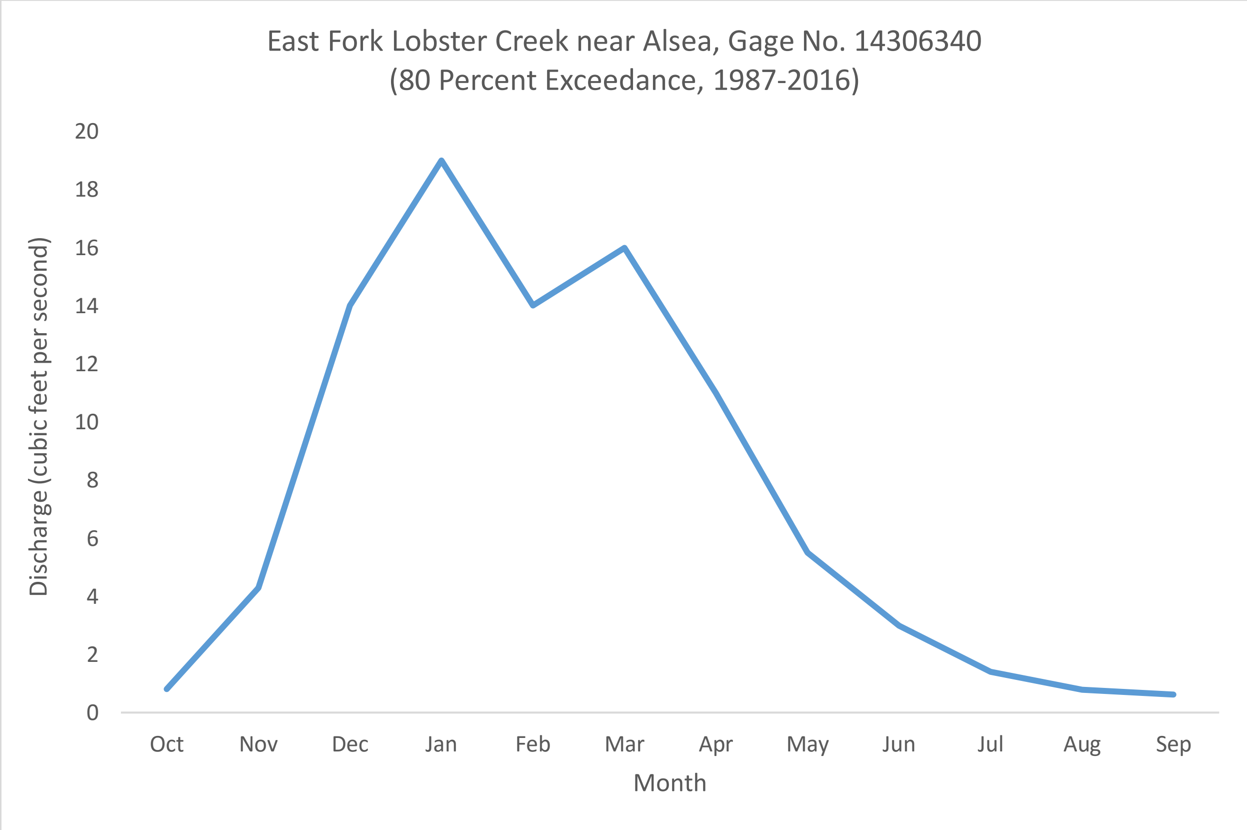
Drift Creek is a tributary to the Alsea River in the Drift Creek Wilderness Area of the Siuslaw National Forest (NRCS, 2005). The Drift Creek watershed receives as much as 120 inches of annual rainfall (OWRD[2], 2017). The measured 80 percent exceedance streamflow in Drift Creek is highest in late March then declines sharply between late March and late June and is lowest from late July through late September. Streamflow increases between late October and late March (OWRD[1], 2017).



