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# **Stream Flow Monitoring Report - Water Year 2020 – Salmon Creek**

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*Annex Creek/Salmon Creek Hydroelectric Project  
(FERC Project No. 2307)*

**Alaska Electric Light and Power Company  
Juneau, Alaska**

**October 22, 2020**

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## **1. INTRODUCTION AND PURPOSE**

In October 2015, Alaska Electric Light & Power Company (AELP) 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 (ADFG), National Marine Fisheries Service (NMFS), and the United State Fish and Wildlife Service (USFWS). AELP prepared a plan in consultation with ADFG, 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 an instream flow monitoring report biannually to the FERC, NMFS, USFWS and ADFG with the requirement changing to an annual report after four successful biannual reports. 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 on August 16, 2017, the third on February 20, 2018 and the fourth on August 28, 2018. With the submission to FERC of the fourth report, AELP requested that the due date for the annual report be changed to December 1, 2019 to allow the entire water year to be analyzed in the report. This request was approved by FERC Order on October 9, 2018.

This is the second annual report, it covers the period since the last annual report submitted on December 2, 2019 which includes all of water year 2020.

### **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](http://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 AELP 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.

In April of 2019, AELP changed cell providers which resulted in multiple communication failures; each time requiring a person visit the site to reset the modem. This did not result in any data loss, since the data was still stored locally on the datalogger but it did result in a loss of real-time communication to the AELP SCADA system. Although in most cases, the stream flow was well above the 9CFS action level and the stream flow doesn't change rapidly, the AELP Operator opened the valve for any loss of communication event and left the valve opened until communication was restored. This ensured that AELP remained in compliance with the license requirements. Periodically since that change over, there were additional communication failures, but the same action was taken to open the valve in each case.

After multiple communication failures in October and November of 2019, AELP worked with AT&T to install a new cellular modem intended to provide a more stable communications path for the site. Installation of the new cellular modem was completed on December 2, 2019. Except for one communications failure in late July 2020, the new cellular modem has proven very reliable.

Figures 1 through 4 below show the plots of daily mean discharge and field measured discharge for the period from October 1, 2019 to September 30, 2020. A total of seven discharge measurements were conducted to validate discharges from October 2019 through September 2020. Calibration measurements ranged from 15.3 to 74 CFS.

Ed Neal with Alaska Hydrosience provided a new rating table for the stream on January 22, 2019 and this rating is still in use. The datalogger was changed to use the new rating provided and a copy was distributed to NOAA. On June 25, 2019, Alaska Hydrosience provided a small shift correction of -0.06 based on the manual measurements taken to date. Following a large peak discharge on October 6, 2019 a shift adjustment of -0.08 was applied based on field measured discharge. This shift was implemented in the datalogger. A copy of the rating curve is included in Appendix C.

A table of the Daily Mean Discharge for the months of October 2016 through September 2020 is included in Appendix B.

