# Stream Flow Monitoring Report III – Salmon Creek

*Annex Creek/Salmon Creek Hydroelectric Project*

*(FERC Project No. 2307)*

**Alaska Electric Light and Power Company**

**Juneau, Alaska**

**February 20, 2018**

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# 1. INTRODUCTION AND PURPOSE

In October 2015, Alaska Electric Light & Power (AEL&P) requested an amendment to its license that would allow the operation of the stream gage to be performed by the licensee. By Order issued December 30, 2015, the Federal Energy Regulatory Commission (FERC) approved the amendment and stipulated that a new stream flow plan be developed after consultation with Alaska Department of Fish and Game (ADF&G), National Marine Fisheries Service (NMFS), and the United State Fish and Wildlife Service (USFWS). AEL&P prepared a plan in consultation with ADF&G, NMFS, and USFWS, as well as with the Alaska Department of Natural Resources (ADNR) Water Division and National Weather Service (NWS).

By Order issued August 9, 2016 the FERC approved the stream flow monitoring plan with a requirement to file a instream flow monitoring report biannually to the FERC, NMFS, USFWS and ADF&G. The report is to review operation of the gage, identify when supplemental water was released and include information on the operation of the supplemental water valve. The report is to be submitted for agency review, with a 30-day review and comment period, prior to filing with the FERC. Documentation of agency consultation should be included in the report.

The first report was submitted to FERC on April 19, 2017. The second report was filed with FERC on August 16, 2017. This is the third semi-annual report to be filed with FERC, it covers the period from July 1, 2017 through December 31, 2017.

## 1.1. Gage Operation

The stream gage started operation on April 27, 2016, taking level measurements on a 15 minute basis. This data is automatically distributed to www.aelp.com/About-Us/Salmon-Creek-Streamflow where it is available for public display. The page has multiple graph options for quick review of the data. Real-time flow data is supplied directly to the AELP Supervisory Control and Data Acquisition (SCADA) System where it is logged and monitored. Alarms are automatically generated for low flow conditions or for loss of communication with the sensor.

The communication path between the gage and the AEL&P SCADA system is through a cellular phone modem, which performed well during the period. This communication link is continuously monitored by the AELP SCADA system at the AELP dispatch center which is manned 24 hours per day. The operators are trained to respond to all alarms, either by taking direct action or calling a technical specialist who can resolve the specific problem.

Figures 1 and 2 below show the corrected discharge graphs for the second half of 2017. The corrections shown during the third quarter of 2017 are due to backwater from ice, which impacted operation of the gage, resulting in false high readings. The dates of the manual discharge readings are identified in figures 1 and 2. A total of three discharge measurements were conducted to calibrate discharges for the

second half of 2017, including a low flow discharge measurement of 15.9 CFS. Comments received from ADF&G on August 14, 2017 stated they would like to see the manual discharge measurements taken when flows are low (<25 CFS) to ensure the gage accuracy during periods of low flow. Since the primary function of this gage is to alert AELP to flows less than 9 CFS so that supplemental water can be added to the stream, this is a valid concern. AELP will try to take more discharge measurements during low flow periods. It should be noted, that low flow periods typically occur during the coldest winter periods and that AELP opens the supplemental valve when we reach 9 CFS and leaves it open until ambient temperatures are above freezing and flow measurements are above 12 CFS.

A table of the Daily Mean Discharge for the months of October 2016 through December 2017 is included in Appendix B.

Figure 1 – Third Quarter 2017 Corrected Discharge

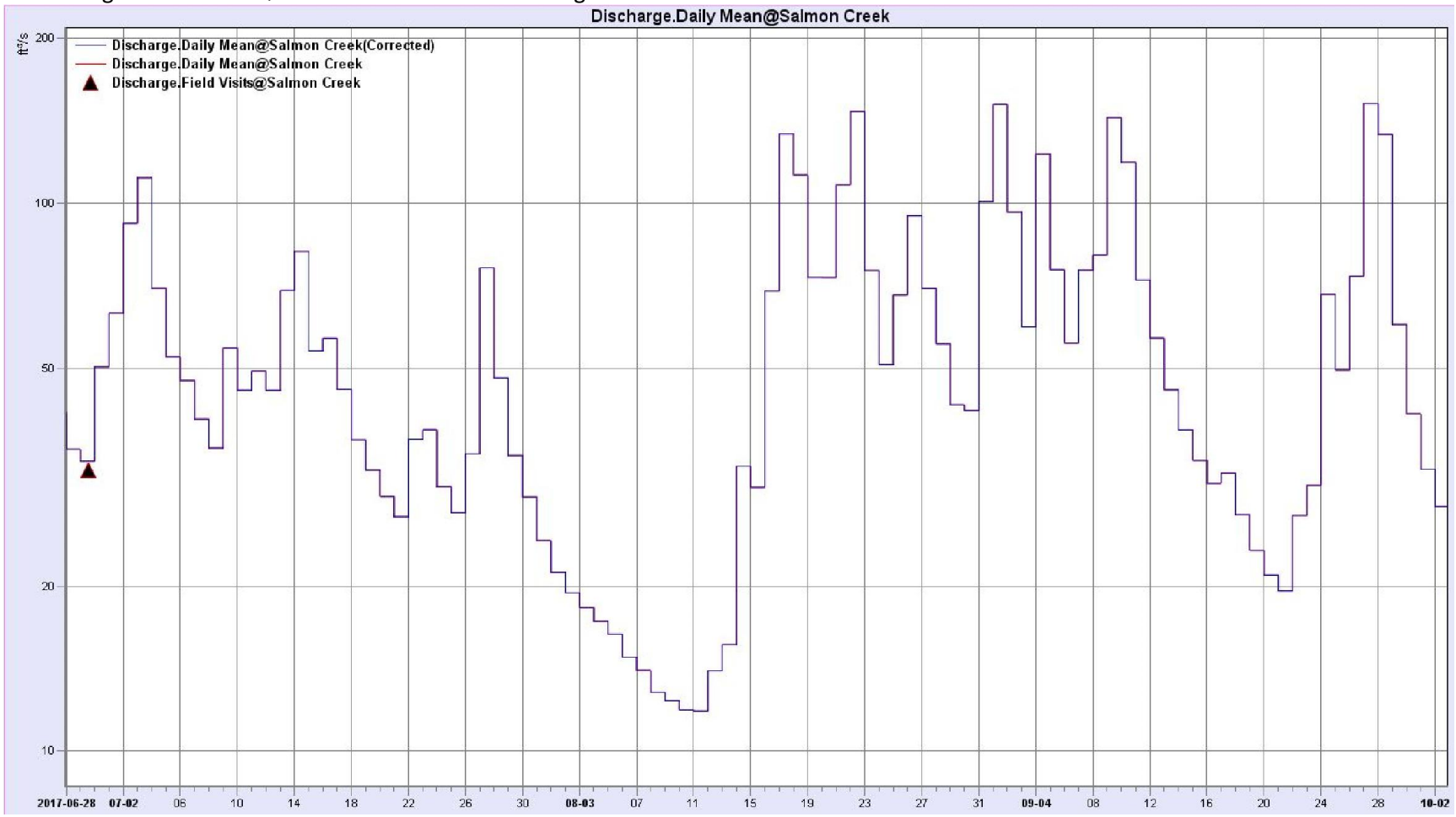
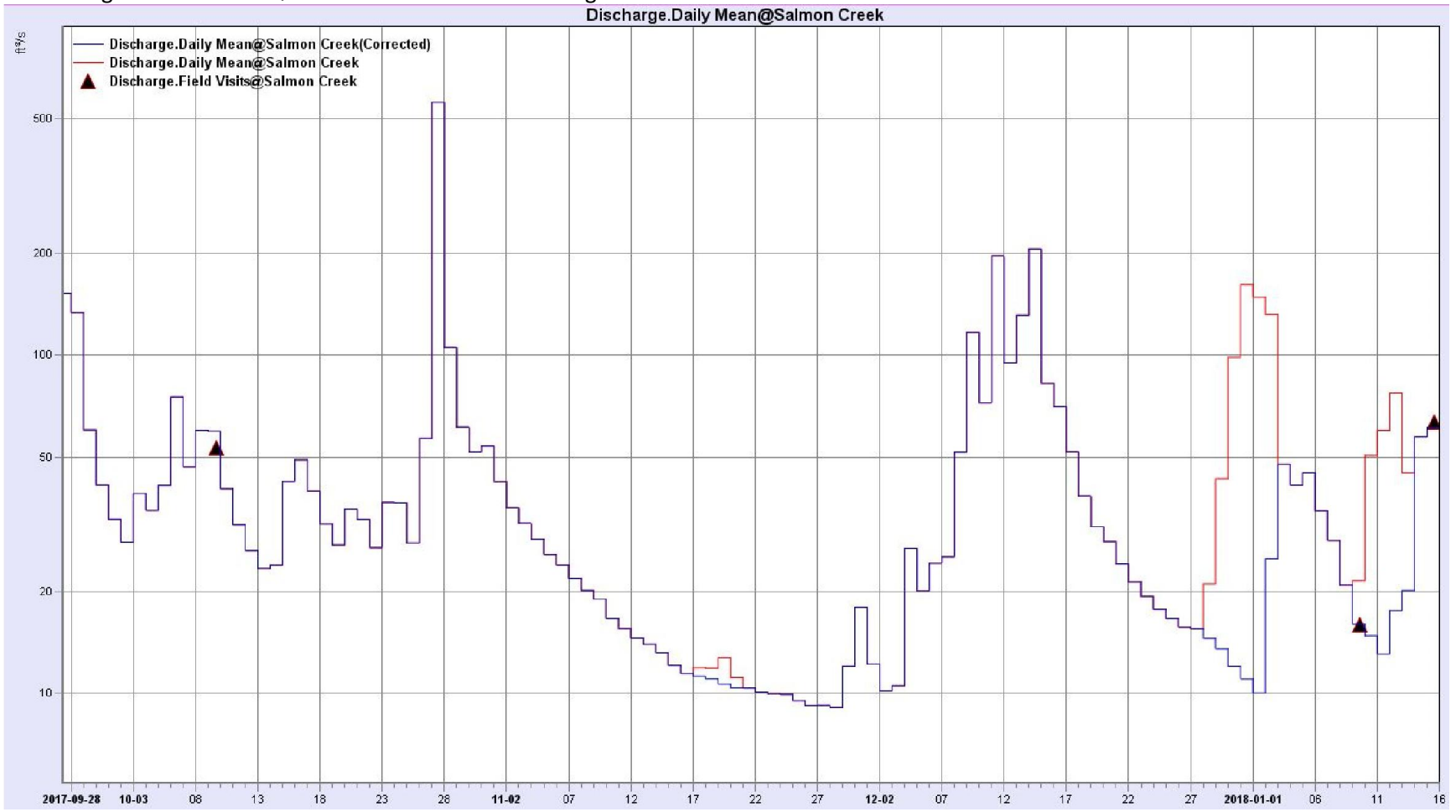