Source: OWRD[1], 2017

East Fork Lobster Creek

East Fork Lobster Creek is a tributary to Lobster Creek (tributary to Five Rivers) and has its headwaters in Lane County. The measured 80 percent exceedance streamflow shows the creek experiences high flows December through March and low flows July through September (OWRD[1], 2017).



Source: OWRD[1], 2017

Yachats River Watershed

- North Fork Yachats
- School Fork
- Stump Creek
- Big Creek
- Salmon Creek

Appendix D

Water Availability Basins in the Mid Coast

Water Availability Basins in the Mid Coast by Watershed[1]

Water Availability Basins: Salmon River Watershed (OWRD[2], 2017)
SALMON R > PACIFIC OCEAN - AB SLICK ROCK CR
PANTHER CR > SALMON R - AT MOUTH
SLICK ROCK CR > SALMON R - AT MOUTH
BEAR CR > SALMON R - AT MOUTH
SULPHUR CR > SALMON R - AT MOUTH
SALMON CR > SALMON R - AT MOUTH
SALMON R > PACIFIC OCEAN - AB DEER CR AT GAGE 14303750
SALMON R > PACIFIC OCEAN - AT MOUTH
DEER CR > SALMON R - AT MOUTH

Water Availability Basins: Siletz River Watershed (OWRD[2], 2017)
S FK SILETZ R > SILETZ R - AT MOUTH
N FK SILETZ R > SILETZ R - AT MOUTH
SILETZ R > SILETZ BAY - AB GRAVEL CR
GRAVEL CR > SILETZ R - AT MOUTH
SILETZ R > SILETZ BAY - AB SUNSHINE CR
ROCK CR > SILETZ R - AT MOUTH
MILL CR > SILETZ R - AT MOUTH
SAM CR > SILETZ R - AT MOUTH
SCHOONER CR > SILETZ BAY - AB ABRAMS CR AT GAGE 14303950
EUCHRE CR > SILETZ R - AT MOUTH
SILETZ R > SILETZ BAY - AT MOUTH
SIJOTA CR > SILETZ BAY - AT MOUTH
BEAR CR > SILETZ R - AT MOUTH
SILETZ R > SILETZ BAY - AB MILL CR AT GAGE 14305500
CEDAR CR > SILETZ R - AT MOUTH
DRIFT CR > SILETZ BAY - AT MOUTH
BIG ROCK CR > ROCK CR - AB LUCAS CR AT GAGE 14304850
BIG ROCK CR > ROCK CR - AT MOUTH
LITTLE ROCK CR > ROCK CR - AT MOUTH
SCHOONER CR > SILETZ BAY - AT MOUTH

[1] Streams highlighted in yellow were identified as important by the Partnership.

Water Availability Basins: Yaquina River Watershed[2] (OWRD2, 2017)
YAQUINA R > YAQUINA BAY - AB BALES CR
LITTLE ELK CR > YAQUINA R - AT MOUTH
FEAGLES CR > ELK CR - AT MOUTH
YAQUINA R > YAQUINA BAY - AB TRAPP CR AT GAGE 14306030
ELK CR > YAQUINA R - AB GRANT CR
YAQUINA R > YAQUINA BAY - AB SIMPSON CR
SIMPSON CR > YAQUINA R - AT MOUTH
ELK CR > YAQUINA R - AB BEAR CR
MILL CR > YAQUINA R - AB UNN STR AT GAGE 14306036
YAQUINA R > YAQUINA BAY - AB ELK CR
OLALLA CR > YAQUINA R - AT MOUTH
ELK CR > YAQUINA R - AT MOUTH
MILL CR > YAQUINA R - AT MOUTH
YAQUINA R > YAQUINA BAY - AT MOUTH
KING SL > YAQUINA BAY - AT MOUTH
BEAR CR > ELK CR - AT MOUTH
DEER CR > ELK CR - AT MOUTH
GRANT CR > ELK CR - AT MOUTH

[2] Streams highlighted in yellow were identified as important to the Partnership.