Figure 1 – Fourth Quarter 2019 Corrected Discharge

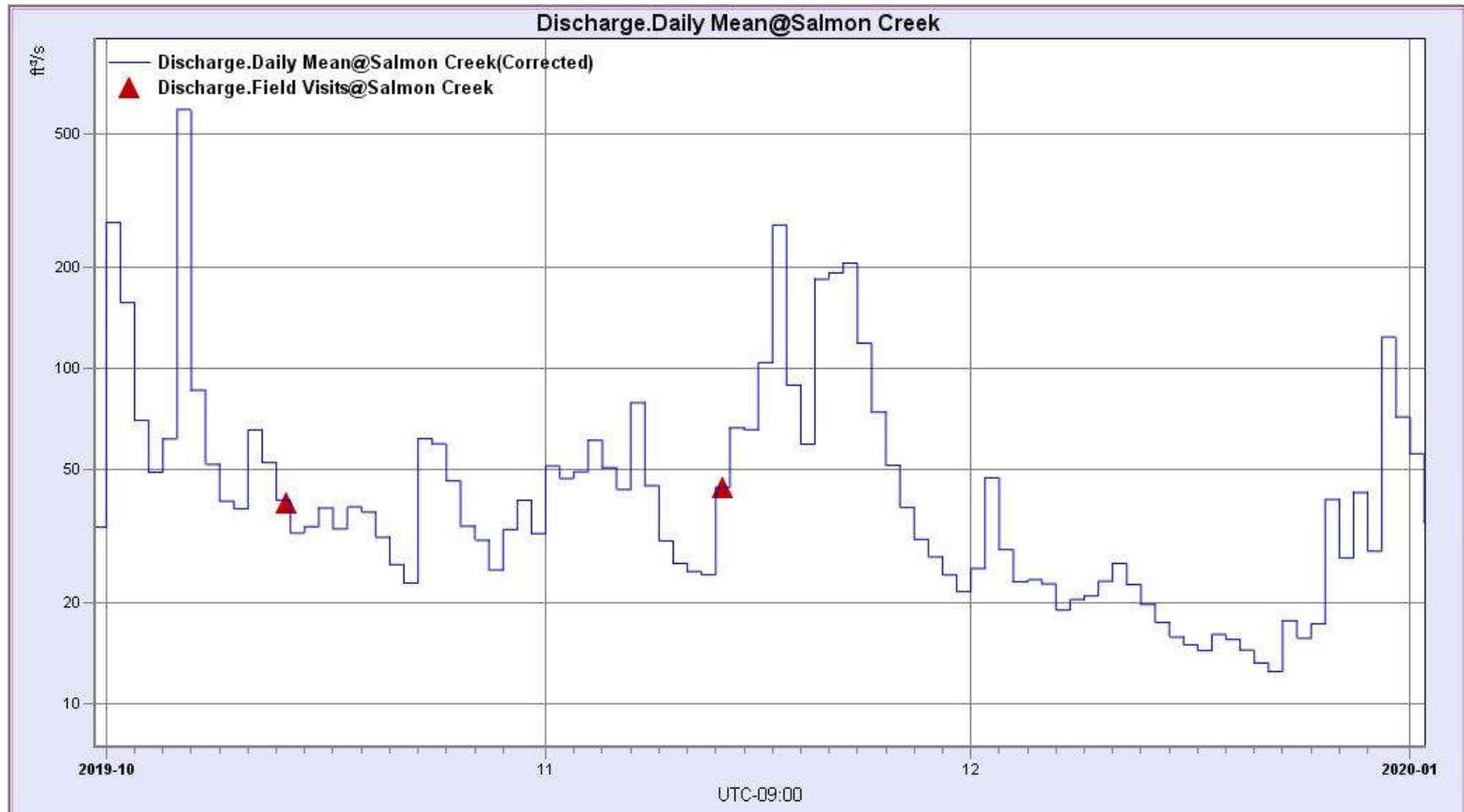


Figure 2 – First Quarter 2020 Corrected Discharge

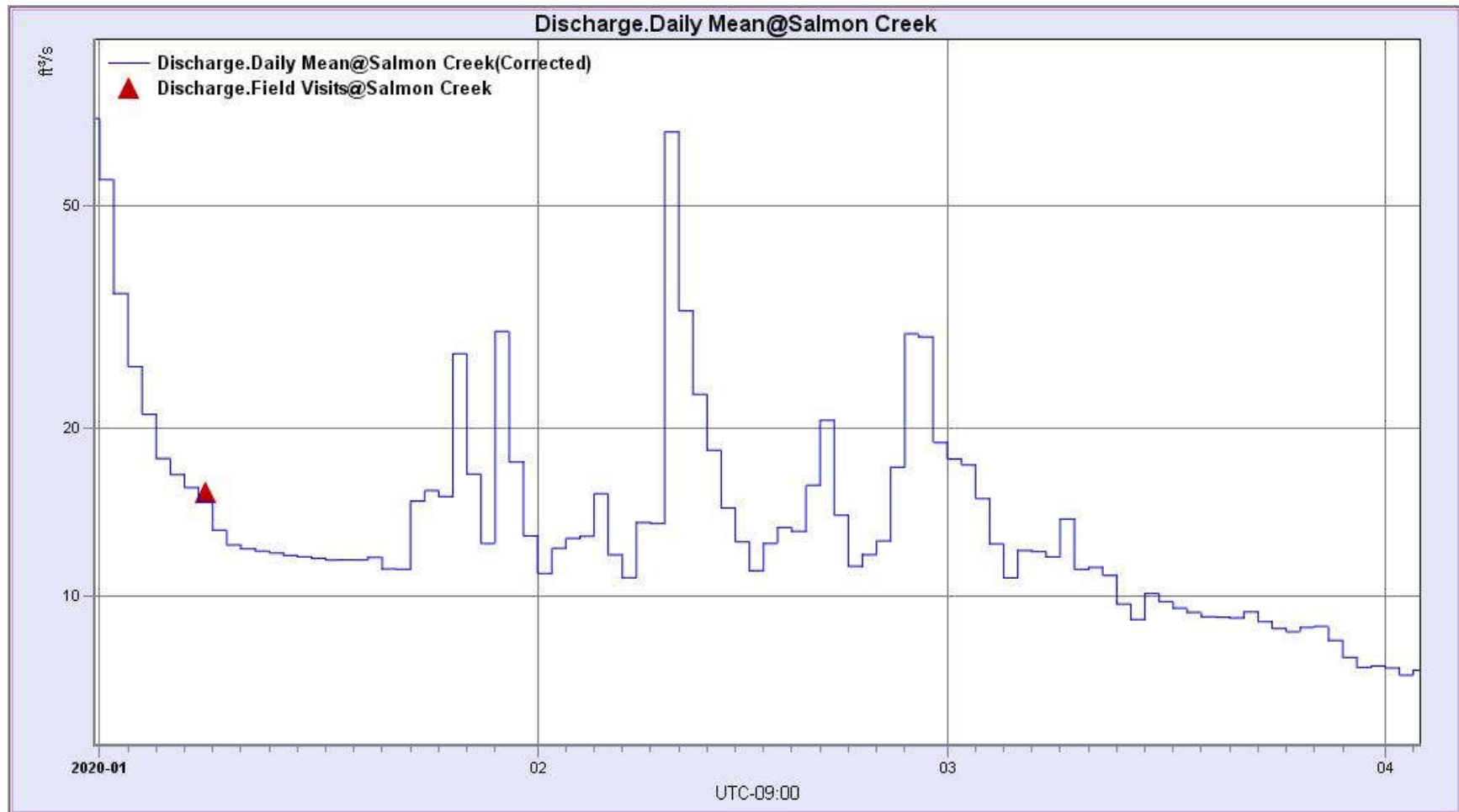




Figure 3 – Second Quarter 2020 Corrected Discharge

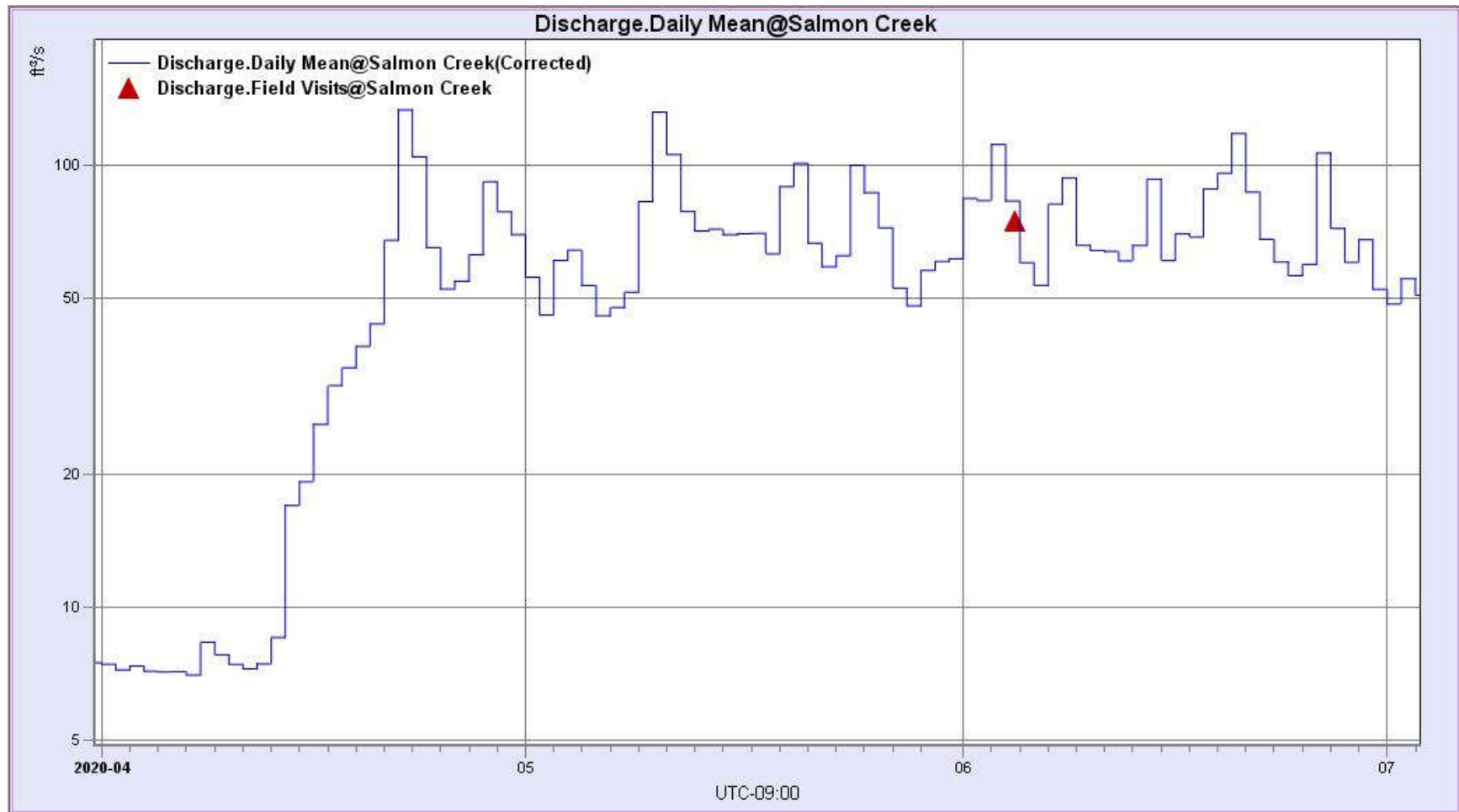
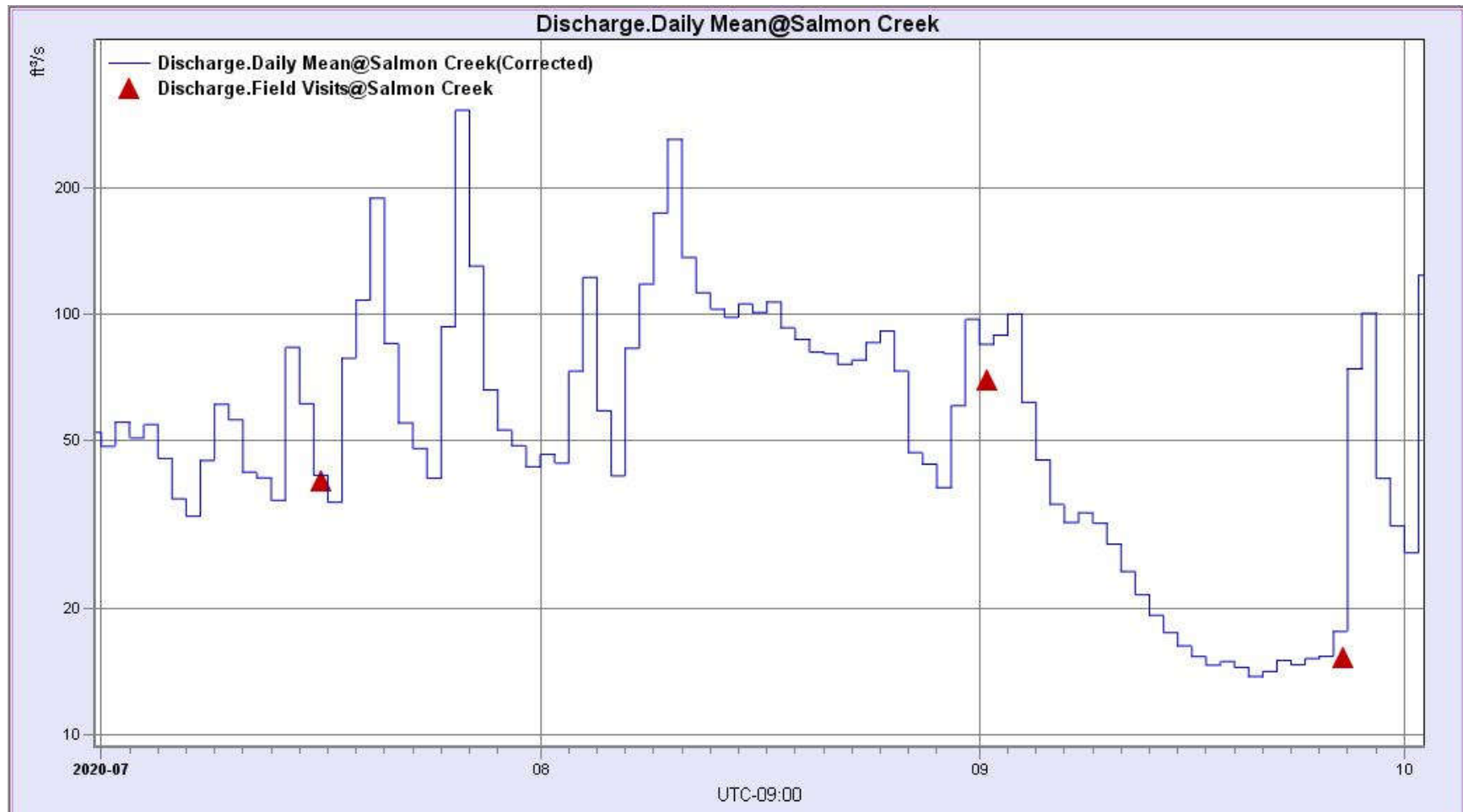


Figure 4 – Third Quarter 2020 Corrected Discharge



## 1.2. Supplemental Valve Operation

The supplemental water valve is a 6" valve tapped off 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 AELP System Operator who also has real-time indication of the streamflow. When the flow drops to 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 reservoir 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 minimum reservoir elevation, so typically more than 3 CFS is discharged to the stream.

## 1.3. Supplemental Valve Release

The 2020 water year proved to be much wetter than the previous two years when many areas of Alaska including Southeast were experiencing drought conditions. Juneau had its third wettest summer on record in 2020. As a result, the supplemental valve was not used from May until August, when it was opened for a Salmon Creek Dam Emergency Action Plan (EAP) Condition Green to help reduce the elevation of the Salmon Creek Reservoir. The table below shows operations of the supplemental valve for the period since the last annual report.

Station service at the valvehouse located at the base of the dam is provided by a small hydroelectric DC generator. This power is used for monitoring, valve operation, and battery charging. The output of the turbine is discharged into the stream at the base of the dam, which increases the flow into the natural drainage. During the low flow periods, the stream flow in Salmon Creek was stable due to the consistent releases through the supplemental valve and the hydroelectric turbine output.

Date	Time	Action	Release Flow (CFS)
10/26/2019	23:11	OPEN <sup>(1)</sup>	4.6
10/27/2019	12:40	CLOSED	4.2
11/7/2019	02:00	OPEN <sup>(1)</sup>	4.1
11/7/2019	08:49	CLOSED	4.2
11/10/2019	17:45	OPEN <sup>(1)</sup>	4.2
11/11/2019	10:20	CLOSED	4.2
11/12/2019	05:45	OPEN <sup>(1)</sup>	4.2
11/12/2019	09:19	CLOSED	4.2
1/11/2020	09:43	OPEN <sup>(2)</sup>	4.2

1/26/2020	13:13	CLOSED	4.2
2/2/2020	03:27	OPEN	4.1
2/5/2020	02:40	CLOSED	4.1
2/7/2020	19:09	OPEN	4.1
2/10/2020	03:45	CLOSED	4.1
2/17/2020	04:23	OPEN	4.0
2/18/2020	14:13	CLOSED	4.0
2/23/2020	05:29	OPEN	4.0
2/26/2020	08:35	CLOSED	4.0
3/6/2020	01:22	OPEN	3.9
3/9/2020	19:12	CLOSED	3.9
3/11/2020	06:23	OPEN	3.9
3/13/2020	09:12	CLOSED	3.9
3/13/2020	21:33	OPEN	3.6
3/14/2020	14:50	CLOSED	3.9
3/14/2020	19:27	OPEN	3.8
4/14/2020	03:51	CLOSED	3.1
7/29/2020	00:15	OPEN <sup>(1)</sup>	4.4
8/3/2020	15:22	CLOSED	4.4
8/7/2020	09:42	OPEN <sup>(3)</sup>	4.4
8/25/2020	16:00	CLOSED	4.3

(1) Valve opened due to communication failure to stream gage, not a low flow condition.