Figure 2 – Fourth Quarter 2017 Corrected Discharge



## 1.2. Supplemental Valve Operation

The supplemental water valve is a 6" valve tapped off of the penstock at the base of the dam. The valve discharges water directly into the natural drainage. Operation of the valve is performed remotely by the AEL&P System Operator who also has real-time indication of the streamflow. When the flow drops below 9CFS, an alarm is generated and the Operator opens the valve and logs the operation.

The valve is either open or closed, there are no intermediate positions. The Operator has feedback on the valve position, provided by limit switches which show the valve position as well as an analog signal which reflects valve position. In addition to valve position, there is a flowmeter on the outlet of the valve. The amount of flow through the valve when open varies with the lake elevation. At a higher elevation there is more flow and at a lower elevation the flow is less. The valve has been sized to ensure a minimum of 3CFS of flow at a low lake elevation, so typically more CFS is discharged to the stream.

## 1.3. Supplemental Valve Release

The supplemental water valve was not operated due to low streamflow (<9 cfs) between July 1, 2017 and December 31, 2017.

## 1.4. Agency Consultation

A copy of the draft report with a request for consultation was sent on January 19, 2018 by Christy Yearous with AEL&P to ADF&G, USFWS and NMFS by e-mail.

Comment: Sean Eagan with NMFS commented on January 22, 2018.

(1) When I look at the website, it seems to show that Nov 24-28, 2017 period did not drop below 10 cfs, but when I look at Appendix B it shows daily averages of 9.9, 9.5, 9.2,9.2 and 9.1 cfs; these averages probably jive with the log scale graphic in Figure 2. Which one is correct? If the web site is the one that is slightly off, do you plan to rectify it?

(2) Appendix B puts two letter codes after each discharge (UN, BL, EP, EF). Are these defined some place? If they aren't defined yet, please define them in the final semi-annual report.

(3) We concur with ADF&G that a few more manual measurements taken between 9 and 15 cfs would strengthen the rating curve.

Response: (1) The website provides provisional data and finalized data is provided twice annually in this report and includes the stage and stage-variable shift corrections to discharge as defined by the measurements and site visits. The log scale graphics in the report and the

values shown in Appendix B are the correct final values. The finalized data for the 2017 water year has been posted on the website as finalized data.

(2) The letter codes are now defined in Appendix B.

(3) Emphasis will continue to be placed on manual measurements in the lower flow range (9-15 cfs).

Comment: Kevin Keith with ADF&G responded on February 1, 2018. He requested that a graph of the rating curve (Stage vs. Discharge) along with points showing where the measurements taken during recent field visits are in relationship to the curve.

Response: AEL&P has included *Station Description and Analysis for Salmon Creek Gaging Station near Juneau, Alaska for the 2017 Water Year* as prepared by Alaska Hydroscience in Appendix C of the report. A rating curve is included with the manual measurements identified on the curve.

A copy of the request for consultation and comments received are in Appendix A.

# APPENDIX A: AGENCY COMMENTS

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From: Sean Eagan - NOAA Federal <sean.eagan@noaa.gov>
Sent: Monday, January 22, 2018 9:43 AM
To: Christy Yearous
Cc: kevin.keith@alaska.gov; steve_brockmann@fws.gov; susan.walker@noaa.gov; Crane Johnson - NOAA Federal
Subject:** EXTERNAL ** Re: P-2307 Salmon Creek Semi-Annual Streamflow Monitoring Report

Christy,

Thanks for the draft Streamflow Monitoring report. It appears AEL&P is doing a good job of keeping the gage running.

Here are a few questions/comments that hopefully you will address in the final semi-annual report:

1. When I look at the website, it seems to show that Nov 24-28, 2017 period did not drop below 10 cfs, but when I look at Appendix B it shows daily averages of 9.9, 9.5, 9.2,9.2 and 9.1 cfs; these averages probably jive with the log scale graphic in Figure 2. Which one is correct? If the web site is the one that is slightly off, do you plan to rectify it?
2. Appendix B puts two letter codes after each discharge (UN, BL, EP, EF). Are these defined some place? If they aren't defined yet, please define them in the final semi-annual report.

