

Washington State Department of Ecology

Stream Discharge Technical Notes

Station ID: 05B090

Station Name: North Fork Stillaguamish River at Oso

Water Year: 2024

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Watershed Description

The North Fork Stillaguamish River basin is made up of a narrow lowland valley surrounded by steep forested hillsides and a few snowcapped mountain peaks. Elevation ranges from just over 200 feet at the gage to more than 6800 feet at points along the southern boundary of the basin. The mean basin elevation is 2230 feet. The average slope in the basin is calculated as 41%. Forest canopy is estimated to cover 75% of the basin. Mean annual precipitation is about 85 inches.

- Drainage area (square miles) = 161

Gage Location

The gage is located on the right bank of the North Fork Stillaguamish River at the north end of Whitman Road bridge. The gage house is at the same elevation as the roadway; and the slant-pipe drops about 25 feet along the side of an old bridge abutment into the river. The terminal end of the pipe extends into a deep portion of the channel a few feet offshore.

- Latitude (decimal degrees) = 48.272349
- Longitude (decimal degrees) = -121.887886

Location Photograph(s)

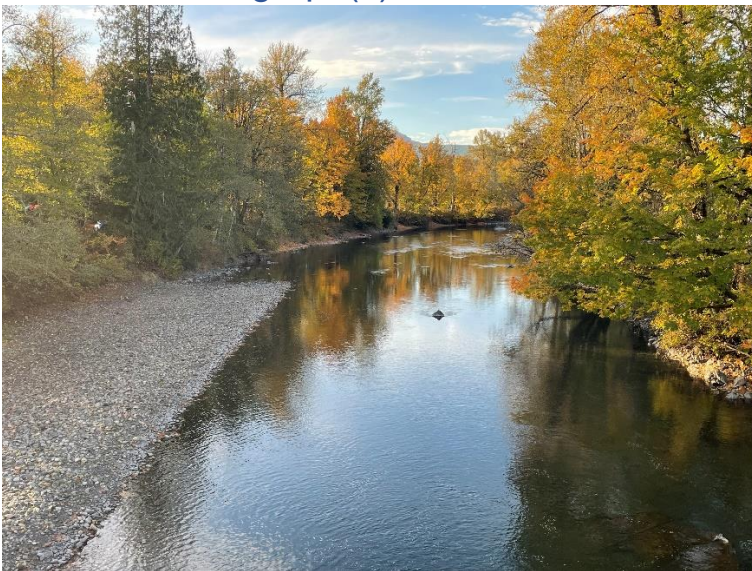


Figure 1: Downstream view of the North Fork Stillaguamish River at Oso during autumn flows.

Discharge Summary

Discharge is the volumetric flow rate of water that passes through a given cross-sectional area of a creek or river, and is measured in cubic feet per second (cfs). The following section summarizes the streamflow conditions at the gage location during the reported water year.

Table 1: Discharge statistics

| Discharge attribute | Number in cfs or number of days |
|--|--|
| Mean annual discharge | 953 cfs |
| Median annual discharge | 841 cfs |
| Maximum daily mean discharge | 10100 cfs |
| Minimum daily mean discharge | 118 cfs |
| Maximum instantaneous discharge | 15300 cfs |
| Minimum instantaneous discharge | 110 cfs |
| Discharge equaled or exceeded 10% of recorded time | 1740 cfs |
| Discharge equaled or exceeded 90% of recorded time | 179 cfs |
| Days discharge is greater than range of ratings | 1 day |
| Days discharge is less than range of ratings | 0 days |
| Un-reported days | 1 day |
| Days qualified as estimates | 12 days |
| Modeled days | 0 days |

Note: Table 1 may not include values in which the predicted discharge exceeds the range of ratings.

Discussion of discharge statistics

One day was greater than the range of ratings and no days were less than the range of ratings. One day was unreported during water year 2024 because discharge was greater than the range of ratings.

Twelve days were qualified as estimates. Five days were qualified as estimates based on the logger drift assessment. The remaining seven days were qualified as estimates because data from another similar station was used in a regression equation to fill a data gap from a failure of the stage measurement device.

Error Analysis Summary

The following section outlines the main component sources of potential error in the annual discharge record at this station. Logger drift is an undesired change in the continuous stage sensor that is not a function of real changes in the water surface elevation. Weighted rating error is the difference between discharges predicted by the rating curve and measured discharges adjusted to the maximum degree of possible error, based on the field observed measurement quality rating.

Table 2: Summary of errors

| Error type | Percent of discharge |
|---------------------------------|-----------------------------|
| Potential logger drift error | 4.7% |
| Potential weighted rating error | 16% |
| Total potential error | 21% |

Discussion of error analysis

Most of the error during water year 2024 came from rating error. Much of the error was driven by difficulty in measuring discharge at high flows and to a lesser extent low flows. Fast and turbulent water, standing waves, and areas of shear between fast and slow water at higher flows were the largest drivers in error.

Stage Record Summary

Stage is the height of the water surface in a creek, river, or lake above a known datum. The table below summarizes the range of stage observed at this gage during the water year.

Table 3: Summary of recorded stages

| Stage record | Feet | Date |
|-------------------------|-------------|-------------|
| Minimum recorded stage | 212.48 feet | 09/25/24 |
| Maximum recorded stage | 225.98 feet | 12/05/23 |
| Range of recorded stage | 13.50 feet | |

Discussion of stage record

Typically, lowest flows in the western part of Washington State occur from late September to early October. The minimum recorded stage occurred in late September which falls in the normal range. The maximum recorded stage occurred in early December 2023 during a large storm event.

Ratings Summary

Rating curves are developed to define the relationship between observed stage and measured discharge at a gaging station for a specific period. The table below lists which ratings were used during the water year, followed by a discussion of notable aspects of rating development and progression through the year.

Table 4: Rating summary table

| Rating number | Period of ratings | Range of ratings in cfs | Number of defining measurements | Rating error (percent) |
|----------------------|--------------------------|--------------------------------|--|-------------------------------|
| 9 | 10/01/23 to 9/30/24 | 80 to 24800 cfs | 30 | 16.2% |

Discussion of rating(s)

Rating 9 is a carry-over from water year 2023 and was in effect for the entire water year.

High Flow Model Summary

In cases where it is not practical to measure the entire range of discharge at a gaging station, a hydrologic model is developed to estimate discharges significantly greater than the measured range.

- Model type (slope conveyance, other, none) = none
- Range of modeled stage (feet) =
- Range of modeled discharge (cfs) =
- Valid period for model =
- Model confidence =

Discussion of modeled data

Survey Type and Date

Periodic surveys are conducted to establish or validate gage datum continuity, reference marks, and gage height indices. In addition, channel shape and slope are surveyed to develop high flow models.

Table 5: Types of surveys conducted with dates

| Survey Type | Date |
|-------------|------|
| None | |
| | |

Discussion of surveys

Activities Completed

A total of seven flow measurements were taken during routine site visits during the water year. In addition, there was a non-routine site visit to upgrade the data collection platform and change the stage measurement device from a constant flow bubbler to a radar gage.

Appendix