(2) False readings from gauge due to icing.

(3) Valve opened due to EAP Condition Green.

## 1.4. Agency Consultation

A copy of the draft report with a request for consultation was sent on October 22, 2020 by Steve Vorderbruggen with AELP to ADFG, USFWS and NMFS by e-mail.

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

## **APPENDIX A: AGENCY COMMENTS**

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## **APPENDIX B: DAILY DISCHARGE TABLE OCTOBER 2016-SEPTEMBER 2020**

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## Salmon Creek

Identifier: Discharge.Daily Mean@Salmon Creek

Location: Salmon Creek Juneau

Units: ft<sup>3</sup>/s

Filter: None

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

## Salmon Creek - Daily Mean Discharge

Identifier: Discharge.Daily Mean@Salmon Creek

Location: Salmon Creek Juneau

Units: ft<sup>3</sup>/s

Filter: None

Year: Oct. 2017-Sept. 2018

Aggr: 28

Min: 7.8

Max: 210

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	33	42	12	10	14	8.6	8.7	37	31	31	12	43
2	28	35	10	25	14	8.2	8.6	50	31	24	11	33
3	39	32	11	48	13	8.2	8.5	28	29	23	9.7	27
4	35	29	27	41	13	8	8.3	56	33	21	12	23
5	41	26	20	45	12	7.8	8.3	100	35	20	11	20
6	75	24	24	35	11	8	8.4	71	31	18	11	18
7	47	22	25	28	11	7.8	8.7	54	31	17	14	16
8	60	20	52	18	10	7.9	9.9	53	29	15	23	15
9	60	19	120	16	9.4	7.9	18	63	26	14	100	14
10	40	17	72	15	9.1	8.1	22	64	33	16	53	13
11	31	16	200	13	9.7	12	21	79	38	20	30	12
12	26	15	95	18	10	16	16	110	32	20	25	11
13	23	14	130	20	10	25	15	75	29	16	39	11
14	24	13	210	57	10	22	15	56	31	15	100	10
15	42	12	83	63	9.9	16	14	37	27	32	38	9.9
16	49	11	70	50	9.8	15	13	31	28	100	28	9.5
17	40	11	52	35	9.6	14	12	30	44	40	26	9.5
18	32	11	38	26	9.5	12	16	36	40	28	21	12
19	27	11	31	22	9.3	14	28	39	35	24	18	12
20	35	10	28	20	9.2	16	20	41	33	20	16	11
21	33	10	24	17	9	13	14	77	31	18	16	11
22	27	10	21	16	8.9	11	15	85	25	17	21	11
23	37	10	19	15	8.9	11	49	49	21	15	23	16
24	37	9.9	18	16	8.7	9.8	41	43	20	14	26	12
25	28	9.5	17	17	8.7	9.9	27	42	18	13	57	18
26	57	9.2	16	16	8.4	10	36	66	19	12	35	32
27	560	9.2	15	16	8.4	10	36	69	20	11	36	18
28	110	9.1	14	15	8.3	9.9	24	51	18	11	96	14
29	61	12	14	15		9.5	19	42	30	10	50	12
30	52	18	12	15		9.1	17	37	39	9.5	34	11
31	54		11	15		8.8		34		9.9	43	
Aggr	59	17	48	25	10	11	19	55	30	21	33	16
Min	23	9.1	10	10	8.3	7.8	8.3	28	18	9.5	9.7	9.5
Max	560	42	210	63	14	25	49	110	44	100	100	43

## Salmon Creek - Daily Mean Discharge

Identifier: Discharge.Daily Mean@Salmon Creek

Location: Salmon Creek Juneau

Units: ft<sup>3</sup>/s

Filter: None

Year: Oct. 2018-Sept. 2019

Aggr: 32

Min: 7.4

Max: 600

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	9.9	23	20	120	19	9.5	15	14	39	14	13	10
2	9.3	22	18	50	18	9.2	15	17	36	13	12	14
3	11	20	17	29	16	8.9	15	26	31	13	11	20
4	12	19	17	21	16	8.8	16	31	37	12	10	14
5	16	17	16	20	16	8.7	14	44	31	12	9.9	12
6	17	16	15	18	16	8.5	13	78	26	11	9.5	10
7	14	15	14	18	15	8.4	14	130	27	13	9.2	12
8	28	22	16	18	15	8.3	19	120	28	14	8.7	11
9	19	34	30	17	15	8.4	18	110	35	14	8.3	10
10	16	27	42	14	14	9.1	20	71	32	13	8.1	10
11	26	64	56	15	14	9.4	17	52	81	13	7.8	9.8
12	19	40	32	15	13	9.5	17	37	54	12	7.7	10
13	28	46	25	35	13	10	15	33	36	12	7.5	29
14	160	58	20	61	12	11	13	31	29	12	7.4	23
15	190	38	18	33	12	11	12	37	30	11	7.7	13
16	81	30	18	26	11	15	12	40	45	13	7.4	12
17	100	79	25	21	11	29	13	46	52	12	13	12
18	56	110	24	18	11	76	45	41	69	14	10	18
19	71	83	31	16	11	45	39	38	45	13	8.6	33
20	56	70	23	15	11	38	24	39	34	14	7.9	330
21	42	50	19	16	11	40	19	48	32	12	7.6	340
22	47	37	17	15	10	41	26	41	30	11	9.5	99
23	46	31	16	13	10	42	25	35	28	11	21	67
24	37	27	15	16	9.8	35	20	31	25	11	27	170
25	49	26	14	47	9.6	27	17	31	22	11	35	130
26	44	37	13	160	9.6	22	16	40	21	14	32	94
27	39	32	16	55	9.6	20	14	43	24	15	52	57
28	31	26	16	35	9.6	19	13	41	22	40	26	41
29	27	24	14	33		18	13	33	17	19	17	33
30	31	22	13	35		17	13	30	16	13	13	34
31	27		23	30		16		35		12	11	
Aggr	44	38	21	33	13	21	18	47	34	14	14	56
Min	9.3	15	13	13	9.6	8.3	12	14	16	11	7.4	9.8
Max	190	110	56	160	19	76	45	130	81	40	52	340

## Daily Mean Discharge 2020 WY-Salmon Creek

Identifier: Discharge.Daily Mean@Salmon Creek

Location: Salmon Creek Juneau

Units: ft<sup>3</sup>/s

Filter: None

Year: 2020 Water Year

Aggr: 48

Min: 7

Max: 300

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	270	51	25	56	11	18	7.4	56	84	48	46	85
2	160	47	47	35	12	17	7.2	46	83	55	44	89
3	70	49	29	26	13	15	7.4	61	110	51	73	100
4	49	61	23	21	13	12	7.2	64	83	55	120	62
5	62	51	24	18	15	11	7.1	53	60	45	59	45
6	590	44	23	17	12	12	7.2	46	53	36	41	35
7	86	79	19	16	11	12	7	48	82	33	83	32
8	52	45	21	15	14	12	8.3	52	93	45	120	34
9	40	31	21	13	13	14	7.8	83	66	61	170	32
10	38	26	23	12	68	11	7.4	130	64	56	260	28
11	66	25	26	12	32	11	7.3	110	64	42	140	24
12	53	24	23	12	23	11	7.4	78	61	41	110	22
13	41	44	20	12	18	9.7	8.5	71	66	36	100	19
14	32	67	18	12	14	9.1	17	72	93	83	98	18
15	34	66	16	12	13	10	19	70	61	61	110	16
16	38	100	15	12	11	9.8	26	70	70	41	100	15
17	33	270	14	12	12	9.5	32	70	69	36	110	15
18	39	89	16	12	13	9.4	35	63	88	79	93	15
19	37	60	16	12	13	9.2	39	89	96	110	87	14
20	31	180	15	12	16	9.2	44	100	120	190	81	14
21	26	190	13	11	21	9.1	68	67	87	85	80	14
22	23	210	13	11	14	9.4	130	59	68	55	76	15
23	62	120	18	15	11	9	100	62	60	48	78	15
24	60	74	16	15	12	8.7	65	100	56	41	86	15
25	46	52	17	15	13	8.6	52	87	60	93	91	15
26	34	39	41	27	17	8.8	55	72	110	300	73	18
27	31	31	27	17	30	8.8	63	53	72	130	47	74
28	25	27	43	12	29	8.3	92	48	60	66	44	100
29	33	24	29	30	19	7.8	78	58	68	53	39	41
30	41	22	120	17		7.5	70	61	52	49	61	31
31	32		72	13		7.5		61		43	97	
Aggr	72	74	27	17	18	10	36	70	75	70	91	35
Min	23	22	13	11	11	7.5	7	46	52	33	39	14
Max	590	270	120	56	68	18	130	130	120	300	260	100