Base on the current level of 9.8 - 10 cfs and the anticipated cold weather, it looks like opening the valve may happen in the next few days. Do you actually wait until it reads 9.0 or lower exactly or might you open it at say mid way between 9.0 and 10.0 just for precaution?

We concur with ADF&G that a few more manual measurements taken between 9 and 15 cfs would strengthen the rating curve.

Thank you for all your work on this. I appreciated my very consistent electrical power in 2017.

Sean

From: Keith, Kevin D (DFG) <kevin.keith@alaska.gov>
Sent: Thursday, February 01, 2018 11:54 AM
To: Christy Yearous
Cc: steve_brockmann@fws.gov; susan.walker@noaa.gov; Crane Johnson - NOAA Federal; Sean Eagan - NOAA Federal; Klein, Joseph P (DFG)
Subject:** EXTERNAL ** RE: P-2307 Salmon Creek Semi-Annual Streamflow Monitoring Report

Hi Christy,

Thanks for the opportunity to comment on the 3rd semi-annual Stream Flow Monitoring Report. We appreciate your efforts to protect the fish resources in Salmon Creek.

The report is clear and concise. We agree with the questions/comments from NOAA (below). Beyond that, we have only one suggestion:

1. In reviewing the operation of the gage, it is important to understand the accuracy of the discharge as calculated from the pressure transducer data. Along those lines, it would be useful for the report to include a graph of the rating curve (Stage vs. Discharge) along with points showing where the measurements taken during the recent field visits (i.e. field measurement vs. staff gage) are in relationship to the rating curve.

We appreciate the inclusion of our previous comments, as well as your efforts to take discharge measurements during low flow periods.

Please don't hesitate to get in touch if you have any questions.

-Kevin

Kevin D. Keith
FERC Hydropower Coordinator
Statewide Aquatic Resources Coordination Unit
Alaska Department of Fish & Game

907-267-2836

From: Christy Yearous
Sent: Friday, January 19, 2018 4:27 PM
To: 'kevin.keith@alaska.gov'; 'steve_brockmann@fws.gov'; 'Sean Eagan - NOAA Federal'; 'susan.walker@noaa.gov'
Cc: 'Crane Johnson - NOAA Federal'
Subject: P-2307 Salmon Creek Semi-Annual Streamflow Monitoring Report
Attachments: January_2018_StreamFlow_Report.pdf

Per the Salmon Creek Streamflow Monitoring Plan, AEL&P is required to submit semi-annual reports for the AEL&P operated Salmon Creek stream gage. Attached is the DRAFT semi-annual report for July 1 through December 31, 2017. Please provide comments to me via e-mail by February 19, 2018. I will incorporate any comments received and submit the report to FERC after the comment period has ended.

Thank you,
Christy Yearous
AEL&P
463-6387

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# APPENDIX B: DAILY DISCHARGE TABLE OCTOBER 2016-DECEMBER 2017

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**Identifier:** Discharge.Daily Mean@Salmon Creek
**Location:** Salmon Creek Juneau
**Units:** ft^3/s
**Filter:** None

## Daily Mean Discharge - Daily Mean Discharge Salmon Creek

**Year:** Oct. 2016 to Sept. 2017 **Aggr:** 39 **Min:** 8.2 **Max:** 560

| Day | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25 UN | 11 UN | 19 UN | 12 UN | 13 UN | 12 UN | 34 UN | 34 UN | 64 UN | 63 UN | 21 UN | 150 UN |
| 2 | 22 UN | 12 UN | 67 UN | 12 UN | 12 UN | 12 UN | 21 UN | 37 UN | 62 UN | 92 UN | 19 UN | 96 UN |
| 3 | 20 UN | 24 UN | 98 UN | 12 UN | 11 UN | 12 EF | 16 UN | 39 UN | 57 UN | 110 UN | 18 UN | 59 UN |
| 4 | 19 UN | 33 UN | 38 UN | 11 UN | 11 UN | 11 EF | 13 UN | 32 UN | 46 UN | 70 UN | 17 UN | 120 UN |
| 5 | 17 UN | 59 UN | 25 UN | 11 UN | 12 EF | 11 EF | 17 UN | 27 UN | 45 UN | 52 UN | 16 UN | 76 UN |
| 6 | 16 UN | 31 UN | 20 UN | 11 EP | 13 EF | 11 EF | 17 UN | 25 UN | 59 UN | 47 UN | 15 UN | 56 UN |
| 7 | 15 UN | 27 UN | 19 UN | 9.9 EP | 12 EF | 11 EF | 14 UN | 25 UN | 68 UN | 40 UN | 14 UN | 75 UN |
| 8 | 14 UN | 51 UN | 17 UN | 9.5 EP | 11 EF | 10 EF | 13 UN | 34 UN | 78 UN | 36 UN | 13 UN | 80 UN |
| 9 | 13 UN | 64 UN | 15 EP | 9 EP | 10 EF | 10 EF | 19 UN | 69 UN | 67 UN | 54 UN | 12 UN | 140 UN |
| 10 | 13 UN | 76 UN | 14 EP | 8.6 EP | 11 EF | 10 EF | 16 UN | 42 UN | 48 UN | 46 UN | 12 UN | 120 UN |
| 11 | 12 UN | 120 UN | 13 EP | 8.3 EP | 19 UN | 9.8 EF | 16 UN | 46 UN | 39 UN | 49 UN | 12 UN | 72 UN |
| 12 | 12 UN | 95 UN | 14 EP | 8.8 EP | 31 UN | 9.6 EF | 18 UN | 55 UN | 37 UN | 46 UN | 14 UN | 57 UN |
| 13 | 12 UN | 65 UN | 16 EP | 16 UN | 53 UN | 9.4 EF | 22 UN | 50 UN | 36 UN | 69 UN | 16 UN | 46 UN |
| 14 | 11 UN | 63 UN | 15 EP | 43 UN | 74 UN | 9.2 EF | 20 UN | 49 UN | 33 UN | 82 UN | 33 UN | 39 UN |
| 15 | 11 UN | 43 UN | 14 EP | 45 UN | 77 UN | 9 EF | 18 UN | 43 UN | 35 UN | 54 UN | 30 UN | 34 UN |
| 16 | 12 UN | 33 UN | 13 EP | 130 UN | 43 UN | 8.7 EF | 18 UN | 44 UN | 51 UN | 57 UN | 69 UN | 31 UN |
| 17 | 17 UN | 27 UN | 15 UN | 55 UN | 27 UN | 8.6 UN | 17 UN | 48 UN | 77 UN | 46 UN | 130 UN | 32 UN |
| 18 | 37 UN | 23 UN | 17 UN | 29 UN | 21 UN | 8.4 UN | 16 UN | 49 UN | 49 UN | 37 UN | 110 UN | 27 UN |
| 19 | 32 UN | 20 UN | 19 UN | 34 UN | 17 UN | 8.3 UN | 13 UN | 81 UN | 45 UN | 33 UN | 73 UN | 23 UN |
| 20 | 31 UN | 18 UN | 20 UN | 22 UN | 15 UN | 8.3 UN | 12 UN | 81 UN | 53 UN | 29 UN | 73 UN | 21 UN |
| 21 | 23 UN | 16 UN | 24 UN | 17 UN | 14 UN | 8.2 UN | 13 UN | 300 UN | 43 UN | 27 UN | 110 UN | 20 UN |
| 22 | 26 UN | 16 UN | 15 UN | 15 UN | 13 UN | 8.2 UN | 18 UN | 150 UN | 42 UN | 37 UN | 150 UN | 27 UN |
| 23 | 25 UN | 16 UN | 12 UN | 14 UN | 12 UN | 8.3 UN | 22 UN | 94 UN | 37 UN | 39 UN | 75 UN | 31 UN |
| 24 | 19 UN | 15 UN | 11 UN | 15 UN | 11 UN | 8.2 UN | 25 UN | 73 UN | 42 UN | 30 UN | 51 UN | 68 UN |
| 25 | 16 UN | 14 UN | 10 UN | 23 UN | 11 UN | 8.2 UN | 32 UN | 59 UN | 40 UN | 27 UN | 68 UN | 50 UN |
| 26 | 15 UN | 14 UN | 12 UN | 22 UN | 12 UN | 8.2 UN | 30 UN | 58 UN | 37 UN | 35 UN | 95 UN | 74 UN |
| 27 | 14 UN | 14 UN | 13 UN | 27 UN | 13 UN | 8.6 UN | 41 UN | 52 UN | 41 UN | 76 UN | 70 UN | 150 UN |
| 28 | 13 UN | 13 UN | 15 UN | 33 UN | 13 UN | 12 UN | 62 UN | 47 UN | 36 UN | 48 UN | 55 UN | 130 UN |
| 29 | 12 UN | 27 UN | 11 UN | 25 UN | | 16 UN | 38 UN | 61 UN | 34 UN | 35 UN | 43 UN | 60 UN |
| 30 | 12 UN | 30 UN | 13 UN | 18 UN | | 13 UN | 29 UN | 64 UN | 50 UN | 29 UN | 42 UN | 41 UN |
| 31 | 11 UN | | 12 UN | 15 UN | | 42 UN | | 62 UN | | 24 UN | 100 UN | |
| **Aggr** | 18 | 36 | 21 | 23 | 21 | 11 | 22 | 62 | 48 | 49 | 51 | 67 |
| **Min** | 11 | 11 | 10 | 8.3 | 10 | 8.2 | 12 | 25 | 33 | 24 | 12 | 20 |
| **Max** | 37 | 120 | 98 | 130 | 77 | 42 | 62 | 300 | 78 | 110 | 150 | 150 |