Water Availability Basins: Alsea River Watershed (OWRD2, 2017)
FIVE RIVERS > ALSEA R - AB GREEN R
GREEN R > FIVE RIVERS - AT MOUTH
FIVE RIVERS > ALSEA R - AB LOBSTER CR
LOBSTER CR > FIVE RIVERS - AT MOUTH
S FK ALSEA R > ALSEA R - AB BUMMER CR AT GAGE 14306200
BUMMER CR > S FK ALSEA R - AT MOUTH
FALL CR > ALSEA R - AB SKUNK CR AT GAGE 14306300
FALL CR > ALSEA R - AT MOUTH
FIVE RIVERS > ALSEA R - AB ELK CR AT GAGE 14306400
N FK ALSEA R > ALSEA R - AT MOUTH
S FK ALSEA R > ALSEA R - AT MOUTH
ALSEA R > ALSEA BAY - AB FIVE RIVERS
FIVE RIVERS > ALSEA R - AT MOUTH
ALSEA R > ALSEA BAY - AB HELLION CAN AT GAGE 1430650
BURNHAM CR > ALSEA BAY - AT MOUTH
LINT SL > ALSEA BAY - AT MOUTH
ALSEA R > ALSEA BAY - AT MOUTH
DRIFT CR > ALSEA R - AT MOUTH
DRIFT CR > ALSEA R - AB WHEELOCK CR
DRIFT CR > ALSEA R - AB MEADOW CR AT GAGE 14306600
ALSEA R > ALSEA BAY - AB LINE CR

Water Availability Basins: Yachats River Watershed (OWRD2, 2017)
SCHOOL FK > YACHATS R - AT MOUTH
WILLIAMSON CR > N FK YACHATS R - AT MOUTH
YACHATS R > PACIFIC OCEAN - AB N FK YACHATS R
N FK YACHATS R > YACHATS R - AT MOUTH
YACHATS R > PACIFIC OCEAN - AB BEAMER CR
YACHATS R > PACIFIC OCEAN - AT MOUTH

Water Availability Basins: Pacific Ocean Tributaries[3] (OWRD[2], 2017)
ROCK CR > DEVILS L - AB UNN STR AT GAGE 14303800
ROCK CR > DEVILS L - AT MOUTH
UNN STR > DEVILS L - AT MOUTH
UNN STR > DEVILS L - AT MOUTH
D R > PACIFIC OCEAN - AT MOUTH
SCHOOLHOUSE CR > PACIFIC OCEAN - AT MOUTH
FOGARTY CR > PACIFIC OCEAN - AT MOUTH
DEPOE BAY CR > DEPOE BAY - AT MOUTH
DEADHORSE CR > PACIFIC OCEAN - AT MOUTH
ROCKY CR > PACIFIC OCEAN - AT MOUTH
JOHNSON CR > PACIFIC OCEAN - AT MOUTH
SPENCER CR > PACIFIC OCEAN - AT MOUTH
WADE CR > PACIFIC OCEAN - AT MOUTH
COAL CR > PACIFIC OCEAN - AT MOUTH
MOOLACK CR > PACIFIC OCEAN - AT MOUTH
SCHOONER CR > PACIFIC OCEAN - AT MOUTH
LITTLE CR > PACIFIC OCEAN - AT MOUTH (NEAR WALDPORT)
BIG CR > PACIFIC OCEAN - AT MOUTH (NEAR WALDPORT)
HENDERSON CR > PACIFIC OCEAN - AT MOUTH
GRANT CR > PACIFIC OCEAN - AT MOUTH
MOORE CR > PACIFIC OCEAN - AT MOUTH
BEAVER CR > PACIFIC OCEAN - AT MOUTH (NEAR SEAL ROCK)
N FK BEAVER CR > BEAVER CR - AB PETERSON CR AT GAGE 1430604 (NEAR SEAL ROCK)
STAR CR > PACIFIC OCEAN - AT MOUTH
AGENCY CR > PACIFIC OCEAN - AT MOUTH
THIEL CR > PACIFIC OCEAN - AT MOUTH
LOST CR > PACIFIC OCEAN - AT MOUTH
BUCKLEY CR > PACIFIC OCEAN - AT MOUTH
PATTERSON CR > PACIFIC OCEAN - AT MOUTH
LITTLE CR > PACIFIC OCEAN - AT MOUTH (NEAR NEWPORT)
BIG CR > PACIFIC OCEAN - AT MOUTH (NEAR YACHATS)
VINGIE CR > PACIFIC OCEAN - AT MOUTH
CLIFF CR > PACIFIC OCEAN - AT MOUTH
LOGAN CR > PACIFIC OCEAN - AT MOUTH
DEER CR > PACIFIC OCEAN - AT MOUTH (NEAR SEAL ROCK)