## **APPENDIX C: STREAM RATING CURVE**

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## Rating Curve

Salmon Cr. Rating C001 - Begin date Feb. 05, 2018

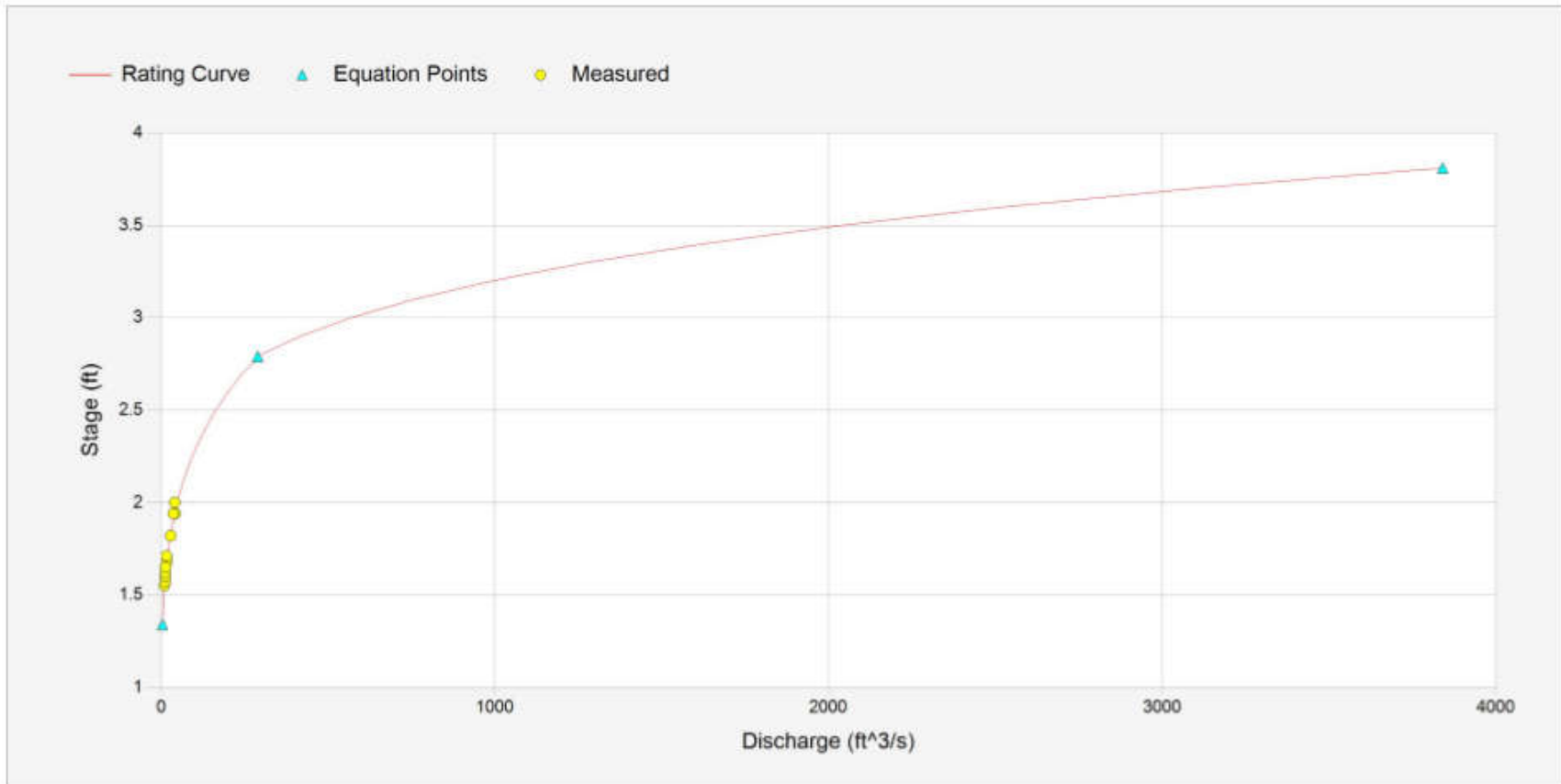
Label: Salmon Creek

Description: Site ID-Salmon Creek

Curve on: October 15, 2019

Curve Start Date: February 5, 2018

Location: Salmon Creek Juneau



STATION NUMBER Salmon Creek Salmon Creek Juneau  
 LATITUDE 49.28 LONGITUDE -123.11  
 Date Processed: 2018-07-27 10:44:09 UTC-09:00 By admin  
 Rating for Discharge (ft<sup>3</sup>/s)  
 Created by admin on 2018-01-11 07:26:59 [UTC], updated by admin on 2018-07-24 23:31:10 [UTC]  
 Remarks:

Offset1: 0.73 offset2: 1.60  
 Breakpoint1: 2.79

## EXPANDED CAQRating TABLE

Stage (m)	.00	.01	.02	Discharge (ft <sup>3</sup> /s) .03	.04	.05	.06	.07	.08	.09	DIFF IN Q PER .1 UNITS
1.30					3.000*	3.189	3.386	3.592	3.807	4.031	2.108
1.40	4.265	4.509	4.763	5.027	5.302	5.587	5.884	6.192	6.512	6.843	2.922
1.50	7.187	7.544	7.913	8.295	8.691	9.100	9.524	9.961	10.41	10.88	4.173
1.60	11.36	11.86	12.37	12.90	13.45	14.01	14.59	15.19	15.80	16.44	5.730
1.70	17.09	17.76	18.45	19.16	19.89	20.63	21.40	22.19	23.00	23.84	7.600
1.80	24.69	25.57	26.47	27.39	28.34	29.31	30.30	31.32	32.36	33.43	9.830
1.90	34.52	35.64	36.79	37.96	39.16	40.39	41.65	42.93	44.24	45.58	12.440
2.00	46.96	48.36	49.79	51.25	52.75	54.28	55.83	57.42	59.05	60.71	15.440
2.10	62.40	64.12	65.88	67.68	69.51	71.38	73.28	75.22	77.20	79.22	18.870
2.20	81.27	83.36	85.50	87.67	89.88	92.13	94.43	96.76	99.14	101.6	22.730
2.30	104.0	106.5	109.1	111.7	114.3	117.0	119.7	122.5	125.3	128.2	27.100
2.40	131.1	134.1	137.1	140.2	143.3	146.5	149.7	153.0	156.3	159.7	32.000
2.50	163.1	166.6	170.1	173.7	177.4	181.1	184.8	188.6	192.5	196.5	37.300
2.60	200.4	204.5	208.6	212.8	217.0	221.3	225.7	230.1	234.6	239.1	43.300
2.70	243.7	248.4	253.1	257.9	262.8	267.7	272.7	277.8	282.9	288.2*	54.700
2.80	298.4	309.0	319.8	330.9	342.3	354.0	366.0	378.3	390.9	403.9	118.700
2.90	417.1	430.7	444.7	458.9	473.5	488.5	503.8	519.5	535.5	552.0	151.700
3.00	568.8	586.0	603.5	621.5	639.9	658.7	677.9	697.6	717.6	738.1	190.300
3.10	759.1	780.5	802.3	824.7	847.5	870.7	894.5	918.7	943.4	968.7	235.300
3.20	994.4	1021	1047	1075	1103	1131	1160	1190	1220	1250	287.600
3.30	1282	1313	1346	1379	1412	1447	1482	1517	1553	1590	346.000
3.40	1628	1666	1705	1744	1784	1825	1867	1909	1953	1996	413.000
3.50	2041	2086	2132	2179	2227	2275	2324	2374	2425	2477	488.000
3.60	2529	2583	2637	2692	2748	2805	2862	2921	2980	3041	573.000
3.70	3102	3165	3228	3292	3357	3423	3490	3558	3628	3698	667.000
3.80	3769										

"\*" indicates a rating descriptor point

ID	Starting Date	Ending Date	Aging	Comments
c001	2018-02-05 12:00:00 [UTC-09:00]		0	



**APPENDIX D: PLOTS OF 15 MINUTE DATA**

**FOURTH QUARTER 2019 – THIRD QUARTER 2020**

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Figure D1 – Fourth Quarter 2019