LEGEND: UN=Ungraded BI=Backwater from Ice EP=Estimated Poor EF=Estimated Fair

**Identifier:** Discharge.Daily Mean@Salmon Creek
**Location:** Salmon Creek Juneau
**Units:** ft^3/s
**Filter:** None

Daily Mean Discharge - Daily Mean Discharge Salmon Creek

**Year:** Oct. 2017 to Jan. 2018 **Aggr:** * **Min:** * **Max:** *

| Day | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 33 UN | 42 UN | 12 UN | 10 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 2 | 28 UN | 35 UN | 10 UN | 25 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 3 | 39 UN | 32 UN | 11 UN | 48 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 4 | 35 UN | 29 UN | 27 UN | 41 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 5 | 41 UN | 26 UN | 20 UN | 45 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 6 | 75 UN | 24 UN | 24 UN | 35 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 7 | 47 UN | 22 UN | 25 UN | 28 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 8 | 60 UN | 20 UN | 52 UN | 18 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 9 | 60 UN | 19 UN | 120 UN | 16 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 10 | 40 UN | 17 UN | 72 UN | 15 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 11 | 31 UN | 16 UN | 200 UN | 13 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 12 | 26 UN | 15 UN | 95 UN | 18 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 13 | 23 UN | 14 UN | 130 UN | 20 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 14 | 24 UN | 13 UN | 210 UN | 57 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 15 | 42 UN | 12 UN | 83 UN | 61 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 16 | 49 UN | 11 BI | 70 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 17 | 40 UN | 11 BI | 52 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 18 | 32 UN | 11 BI | 38 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 19 | 27 UN | 11 BI | 31 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 20 | 35 UN | 10 BI | 28 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 21 | 33 UN | 10 UN | 24 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 22 | 27 UN | 10 UN | 21 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 23 | 37 UN | 10 UN | 19 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 24 | 37 UN | 9.9 UN | 18 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 25 | 28 UN | 9.5 UN | 17 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 26 | 57 UN | 9.2 UN | 16 UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 27 | 560 UN | 9.2 UN | 15 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 28 | 110 UN | 9.1 UN | 14 BI | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 29 | 61 UN | 12 UN | 14 BI | * UN | | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 30 | 52 UN | 18 UN | 12 BI | * UN | | * UN | * UN | * UN | * UN | * UN | * UN | * UN |
| 31 | 54 UN | | 11 BI | * UN | | * UN | | * UN | | * UN | * UN | |
| **Aggr** | 59 | 17 | 48 | * | * | * | * | * | * | * | * | * |
| **Min** | 23 | 9.1 | 10 | * | * | * | * | * | * | * | * | * |
| **Max** | 560 | 42 | 210 | * | * | * | * | * | * | * | * | * |

LEGEND: UN=Ungraded BI=Backwater from Ice EP=Estimated Poor EF=Estimated Fair

# APPENDIX C: STATION DESCRIPTION AND ANALYSIS FOR SALMON CREEK GAGING STATION NEAR JUNEAU, ALASKA FOR THE 2017 WATER YEAR

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# Station Description and Analysis for Salmon Creek Gaging Station near Juneau, Alaska for the 2017 Water Year

**LOCATION.—**Lat 58°19'57", long 134°27'57" referenced to North American Datum of 1927, and Lat 58°19'56", long 134°28'04"referenced to World Geodetic System 1984. Gage is located on the left bank (when facing downstream), about 0.3 mi upstream from the mouth and 2.5 mi northwest of Juneau.

**DRAINAGE AREA.—**Drainage area 9.69 $mi^2$ as reported by the USGS, flows are regulated.

**ESTABLISHMENT AND HISTORY.—**Gage established on April 27, 2016 at the same location of U.S.Geological gaging station number 15051010.

**GAGE.—**A Campbell Scientific CS450 vented and temperature compensated transducer is coupled to a Campbell Scientific CR6 data logger and records stage data in 15 minute intervals. The transducer is housed in 1 inch galvanized pipe and set and referenced to vertical datum established by the U.S. Geological Survey (see reference marks). Additional equipment housed in a gage house on left bank.

**CONTROL.—**Low flow control is a boulder/cobble riffle immediately below the orifice and staff gage. The channel is the control at medium and high stages. Shifting from the rating is possible at all stages as the gage reach can be alternately scoured and filled.

**DISCHARGE MEASUREMENTS.—**Measurements are made by wading in the vicinity of the gage. High flow measurements can be measured from a bridge approximately 0.25 mi downstream.

**FLOODS.—**U.S. Geological Survey recorded a maximum discharge of 2110 $ft^3/s$, Nov. 22, 2005 and gage height 4.20 ft. Minimum discharge recorded by the U.S. Geological Survey was 3.5 $ft^3/s$, March 17-20, 2006.

**WINTER FLOW.—**The stage-discharge relationship will be periodically affected by ice during cold periods most winters.

**REGULATION AND DIVERSIONS.—**Flow is regulated by Salmon Creek Reservoir located 2 miles upstream. Diversion upstream for off-stream hydropower plant; outflow from the plant goes into Gastineau Channel and is not included in the discharge records.

**ACCURACY.—** Accuracy of the discharge records should be fair to good with the exception of ice affected record which will be fair to poor.

**REFERENCE MARKS.—**The gage is referenced to several vertical reference marks (RMs) established by the U.S. Geological Survey to accurately track vertical datum for the gage. The existing gage will continue to reference these RMs to maintain accurate vertical datum.

RM 1 – Brass cap anchored in concrete 2 feet shoreward of the orifice on left bank, elevation 2.44 feet. This RM is the base RM from which to begin level surveys.

