

# Washington State Department of Ecology

## Stream Discharge Technical Notes

**Station ID:** 05B090

**Station Name:** North Fork Stillaguamish River at Oso

**Water Year:** 2020

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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 winter 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

<b>Discharge attribute</b>	<b>Number in cfs or number of days</b>
Mean annual discharge	1180 cfs
Median annual discharge	879 cfs
Maximum daily mean discharge	13600 cfs
Minimum daily mean discharge	138 cfs
Maximum instantaneous discharge	20800 cfs
Minimum instantaneous discharge	136 cfs
Discharge equaled or exceeded 10% of recorded time	2020 cfs
Discharge equaled or exceeded 90% of recorded time	206 cfs
Days discharge is greater than range of ratings	0 days
Days discharge is less than range of ratings	0 days
Un-reported days	0 days
Days qualified as estimates	26 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

No days were greater than the range of ratings. No days were less than the range of ratings. No days were unreported during water year 2020.

Twenty-six days were qualified as estimates. All 26 days were qualified as estimates based on the logger drift assessment.

## 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

<b>Error type</b>	<b>Percent of discharge</b>
Potential logger drift error	8.1%
Potential weighted rating error	16%
Total potential error	24%

### Discussion of error analysis

Most of the error during water year 2020 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.

Also in water year 2020, the primary gage index used to measure stage height was switched from a staff gage to a wire weight gage. In order to account for the differences in the two methods, a weighted average was used in the total potential error calculation.

### 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

<b>Stage record</b>	<b>Feet</b>	<b>Date</b>
Minimum recorded stage	0.31 feet	09/13/20
Maximum recorded stage	11.79 feet	02/01/20
Range of recorded stage	11.48 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 the middle part of September, which falls outside the normal range. The maximum recorded stage occurred at the beginning of February 2020, during a series of large storm events.

### 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)
106	10/1/19 to 8/27/20	115 to 24800 cfs	69	15.2%
801	3/29/20 to 9/30/20	115 to 24800 cfs	29	16.8%

Discussion of rating(s)

Rating 106 is a carry-over from water year 2019. Rating 106 makes a shift for scour to rating 801.

### 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
Levels	10/29/2019

Discussion of surveys

The levels survey conducted in water year 2020 was conducted to validate gage datum continuity, reference marks, and gage height indices. In addition, the survey was conducted in the NAVD88 elevation datum to be consistent with the co-located equipment from the United States Geological Survey.

## Activities Completed

Normally routine maintenance is done at the station at six-week intervals throughout the water year. However, in water year 2020 there was a 4 month pause due to the COVID-19 pandemic. After the pause, site visits were restarted but were scaled back for a few months. Visits included discharge measurements, data downloads, and changing batteries and desiccant as needed.

## Appendix