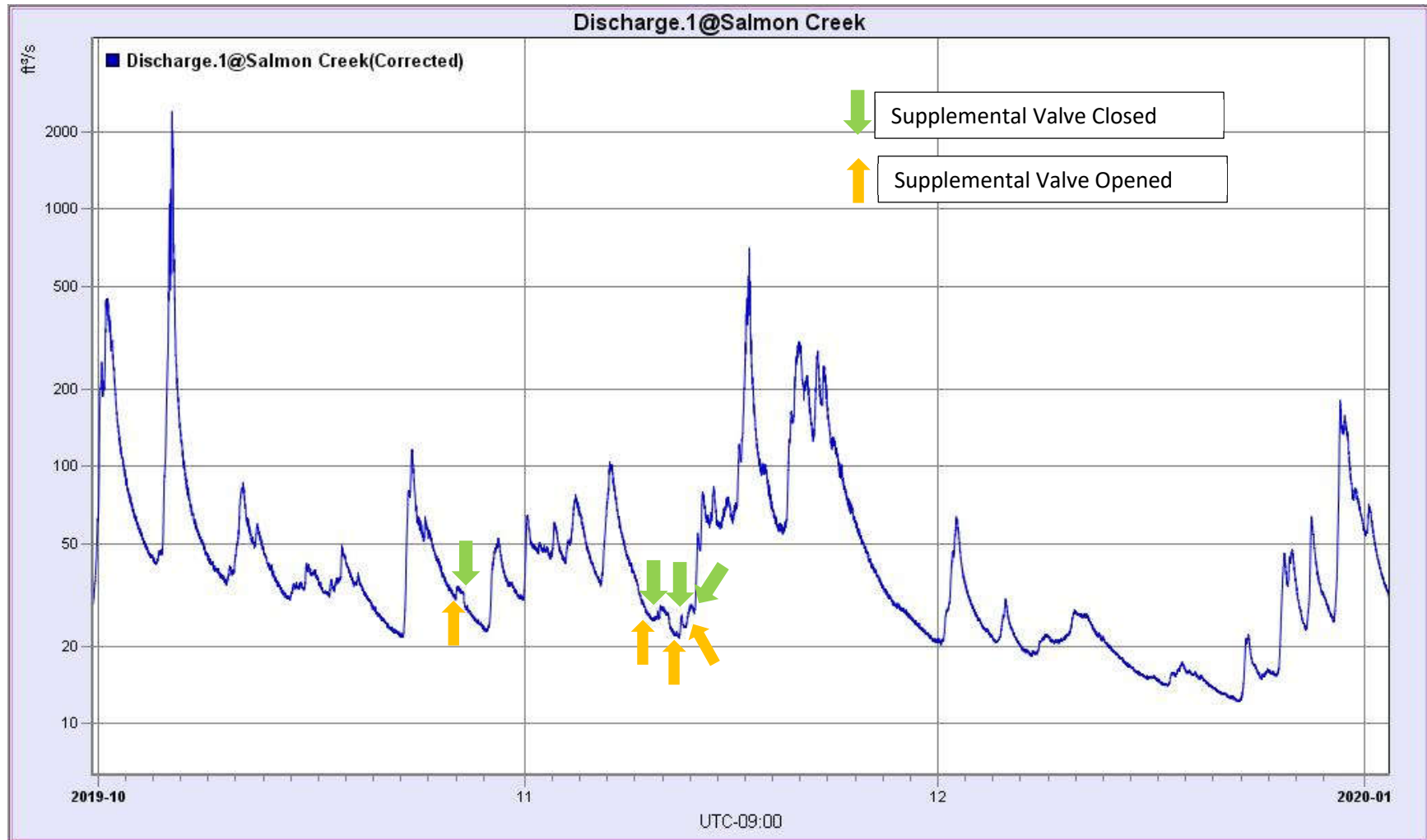


Figure D2 – First Quarter 2020

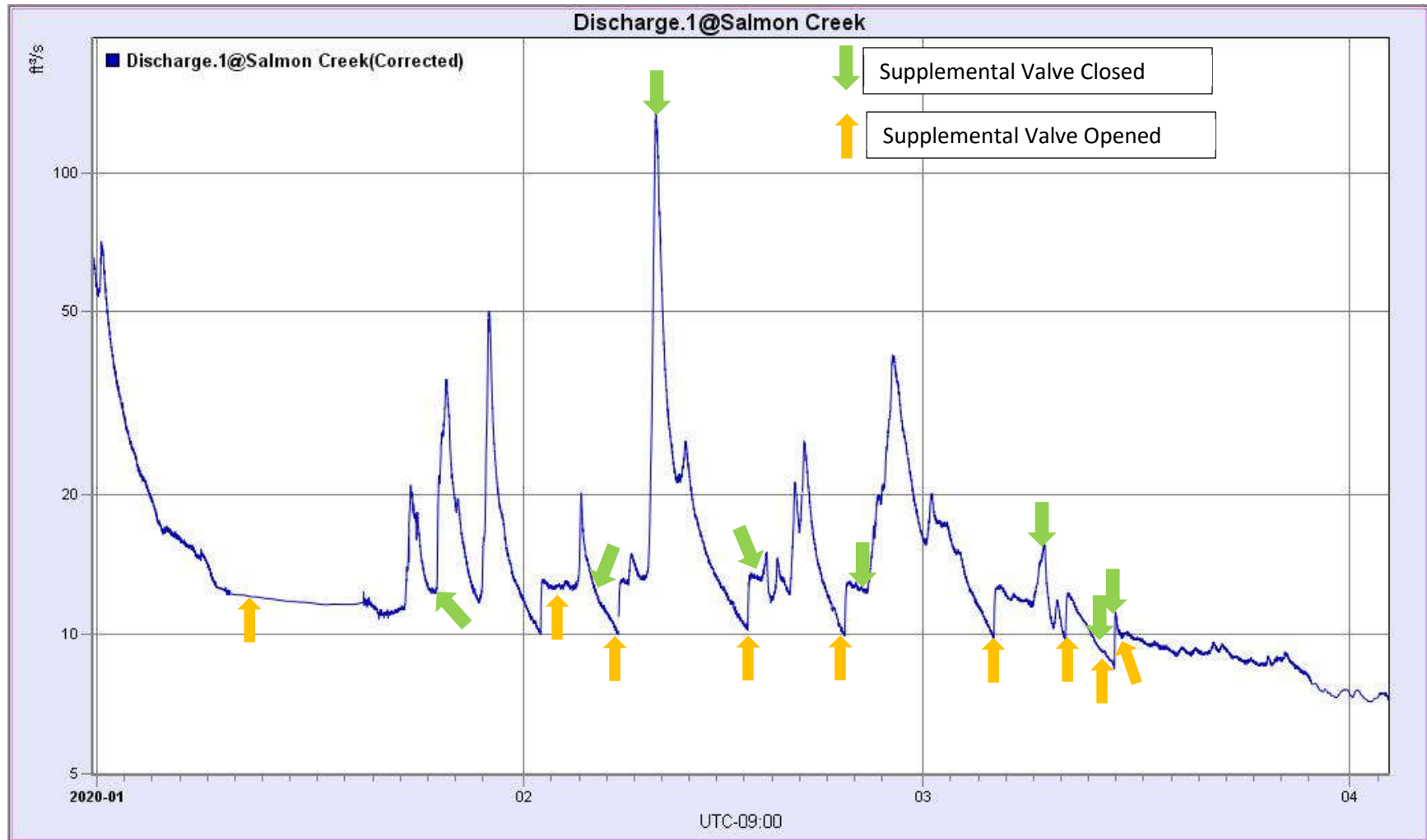


Figure D3 – Second Quarter 2020

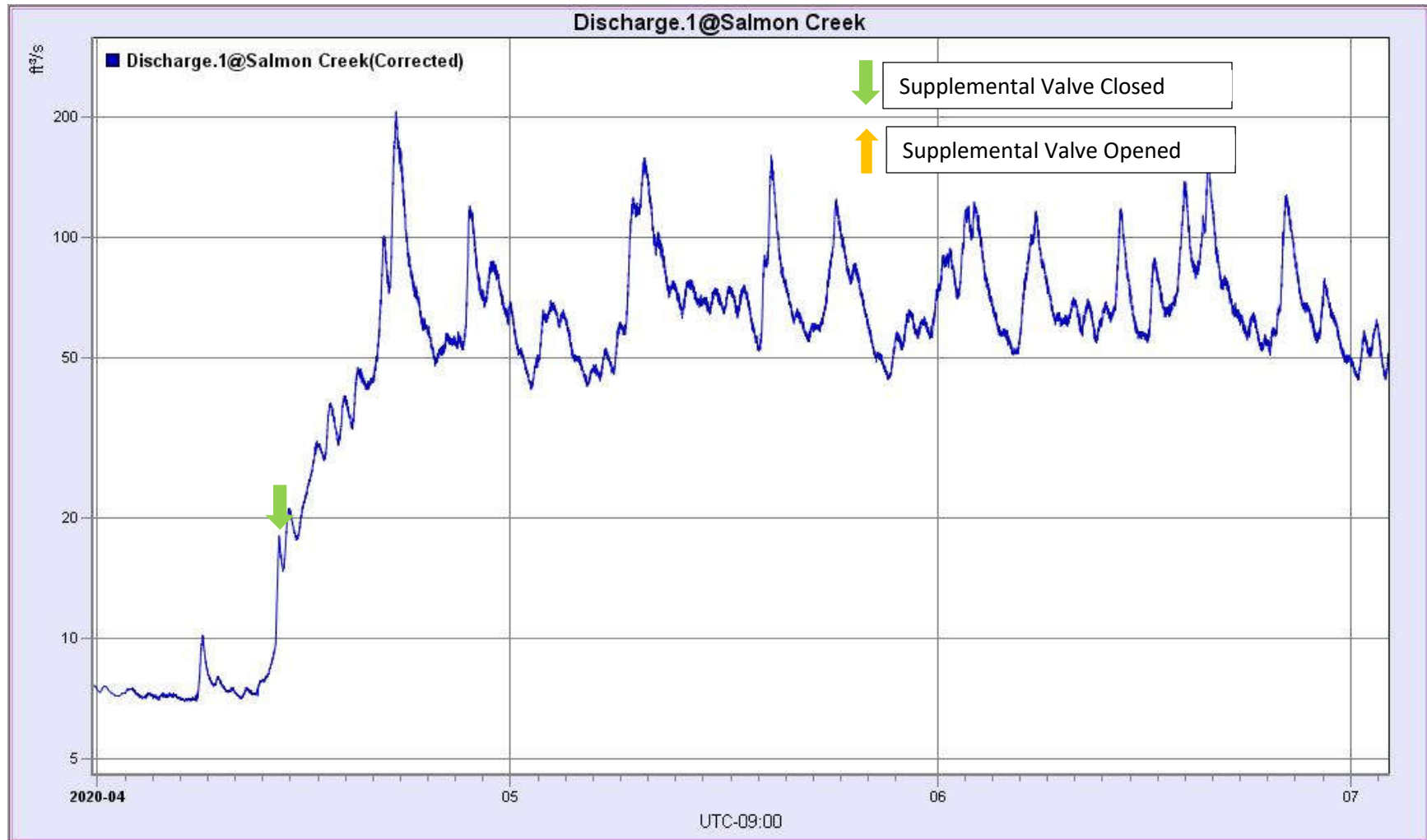
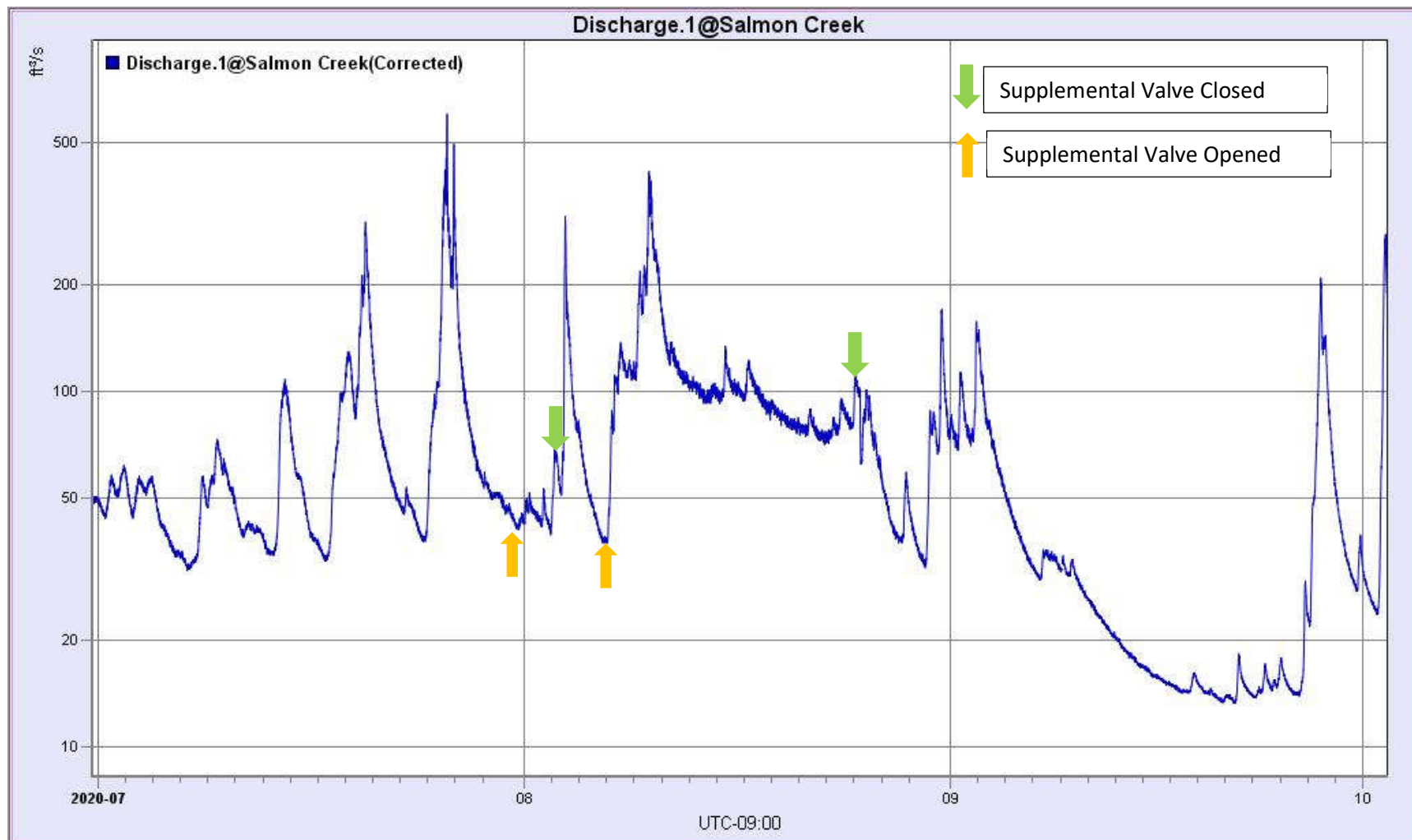