RM 4 – Lag bolt driven in 3 foot diameter spruce tree 20 feet from the left edge of water and 30 feet upstream of the orifice and outside staff gage, elevation 10.82 feet.

RP 1 – ¼ inch anchor bolt drilled in concrete block 1 foot upstream of orifice, elevation 2.44 feet.

RM 5 – ¼ inch lag bolt on upstream side of two foot diameter cottonwood 25 feet from left edge of water and 12 feet downstream of the orifice, elevation 8.574 feet.

RM 6 – ¼ inch lag bolt on upstream side of 1 foot diameter spruce tree, 15 feet from the left edge of water and 15 feet upstream of the orifice, elevation 7.774 feet.

## STATION ANALYSIS

**GAGE HEIGHT RECORD.—**The gage height record is complete for the 2017 water year with no periods of missing record.

**GAGE HEIGHT CORRECTIONS.—**Gage height corrections to the recorder are used to adjust for differences between the recorded values and readings of the outside reference gage during site visits. A plot of corrected gage heights and measured field values of gage height is shown below in figures 1 and 2.

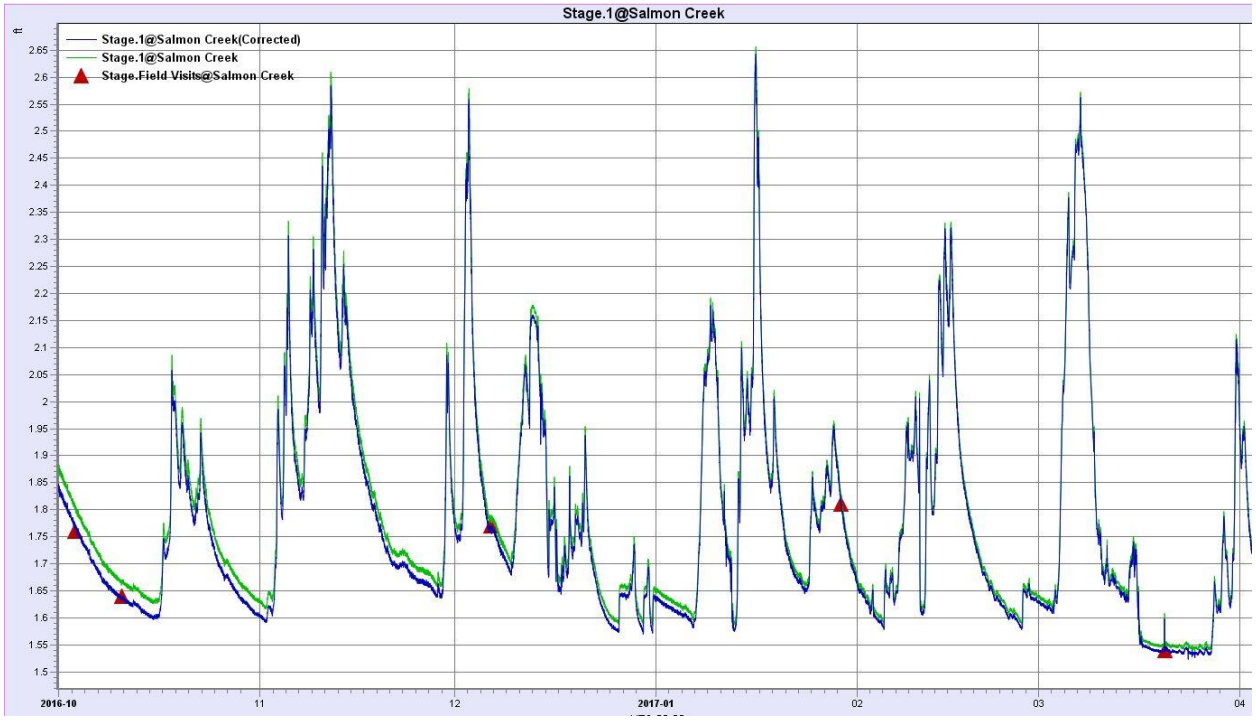
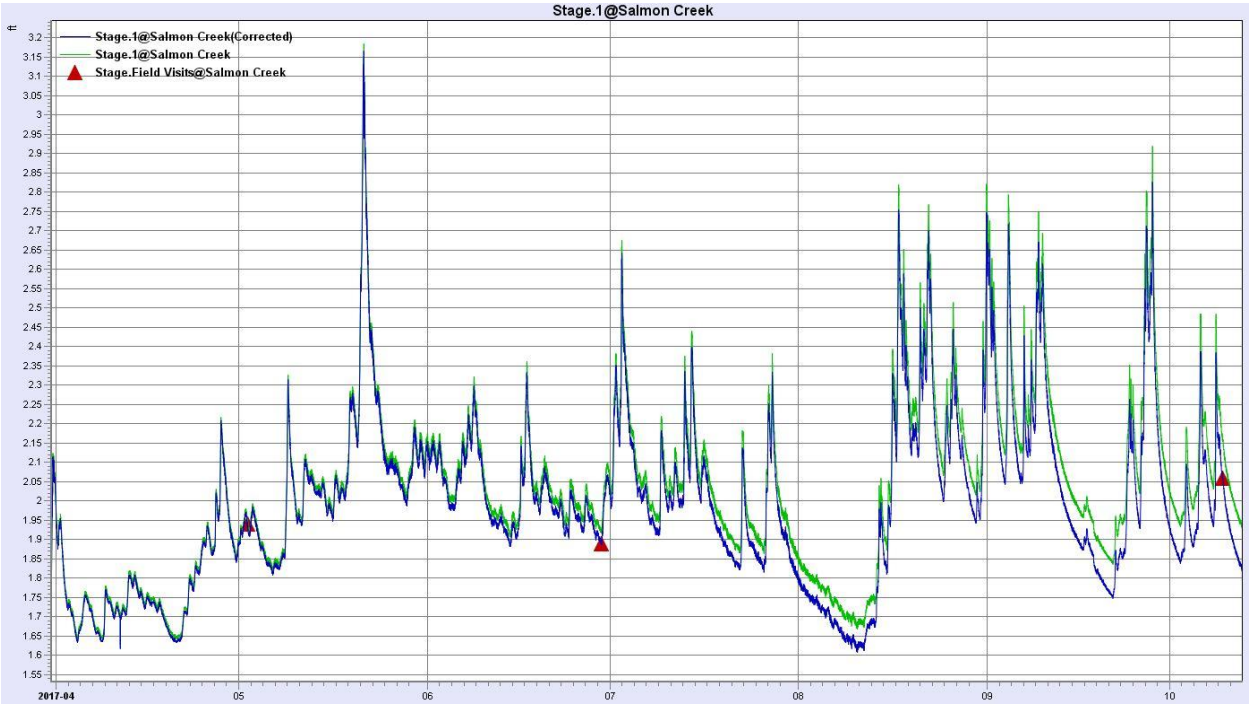



**Figure 1. Stage data from Salmon Creek gaging station showing raw and corrected recorded values and field readings from the outside reference gage (Oct. 2016 through April 2017).**




**Stage data from Salmon Creek gaging station showing raw and corrected recorded values and field readings from the outside reference gage (April 2017 through October 2017).**