[3] Streams highlighted in yellow were identified as important by the Partnership.

Water Availability Basins: Pacific Ocean Tributaries (Cont.)[4] (OWRD2, 2017)
HILL CR > PACIFIC OCEAN - AT MOUTH
COLLINS CR > PACIFIC OCEAN - AT MOUTH
LITTLE CR > PACIFIC OCEAN - AT MOUTH (NEAR SEAL ROCK)

[4] Streams highlighted in yellow were identified as important by the Partnership.

Appendix E

Identified Potential Future Storage Projects

Identified Potential Future Storage Projects (OWRD4, 2017)			
Project #	**Name**	**T-R-S**	**Details**
1685	ELK CITY	11.00S-10.00W-14	Details
1687	EUCHRE CREEK	9.00S-9.00W-16	Details
1688	FALLS #1	8.00S-9.00W-24	Details
1690	FALLS #2	8.00S-9.00W-23	Details
1692	HOLMAN CREEK	8.00S-9.00W-26	Details
1697	SAM CREEK	10.00S-9.00W-6	Details
1698	SCOTT MOUNTAIN	14.00S-9.00W-18	Details
1702	SILETZ TOWN	10.00S-10.00W-9	Details
1703	SUNSHINE CREEK	9.00S-9.00W-15	Details
1704	SUNSHINE CREEK	9.00S-9.00W-3	Details
1707	TIDEWATER	13.00S-10.00W-32	Details
2032	UNNAMED	10.00S-8.00W-8	Details
2033	UNNAMED	10.00S-9.00W-6	Details
1682	UNNAMED	10.00S-10.00W-30	Details
1683	UNNAMED	11.00S-11.00W-11	Details
1684	UNNAMED	12.00S-9.00W-1	Details
1666	UNNAMED	6.00S-9.00W-29	Details
1667	UNNAMED	6.00S-10.00W-25	Details
1668	UNNAMED	6.00S-10.00W-34	Details
1669	UNNAMED	6.00S-10.00W-36	Details
1670	UNNAMED	7.00S-10.00W-30	Details
1671	UNNAMED	8.00S-10.00W-4	Details
1674	UNNAMED	9.00S-9.00W-12	Details
1675	UNNAMED	9.00S-10.00W-8	Details
1676	UNNAMED	9.00S-10.00W-14	Details
1677	UNNAMED	9.00S-10.00W-18	Details
1678	UNNAMED	9.00S-11.00W-8	Details
1679	UNNAMED	9.00S-11.00W-21	Details
1693	UNNAMED	12.00S-11.00W-33	Details
1694	UNNAMED	13.00S-8.00W-2	Details
2168	UNNAMED	12.00S-11.00W-14	Details
2170	UNNAMED	12.00S-10.00W-24	Details
2171	UNNAMED	13.00S-8.00W-3	Details

Identified Potential Future Storage Projects (Cont.) (OWRD2, 2017)			
Project #	**Name**	**T-R-S**	**Details**
2177	UNNAMED	15.00S-11.00W-2	Details
2178	UNNAMED	14.00S-10.00W-26	Details

Source: OWRD4, 2017