Figure D4 – Third Quarter 2020



## **APPENDIX E: SALMON CREEK STATION DESCRIPTION AND ANALYSIS WATER YEAR 2020 (ALASKA HYDROSCIENCE)**

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# Salmon Creek Gaging Station near Juneau, Alaska

## Station Description for the 2020 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<sup>2</sup> as reported by the USGS, discharges are regulated.

**ESTABLISHMENT AND HISTORY.**—Gage established on April 27, 2016 at the same location and datum 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 is 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<sup>3</sup>/s, Nov. 22, 2005 and gage height 4.20 ft. Minimum discharge recorded by the U.S. Geological Survey was 3.5 ft<sup>3</sup>/s, March 17-20, 2006.

**WINTER FLOW.**—The stage-discharge relationship will be periodically affected by ice during cold periods during 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. There is a supplemental water valve tapped off of the penstock at the base of the dam to supply additional water to Salmon Creek during periods of low flow. The valve discharges water directly into the natural channel. 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 to 9 ft<sup>3</sup>/s, an alarm is generated and the Operator opens the valve and logs the operation.

**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 continues to reference these RMs to maintain accurate vertical datum. In a survey conducted on July 3, 2020 additional reference marks were added to the station to facilitate accurate tracking of station datum.

RM 1 – Brass cap anchored in concrete 2 feet shoreward of the orifice on left bank, elevation 2.64 feet. This RM is the base RM from which to begin level surveys.

RM2-- Established July 3, 2020. Head of rock bolt protruding from top of boulder 3 feet upstream from RM1, elevation 4.87 feet.

RM3—Established July 3, 2020. 3/8 in anchor bolt in on top of 5-foot boulder located approximately 15 feet upstream near the left edge of water, elevation 3.77 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 8.59 feet.

RM5.1-- Established July 3, 2020. Lag bolt on upstream side of 26-inch cottonwood tree on left bank 25 feet shoreward and 12 feet downstream of orifice, elevation 8.70 feet. Replacing RM5, which was nearly grown over by bark.

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 7.77 feet.

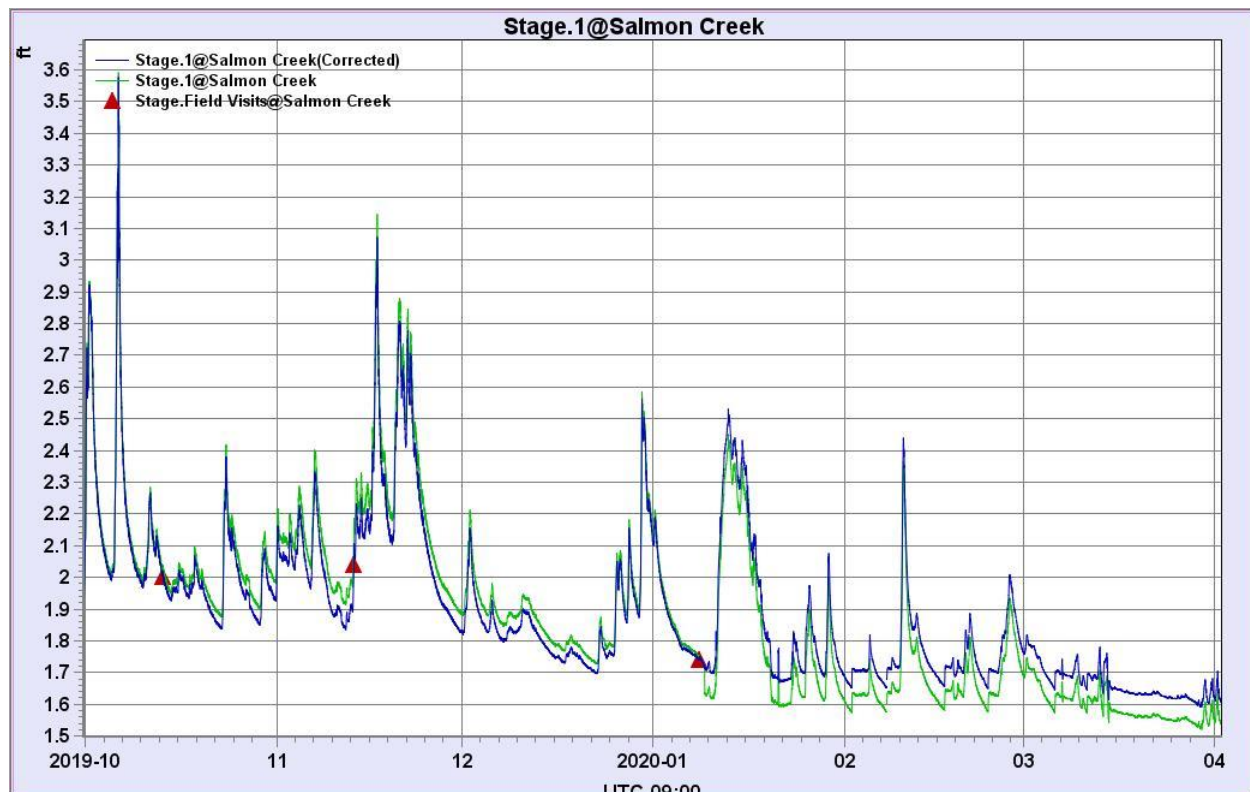
RM6.1- Established July 3, 2020. Lag bolt on same tree as RM6, elevation 8.02 feet. Used to replace RM6, which is nearly overgrown.

## 2020 WATER YEAR STATION ANALYSIS

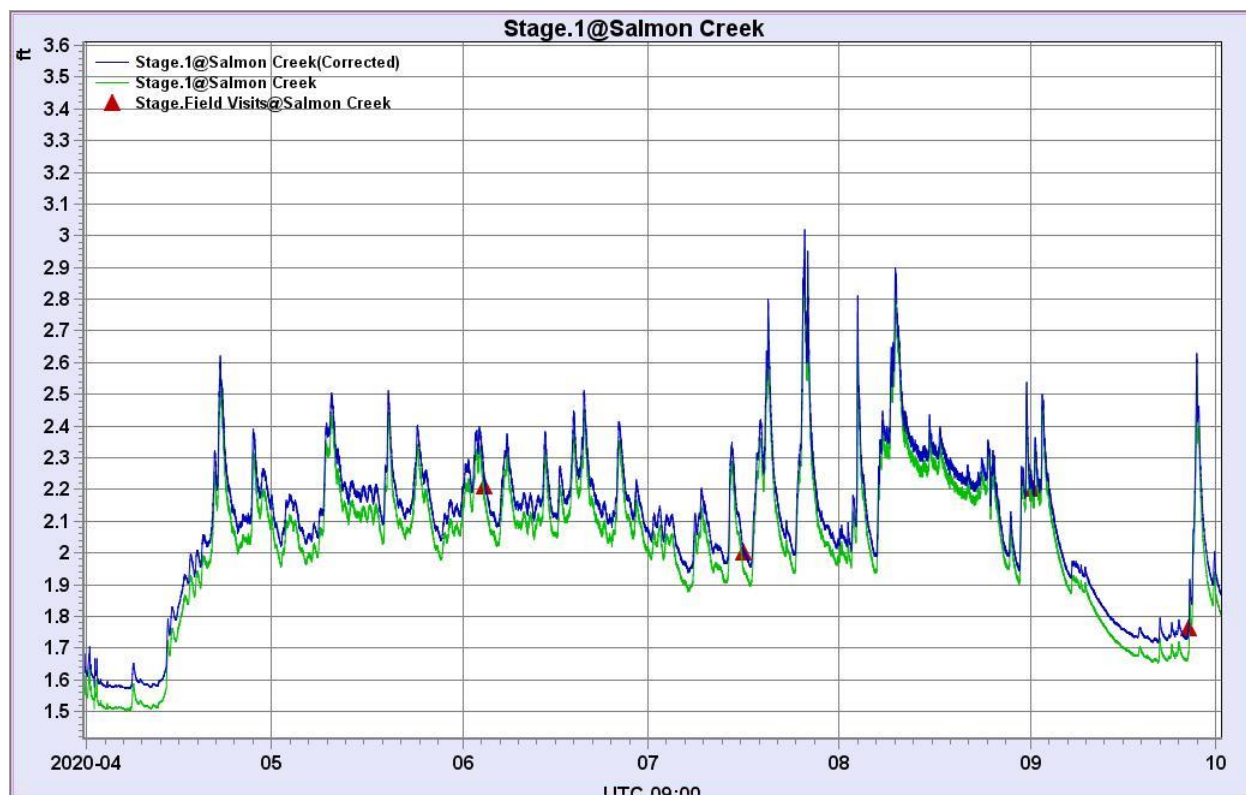
**GAGE HEIGHT RECORD.**—The gage height record is complete for the 2020 water year with no periods of missing record. The gage height record was periodically subject to backwater due to ice during which discharges were estimated. Gage height record was subject to backwater from ice during the following dates:

Jan. 9-21, 2020; Mar. 7; Mar. 12-15; Mar. 29-Apr. 4. 23-24; and Mar. 4-6.