**Corrections to gage height were applied as follows:**

9/14/16 to 10/10/16: correction of -0.05 ft prorated to -0.03 ft

10/10/16 to 1/29/17: correction of -0.03 ft prorated to -0.01 ft

1/29/17 to 5/02/17: correction of -0.01 ft

5/02/17 to 6/29/17: correction of -0.01 ft prorated to -0.03 ft

6/29/17 to 10/09/17: correction of -0.03 ft prorated to -0.10 ft

**DATUM CORRECTIONS.—** Level survey conducted on May 22, 2016. No datum corrections were needed.

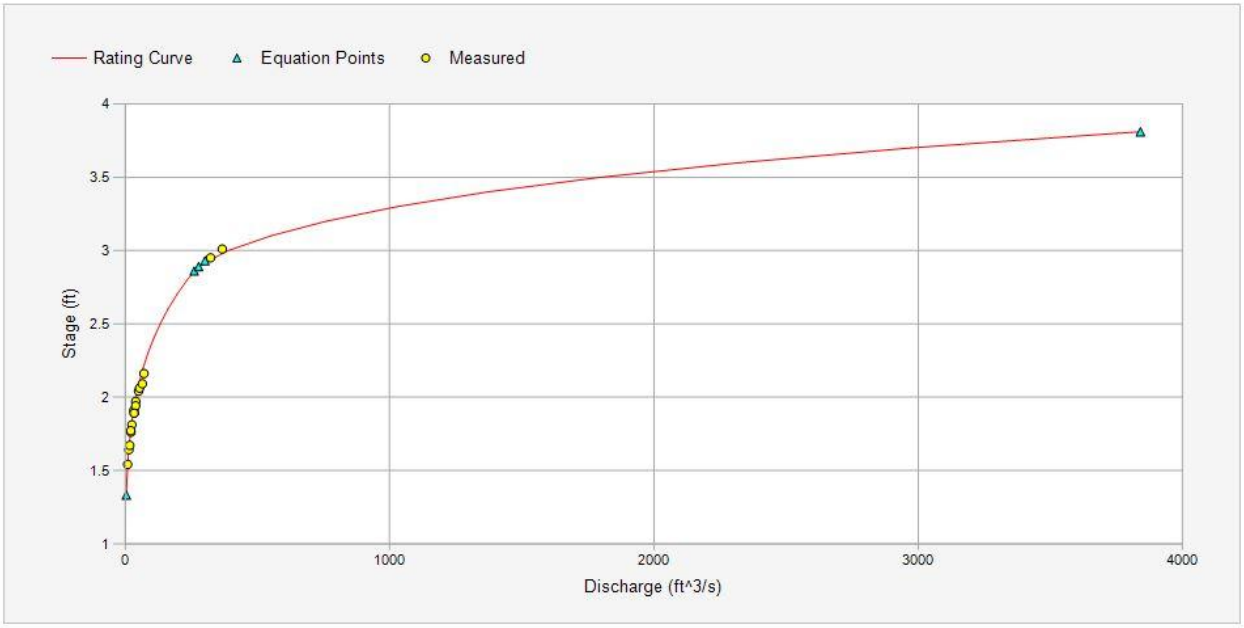
**RATING.—**Rating 1 was developed by the USGS and continued in use for the 2017 water year with two stage variable shifts. The gage reach is under section control at low to midrange discharges. The gage reach is subject to scour and fill during peak flows and during lower discharges when salmon spawn throughout the gage reach. Nine discharge measurements were used for rating analysis for the 2017 water year, including one discharge measurement conducted by the USGS. Discharge measurements ranged from 12.8 to 38.7 $ft^3/s$. Rating curve and rating equation points are shown below:

## Rating Curve

Salmon Creek Rating 2017 Water Year - Used to compute discharge with stage variable shift.

Label: Salmon Creek
Description: Site ID-Salmon Creek

Curve on: January 19, 2018 Curve Start Date: April 20, 2015 Location: Salmon Creek Juneau




## Rating Curve

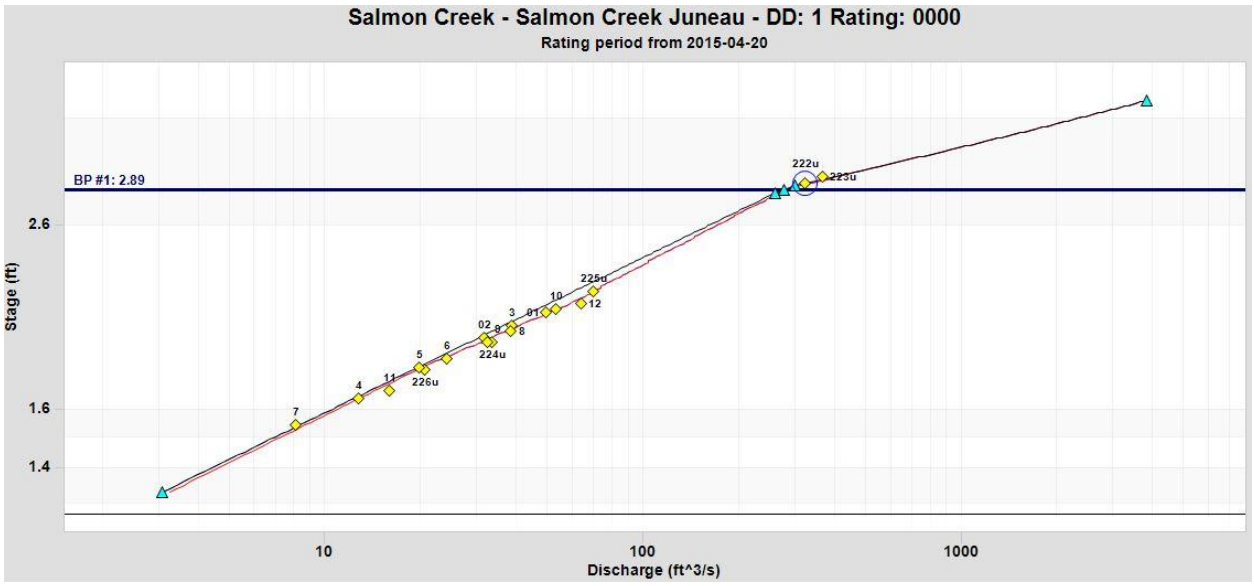
Salmon Creek Rating 2017 Water Year - Used to compute discharge with stage variable shift.

Label: Salmon Creek
Description: Site ID-Salmon Creek
Curve on: January 19, 2018 Curve Start Date: April 20, 2015 Location: Salmon Creek Juneau

| Stage (ft) | 0 | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 | .9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.41 | 7.00 | 10.59 | 15.39 | 21.66 | 29.65 |
| 2.00 | 39.66 | 51.99 | 66.97 | 84.96 | 106.32 | 131.45 | 160.76 | 194.69 | 233.68 | 282.63 |
| 3.00 | 389.17 | 550.06 | 760.28 | 1,030.42 | 1,372.48 | 1,799.96 | 2,327.99 | 2,973.35 | 3,754.63 | 3,841.00 |

**DISCHARGE RECORD.**—Rating number 1 was used to compute discharge with two stage variable shifts to adjust for slight scour conditions. The shifts were defined by measurements 1-6 (shift 1) and 7-10 (shift 2). The two shifts are quite similar and both reflect minor scour conditions. The shifted rating is shown below. The stage variable shift is in effect below stages of 3.08 feet.

Stage record was subject to backwater from ice from Dec. 9-16, Jan. 6-12, Feb. 5-10, and Mar. 3-16. Discharges during periods of ice were estimated from examination of the stage record, comparison with Juneau weather records and hydrographic comparison with the Mendenhall River near Juneau. Hydrographic comparison with the Mendenhall is poor.

