WASHINGTON DEPARTMENT OF ECOLOGY

ENVIRONMENTAL ASSESSMENT PROGRAM

FRESHWATER MONITORING UNIT

STREAM DISCHARGE TECHNICAL NOTES

STATION ID: 07R050

STATION NAME: French Cr. nr mouth

WATER YEAR: 2012

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Introduction

Watershed Description

French Creek drains approximately 29 square miles of south central Snohomish County, a northern portion of the city of Monroe, and a southeastern area of the city of Snohomish. It is fed by seven major tributaries, which include Chain Lake and Cripple, Golf Course, Richardson, Spada, Stables, and Trench Creeks. Land uses in the upper reaches of the French Creek drainage are primarily a mix of residential development, small farms and pastures, forested areas, and equestrian centers. Commercial agriculture dominates the lower reaches. Discharge of French Creek to the Snohomish River near river mile 15 is controlled by a pumping station with fish ladders, operated and maintained by the French Slough Flood Control District (FSFCD).

Gage Location

This gage was located on the right bank, underneath the Old Snohomish-Monroe Rd. Bridge. The station operated from May to October 2012 as part of the French Creek and Pilchuck River Temperature, Dissolved Oxygen, and pH Total Maximum Daily Load (TMDL) study.

Table 1.

Drainage Area (square miles)	26.2
Latitude (degrees, minutes, seconds)	47° 53’ 23” N
Longitude (degrees, minutes, seconds)	122° 4’ 26” W

Station Narrative

This station was established as part of the French Creek and Pilchuck River Temperature, Dissolved Oxygen, and pH TMDL study. Discharge of French Creek to the Snohomish River is controlled by a pumping station, resulting in an extremely dynamic stage-discharge relationship.

This made discharge modeling based solely on river stage impossible. This station was therefore used as a pilot project for index velocity-based flow modeling. A stationary side-looking acoustic Doppler current profiler (ADCP) was deployed at the site. This ADCP (a Sontek Argonaut SL3000) measured velocity across a horizontal slice of the channel (i.e. index velocity) and water depth above the ADCP (river stage) at 15-minute intervals.

Discharge measurements were made at the site by Ecology staff every 2-4 weeks. Data from the discharge measurements were then used in conjunction with the ADCP data to model the relationships between index velocity and average channel velocity, and between river stage and cross-sectional area. Total discharge is the product of average velocity and cross-sectional area.

Due to regular impoundments from the pump station at the mouth of French Creek, discharge at the station was frequently backed up, with the water often flowing in an upstream direction. This resulted in highly erratic and often negative discharge at this station. The relationships described above proved to be so erratic that the entire discharge record is qualified as questionable estimates.

Discharge measurements at this site ranged from -28 cfs to 81 cfs, with variability within single measurements ranging from 37% to 1,120%, indicating extremely difficult measurement conditions. Extremely slow and variable (in terms of both magnitude and direction) velocities, coupled with very soft and mobile substrate contributed to this variability.

The continuous discharge at this site ranged from -128 cfs to 347 cfs. Due to the extremely difficult measuring conditions, all data are considered questionable estimates.

The ability of the ADCP to measure the depth of water in the river channel is known as drift. At this site, a linear regression between recorded ADCP depth and depth to water surface (tape down) readings taken from the Old Snohomish-Monroe Rd. Bridge shows an average variability of 0.03 feet between these readings. Given the inherent variability in tape-down readings, this indicates that drift of the ADCP was not an issue.

Stationary ADCPs are an effective technology for monitoring streams impacted by tides and other backwater conditions. However, the extreme conditions that exist at French Creek during the low-flow season proved to challenge even this technology's ability to monitor streamflow conditions.