**GAGE HEIGHT CORRECTIONS.**— Pressure transducers used to record stage are often subject to slight drift in value. 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. Gage height corrections are typically prorated over time between site visits. Orifice movement, likely due to ice, occurred on Jan. 9, 2020. Corrections ranged from -0.08 to +0.08 ft for the 2019 water year. 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. 2019 to April 2020).



**Figure 2. Stage data from Salmon Creek gaging station showing raw and corrected recorded values and field readings from the outside reference gage (April 2020 to October 2020).**

**DATUM CORRECTIONS.**— A complete level survey was conducted on July 3, 2020. No datum corrections were needed and additional reference marks were added and documented in the station description.

**RATING.**— The gage reach is under section control at low to midrange discharges and channel control at greater discharges. The gage reach is subject to scour and fill during peak flows and during salmon spawning season when salmon spawn throughout the gage reach. Rating 1 was developed by the USGS and continued in use with two stage variable shifts until Feb. 5, 2018. Discussion and description of rating 1 is covered in the 2017 water year station analysis report.

Rating 2 was put into use on Feb. 5, 2018 and was continued in use through the remainder of the 2020 water year. Rating 2 was developed to account for consistent scour conditions relative to rating 1 in lower to mid-range stages as defined by measurements in 2017 and 2018. The changes from rating 1 provide better definition of low to mid-range discharges without the need for application of stage variable shifts. Beginning in Jan. 2019 the channel conditions began to fill and a stage variable shift adjustment of -0.03 feet was applied to the rating at stages less than 2.00 feet as defined by measurements 21-24. A large peak on Oct. 6, 2019 resulted in additional fill conditions and a single stage variable shift adjustment of -0.07 feet was applied for the remainder of the 2020 water year.

Seven discharge measurements (numbers 25-31) ranging from 15.3-74 ft<sup>3</sup>/s were conducted during the 2020 water year. All measurements were used in rating analysis. Measurements 24 (2019 WY) and 32 (2021 WY) were also used in the rating analysis and all measurements plotted within 5% of the shifted rating with the exception of measurement 32 which was within 8.7% of the shifted rating. Rating curve and rating equation points for both ratings are shown below:

## Rating Curve

Salmon Creek Rating #2 - Used to compute discharge for 2019 WY

Label: [Salmon Creek](#)

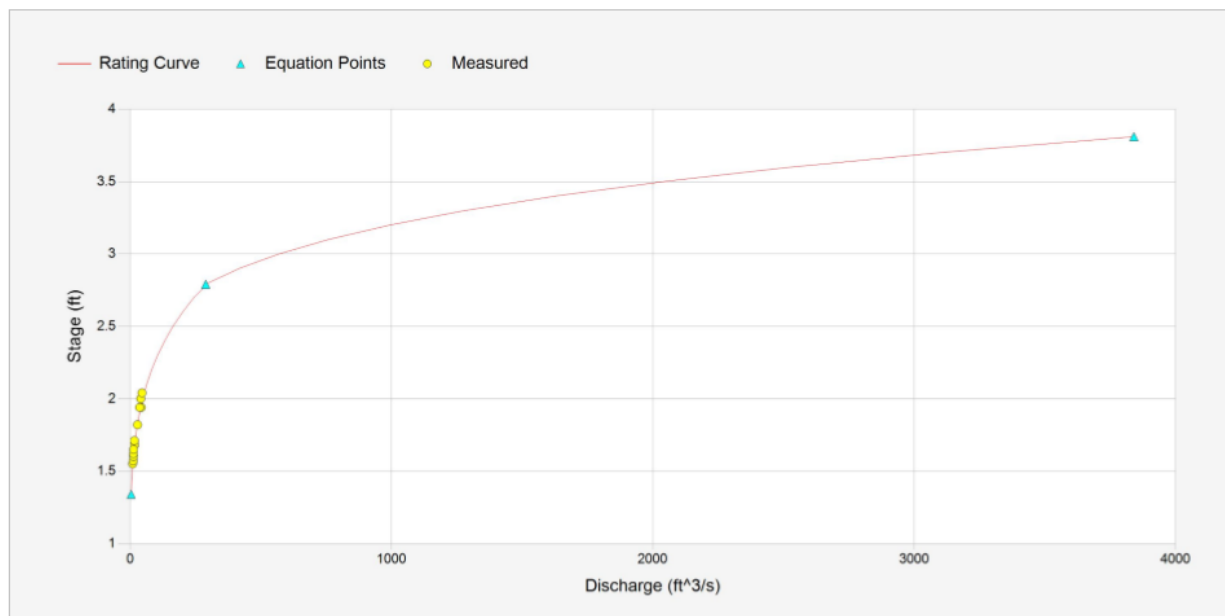
Description: [Site ID-Salmon Creek](#)

Curve on: October 1, 2019

Curve Start Date: February 5, 2018

Location:

Salmon Creek Juneau



## Rating Curve

Salmon Creek Rating #2-Used to compute discharge for 2020 WY

Label: [Salmon Creek](#)

Description: [Site ID-Salmon Creek](#)

Curve on: October 15, 2020

Curve Start Date: February 5, 2018

Location:

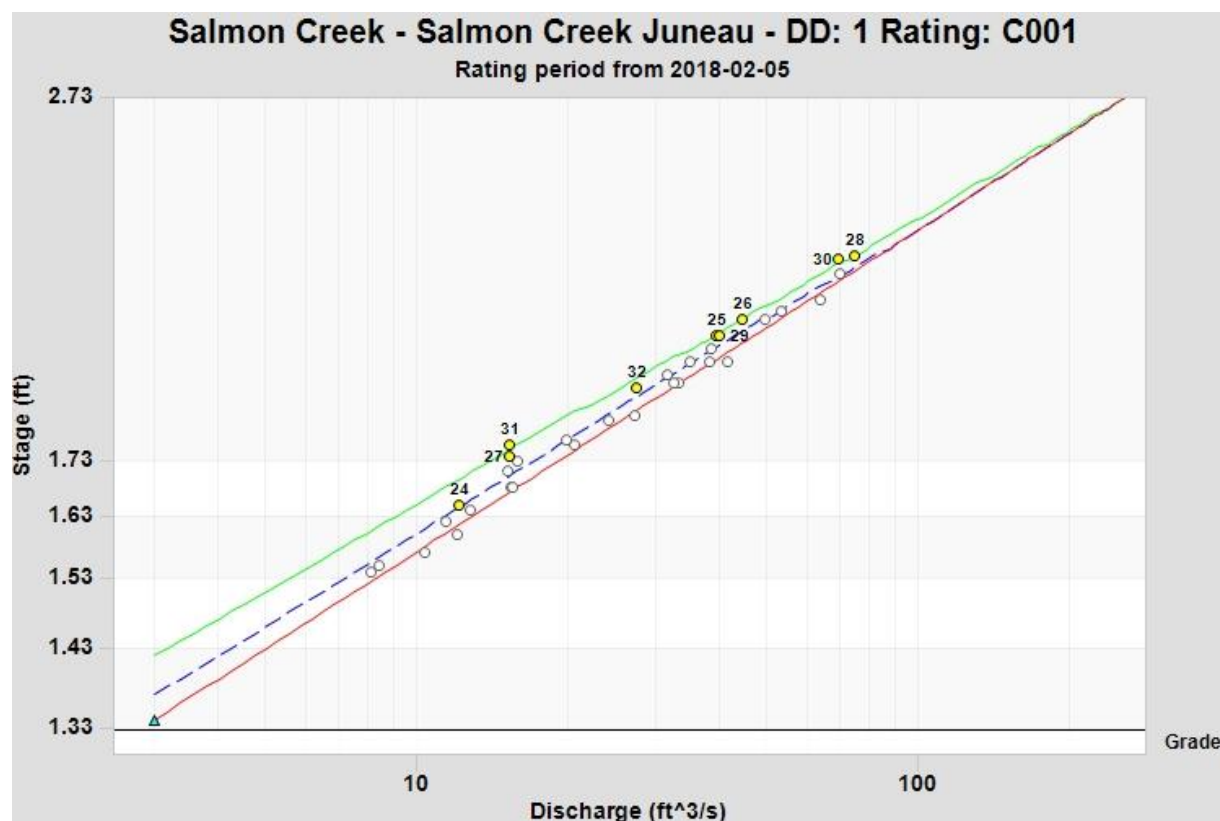
Salmon Creek Juneau

Stage (ft)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0	0	0	0	4.27	7.19	11.36	17.09	24.69	34.52
2	46.96	62.4	81.27	104.03	131.14	163.11	200.45	243.7	298.43	417.14
3	568.77	759.1	994.41	1281.51	1627.72	2040.9	2529.43	3102.24	3768.81	3841

**Figure 3. Salmon Creek Rating number 2 in effect from Feb. 5, 2018 through the 2020 water year, shown in graphic and tabular formats.**

**DISCHARGE RECORD.**—Rating number 2 was used with two stage variable shifts to compute discharge. Stage variable shift number one was used from Oct. 1-6, and stage variable shift number 2 was used for the remainder of the 2020 water year. The shifts were defined by measurements 21-24 (shift 1) and measurements 25-32 (shift 2) and both adjust the rating for slight fill at the gage control reach.

Stage record was affected by ice from Jan. 9-21, 2020; Mar. 7; Mar. 12-15; Mar. 29-Apr. 4. 23-24; and Mar. 4-6. Discharges during periods of ice were estimated from discharge measurements, examination of the stage record, comparison with Juneau weather records and hydrographic comparison with the USGS gaging station number 15052500, Mendenhall River near Juneau. Hydrographic comparison with the Mendenhall River is poor.