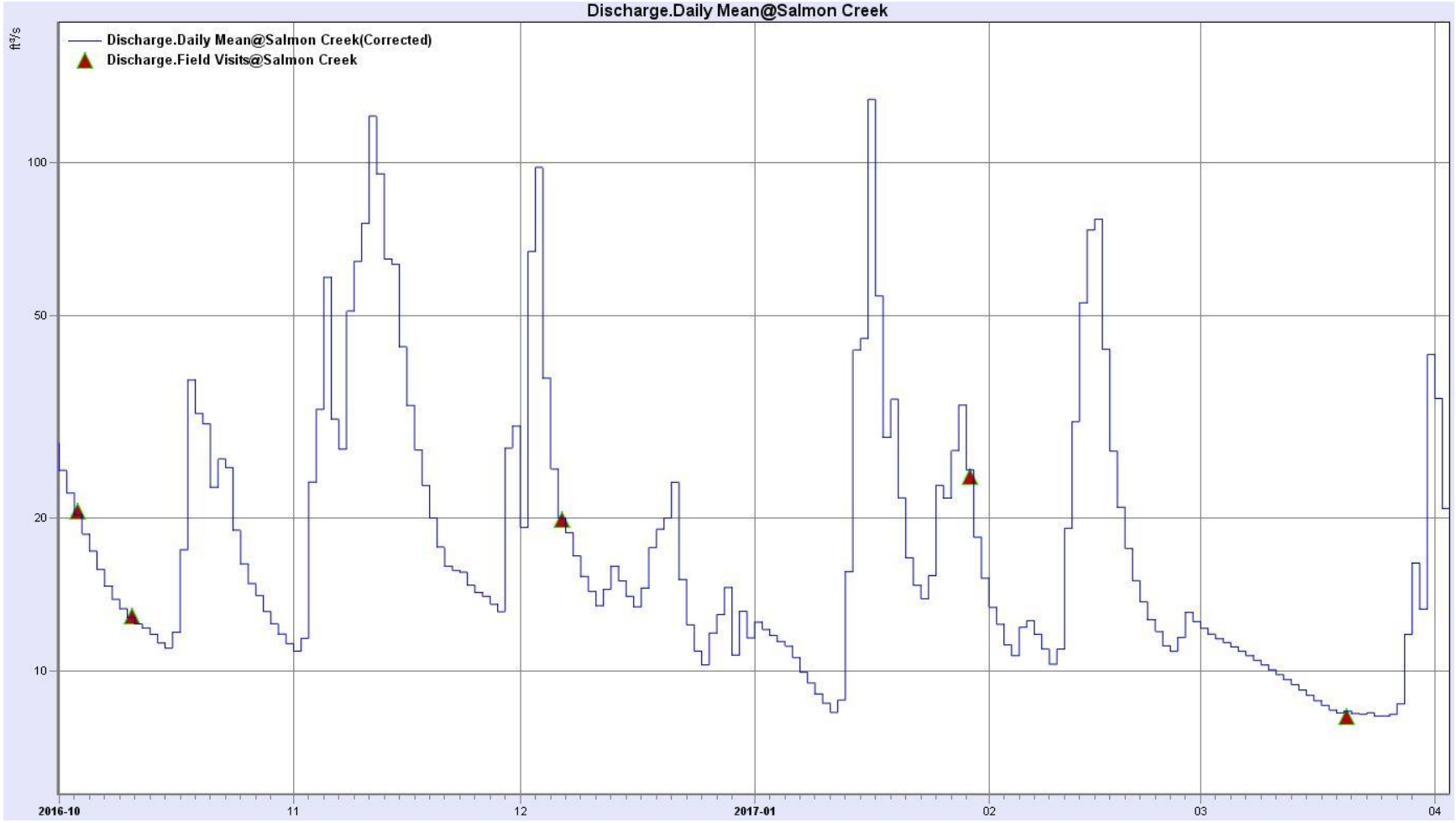



**REMARKS.—** Records of discharge are complete. Discharge records are fair due to drift in stage recordings and the relatively poor gage reach and lack of cross sections available to consistently make good discharge measurements. The stage variable shifts used to compute discharges for the 2017 would not be needed if a slight offset adjustment was made to the existing rating. If future measurements follow similar patterns the rating will be recomputed to better fit the observed measurements under 300 $ft^3/s$.

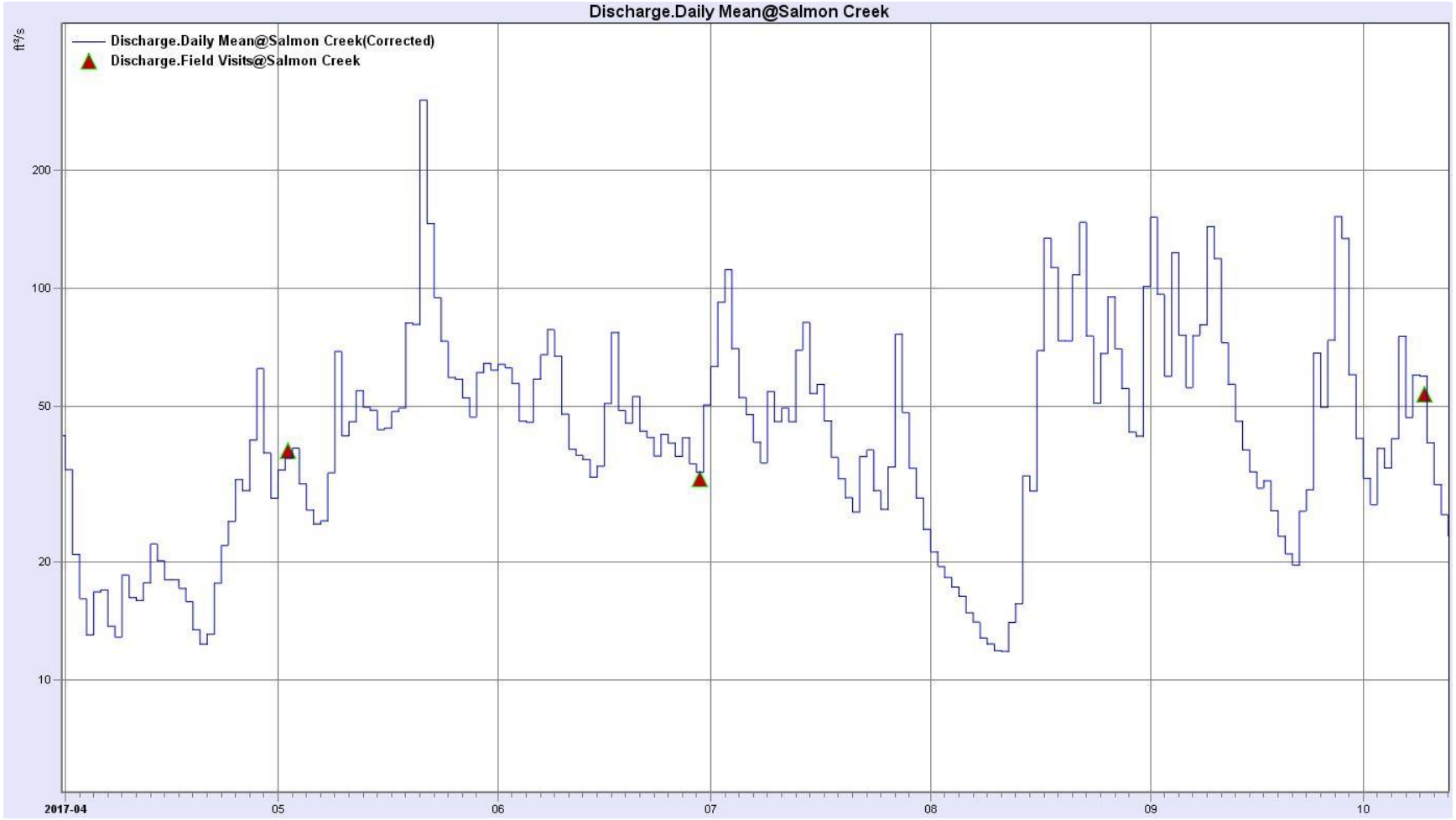
The following file was included as an attachment to this document:

**Salmon Creek 15 min. 2017 Final.**

**Salmon Creek Daily Mean 2017 WY Final.**




**Computed daily mean discharge and field measurements for Salmon Creek near Juneau, Alaska from October 2016 to April 2017.**




**Computed daily mean discharge and field measurements for Salmon Creek near Juneau, Alaska from April 2017 to October 2017.**

# Daily Mean by Year

Daily Mean 2017 Water Year - Daily Mean Discharge at Salmon Creek near Jun

**Identifier:** Discharge.Daily Mean@Salmon Creek
**Location:** Salmon Creek Juneau
**Units:** ft^3/s
**Filter:** None

**Year:** 2016 **Aggr:** 39 **Min:** 8.2 **Max:** 560

| Day | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25 UN | 11 UN | 19 UN | 12 UN | 13 UN | 12 UN | 34 UN | 34 UN | 64 UN | 63 UN | 21 UN | 150 UN |
| 2 | 22 UN | 12 UN | 67 UN | 12 UN | 12 UN | 12 UN | 21 UN | 37 UN | 62 UN | 92 UN | 19 UN | 96 UN |
| 3 | 20 UN | 24 UN | 98 UN | 12 UN | 11 UN | 12 EF | 16 UN | 39 UN | 57 UN | 110 UN | 18 UN | 59 UN |
| 4 | 19 UN | 33 UN | 38 UN | 11 UN | 11 UN | 11 EF | 13 UN | 32 UN | 46 UN | 70 UN | 17 UN | 120 UN |
| 5 | 17 UN | 59 UN | 25 UN | 11 UN | 12 EF | 11 EF | 17 UN | 27 UN | 45 UN | 52 UN | 16 UN | 76 UN |
| 6 | 16 UN | 31 UN | 20 UN | 11 EP | 13 EF | 11 EF | 17 UN | 25 UN | 59 UN | 47 UN | 15 UN | 56 UN |
| 7 | 15 UN | 27 UN | 19 UN | 9.9 EP | 12 EF | 11 EF | 14 UN | 25 UN | 68 UN | 40 UN | 14 UN | 75 UN |
| 8 | 14 UN | 51 UN | 17 UN | 9.5 EP | 11 EF | 10 EF | 13 UN | 34 UN | 78 UN | 36 UN | 13 UN | 80 UN |
| 9 | 13 UN | 64 UN | 15 EP | 9.0 EP | 10 EF | 10 EF | 19 UN | 69 UN | 67 UN | 54 UN | 12 UN | 140 UN |
| 10 | 13 UN | 76 UN | 14 EP | 8.6 EP | 11 EF | 10 EF | 16 UN | 42 UN | 48 UN | 46 UN | 12 UN | 120 UN |
| 11 | 12 UN | 120 UN | 13 EP | 8.3 EP | 19 UN | 9.8 EF | 16 UN | 46 UN | 39 UN | 49 UN | 12 UN | 72 UN |
| 12 | 12 UN | 95 UN | 14 EP | 8.8 EP | 31 UN | 9.6 EF | 18 UN | 55 UN | 37 UN | 46 UN | 14 UN | 57 UN |
| 13 | 12 UN | 65 UN | 16 EP | 16 UN | 53 UN | 9.4 EF | 22 UN | 50 UN | 36 UN | 69 UN | 16 UN | 46 UN |
| 14 | 11 UN | 63 UN | 15 EP | 43 UN | 74 UN | 9.2 EF | 20 UN | 49 UN | 33 UN | 82 UN | 33 UN | 39 UN |
| 15 | 11 UN | 43 UN | 14 EP | 45 UN | 77 UN | 9.0 EF | 18 UN | 43 UN | 35 UN | 54 UN | 30 UN | 34 UN |
| 16 | 12 UN | 33 UN | 13 EP | 130 UN | 43 UN | 8.7 EF | 18 UN | 44 UN | 51 UN | 57 UN | 69 UN | 31 UN |
| 17 | 17 UN | 27 UN | 15 UN | 55 UN | 27 UN | 8.6 UN | 17 UN | 48 UN | 77 UN | 46 UN | 130 UN | 32 UN |
| 18 | 37 UN | 23 UN | 17 UN | 29 UN | 21 UN | 8.4 UN | 16 UN | 49 UN | 49 UN | 37 UN | 110 UN | 27 UN |
| 19 | 32 UN | 20 UN | 19 UN | 34 UN | 17 UN | 8.3 UN | 13 UN | 81 UN | 45 UN | 33 UN | 73 UN | 23 UN |
| 20 | 31 UN | 18 UN | 20 UN | 22 UN | 15 UN | 8.3 UN | 12 UN | 81 UN | 53 UN | 29 UN | 73 UN | 21 UN |
| 21 | 23 UN | 16 UN | 24 UN | 17 UN | 14 UN | 8.2 UN | 13 UN | 300 UN | 43 UN | 27 UN | 110 UN | 20 UN |
| 22 | 26 UN | 16 UN | 15 UN | 15 UN | 13 UN | 8.2 UN | 18 UN | 150 UN | 42 UN | 37 UN | 150 UN | 27 UN |
| 23 | 25 UN | 16 UN | 12 UN | 14 UN | 12 UN | 8.3 UN | 22 UN | 94 UN | 37 UN | 39 UN | 75 UN | 31 UN |
| 24 | 19 UN | 15 UN | 11 UN | 15 UN | 11 UN | 8.2 UN | 25 UN | 73 UN | 42 UN | 30 UN | 51 UN | 68 UN |
| 25 | 16 UN | 14 UN | 10 UN | 23 UN | 11 UN | 8.2 UN | 32 UN | 59 UN | 40 UN | 27 UN | 68 UN | 50 UN |
| 26 | 15 UN | 14 UN | 12 UN | 22 UN | 12 UN | 8.2 UN | 30 UN | 58 UN | 37 UN | 35 UN | 95 UN | 74 UN |
| 27 | 14 UN | 14 UN | 13 UN | 27 UN | 13 UN | 8.6 UN | 41 UN | 52 UN | 41 UN | 76 UN | 70 UN | 150 UN |
| 28 | 13 UN | 13 UN | 15 UN | 33 UN | 13 UN | 12 UN | 62 UN | 47 UN | 36 UN | 48 UN | 55 UN | 130 UN |
| 29 | 12 UN | 27 UN | 11 UN | 25 UN | | 16 UN | 38 UN | 61 UN | 34 UN | 35 UN | 43 UN | 60 UN |
| 30 | 12 UN | 30 UN | 13 UN | 18 UN | | 13 UN | 29 UN | 64 UN | 50 UN | 29 UN | 42 UN | 41 UN |
| 31 | 11 UN | | 12 UN | 15 UN | | 42 UN | | 62 UN | | 24 UN | 100 UN | |
| **Aggr** | 18 | 36 | 21 | 23 | 21 | 11 | 22 | 62 | 48 | 49 | 51 | 67 |
| **Min** | 11 | 11 | 10 | 8.3 | 10 | 8.2 | 12 | 25 | 33 | 24 | 12 | 20 |
| **Max** | 37 | 120 | 98 | 130 | 77 | 42 | 62 | 300 | 78 | 110 | 150 | 150 |

Date Processed: January 19, 2018 18:10

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