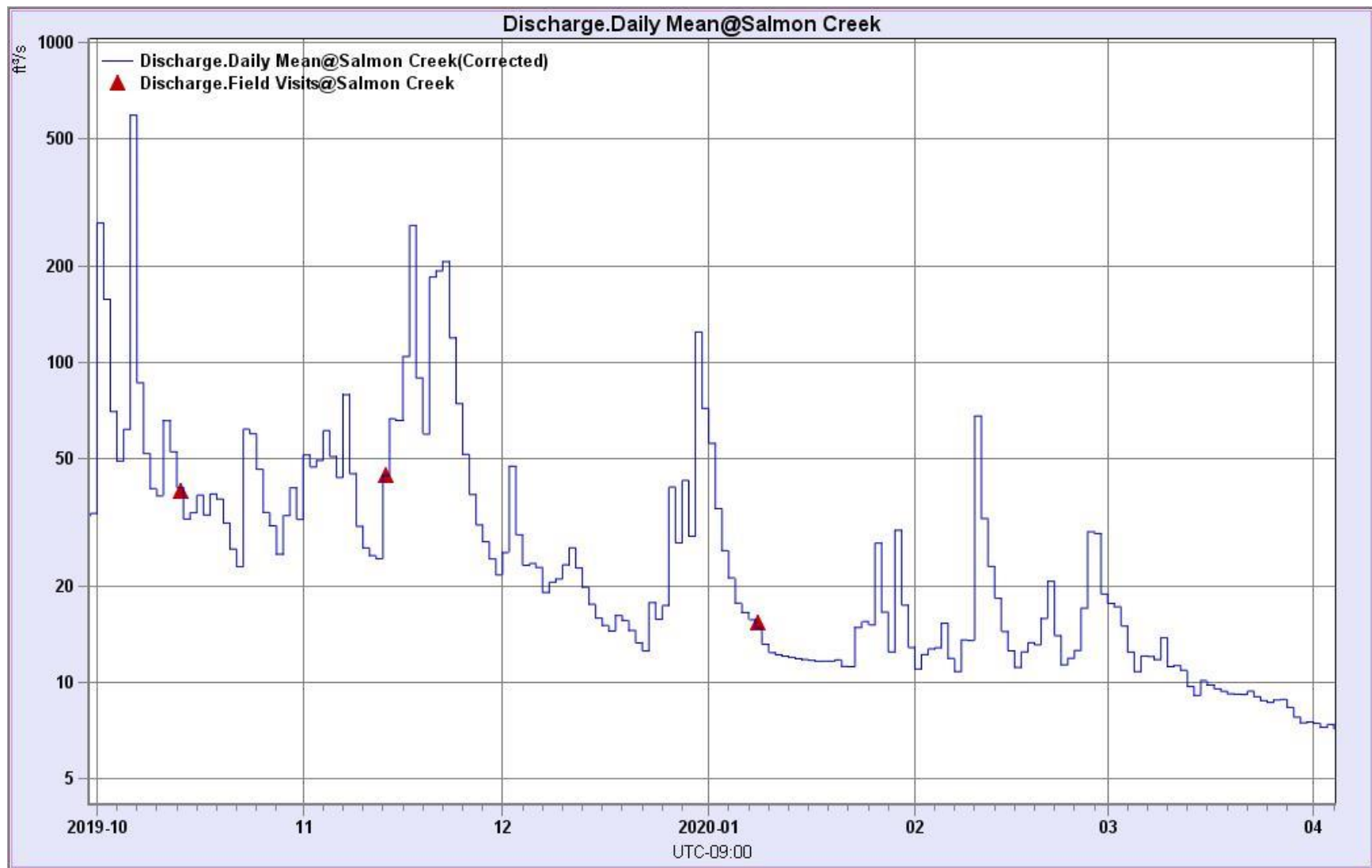
**Figure 4. Salmon Creek rating number 2 (log scale) shown with stage variable shift 1 (blue line) and stage variable shift 2 (green line) used to compute discharge for the 2020 water year.**

**REMARKS.**— Records of discharge are complete. Discharge records are fair to good for discharges below 300 ft<sup>3</sup>/s and poor for larger discharges due to the relatively poor gage reach and lack of cross sections available to consistently make good discharge measurements. Discharges estimated due to backwater from ice are poor.

The following files were included as an attachment to this document:

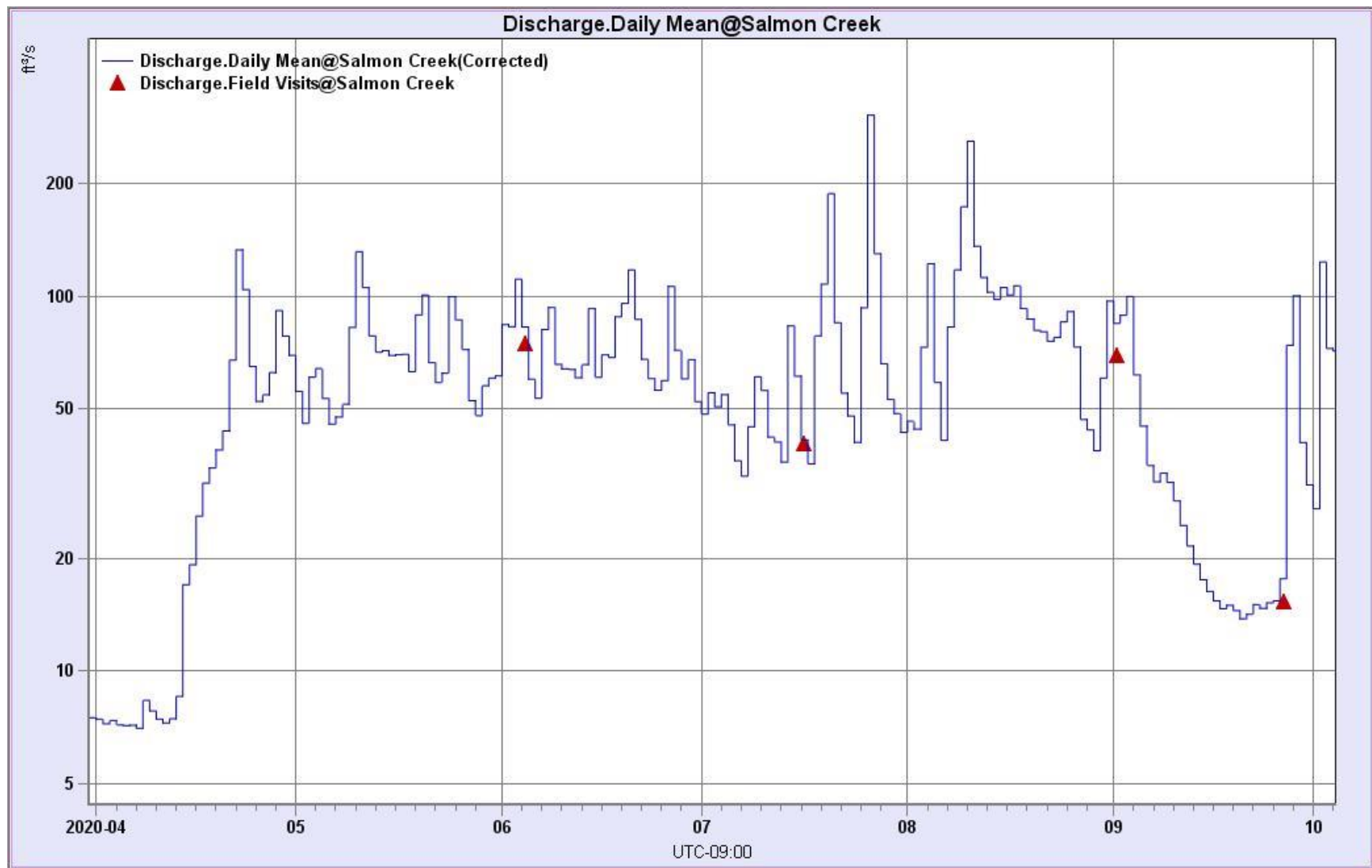
**Salmon Creek 15 min. 2020 Final.**

**Salmon Creek Daily Mean 2020 WY Final.**



Computed daily mean discharge and field measurements for Salmon Creek near Juneau, Alaska from October 2019 to April 2020.





Computed daily mean discharge and field measurements for Salmon Creek near Juneau, Alaska from April 2020 to October 2020.

Identifier: Discharge.Daily Mean@Salmon Creek

Location: Salmon Creek Juneau

Units: ft<sup>3</sup>/s

Filter: None

Daily Mean Discharge 2020 WY-Salmon Creek

Year: 2020 Water Year

Aggr: 48

Min: 7

Max: 300

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	270	51	25	56	11	18	7.4	56	84	48	46	85
2	160	47	47	35	12	17	7.2	46	83	55	44	89
3	70	49	29	26	13	15	7.4	61	110	51	73	100
4	49	61	23	21	13	12	7.2	64	83	55	120	62
5	62	51	24	18	15	11	7.1	53	60	45	59	45
6	590	44	23	17	12	12	7.2	46	53	36	41	35
7	86	79	19	16	11	12	7	48	82	33	83	32
8	52	45	21	15	14	12	8.3	52	93	45	120	34
9	40	31	21	13	13	14	7.8	83	66	61	170	32
10	38	26	23	12	68	11	7.4	130	64	56	260	28
11	66	25	26	12	32	11	7.3	110	64	42	140	24
12	53	24	23	12	23	11	7.4	78	61	41	110	22
13	41	44	20	12	18	9.7	8.5	71	66	36	100	19
14	32	67	18	12	14	9.1	17	72	93	83	98	18
15	34	66	16	12	13	10	19	70	61	61	110	16
16	38	100	15	12	11	9.8	26	70	70	41	100	15
17	33	270	14	12	12	9.5	32	70	69	36	110	15
18	39	89	16	12	13	9.4	35	63	88	79	93	15
19	37	60	16	12	13	9.2	39	89	96	110	87	14
20	31	180	15	12	16	9.2	44	100	120	190	81	14
21	26	190	13	11	21	9.1	68	67	87	85	80	14
22	23	210	13	11	14	9.4	130	59	68	55	76	15
23	62	120	18	15	11	9	100	62	60	48	78	15
24	60	74	16	15	12	8.7	65	100	56	41	86	15
25	46	52	17	15	13	8.6	52	87	60	93	91	15
26	34	39	41	27	17	8.8	55	72	110	300	73	18
27	31	31	27	17	30	8.8	63	53	72	130	47	74
28	25	27	43	12	29	8.3	92	48	60	66	44	100
29	33	24	29	30	19	7.8	78	58	68	53	39	41
30	41	22	120	17	7.5	70	61	52	49	61	31	
31	32	72	13	7.5	61	43	97					
Aggr	72	74	27	17	18	10	36	70	75	70	91	35
Min	23	22	13	11	11	7.5	7	46	52	33	39	14
Max	590	270	120	56	68	18	130	130	120	300	260	100