

# **Forks Creek Hatchery Annual Report**

## *RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*

March 16, 2022

### **Introduction**

The Washington Department of Ecology (Ecology) issued Administrative Order # 9136 dated April 27, 2012. This order requires the Washington Department of Fish and Wildlife (WDFW) to monitor water temperature at the Forks Creek Hatchery.

In accordance with the first action of the order, a Receiving Water and Wastewater Treatment Facility Effluent Temperature Study Quality Assurance Project Plan (QAPP) was developed and submitted to Ecology postmarked no later than June 30, 2012.

The Washington Department of Ecology issued an Amended Administrative Order #12793 dated August 11, 2015.

### **Reporting**

In accordance with the QAPP, the Permittee must submit temperature data from each sampling season to Ecology by March 31 and annually each year thereafter. The report must include all the daily maximum data for the effluent and ambient temperature data in spreadsheet (Excel®) format. The Permittee must submit a written report discussing any issues or problems with the sampling over the course of the study.

This report summarizes the results of the field monitoring. The data report includes:

- Results of the review process
- Any concerns requiring qualification of monitoring data.
- Any data qualifiers or items of interest not specifically qualified but requiring clarification.
- Unique analytical results
- Records of field calibration
- Weather Report- Air Temperature and Rainfall Records (optional)
- Temperature Data- January through December 2019

If you have any questions regarding this report, please contact Renee Fields at (360) 545-5910 or email at [Jacqueline.Fields@dfw.wa.gov](mailto:Jacqueline.Fields@dfw.wa.gov).

### **Temperature**

In 2021 Forks Creek Hatchery collected temperature of the influent and effluent water in accordance with the QAPP (WDFW, 2012). Forks Creek Hatchery has monitored temperature since August 2012.

Temperature data is summarized in a report and Excel® spreadsheet of daily maximum temperature values. This information is submitted to Ecology by March 31 following each calendar year monitoring period.

## **Forks Creek Hatchery Annual Report**

### *RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*

March 16, 2022

- The temperature data for the sampling season August 1 to December 31, 2012, was submitted in a report dated February 26, 2013, and the data was also included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2013, was submitted in a report dated February 5, 2013, and the data was also included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2014, was submitted in a report dated February 3, 2015, and the data was also included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2015, was submitted in a report dated March 2, 2016, and the data was also included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2016, was submitted in a report dated March 15, 2017, and the raw data was included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2017, was submitted in a report dated February 22, 2018, and the raw data was included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2018, was submitted in a report dated March 1, 2019, and the raw data was included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2019, was submitted in a report dated March 27, 2020, and the raw data was included on a CD.
- The temperature data for the sampling season January 1 to December 31, 2020, was submitted to the WQPortal in a report dated March 30, 2021, and the raw data was on an Excel spreadsheet.
- The temperature data for the sampling season January 1 to December 31, 2021, was submitted to the WQPortal in a report dated March 16, 2021, and the raw data for the effluent and influent data was submitted in Excel spreadsheets.

Water Temperature monitoring at Forks Creek Hatchery has been on-going since August 1, 2012. The administrative order requires monitoring until further notice. WDFW requested discontinuation of monitoring effective December 31, 2015, based on similar influent and effluent temperatures for three years, which demonstrated the hatchery has no influence on Forks Creek water temperature.

WDFW staff met with Ecology staff on August 11, 2015, and it was agreed monitoring would continue using only two sites instead of five.

Ecology issued an amended Administrative Order August 11, 2015, reducing the sites to two.

Temperature loggers were moved and monitoring at two sites commenced on August 16, 2015.

# Forks Creek Hatchery Annual Report

## RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

### Temperature Logger Sites

Forks Creek deployed two HOBO Onset temperature data loggers in 2021, one at Site 2 and another at Site 5. The effluent logger was placed a minimum of 50 feet upstream of the outfall diffuser and far enough into the river to get typical river mixing and flow characteristics. HOBO® temperature data loggers are deployed deep enough to avoid collecting air temperatures and shaded from direct sunlight to avoid inaccurate temperature measurements.

Figure 1 shows all five original temperature monitoring sites. In 2021, Forks Creek Hatchery monitored temperature at sites 2 and 5, which are approximately ten feet apart. Table 1 provides logger identification and site coordinates and descriptions.



Figure 1. Temperature Logger Sites at Forks Creek Hatchery.

Table 1. Temperature Logger and Monitoring Site Information.

SITE #	HOBO® Temperature Logger ID	Site Description	GPS Coordinates
2	10186041-Forks Creek at pump intake	Fork Creek influent monitoring station in front of pump intake fins and above weir.	46.5580N, 123.5962W
5	10186039- hatchery discharge	Outfall- location of hatchery discharge below weir.	46.5580N, 123.5962W

Forks Creek Hatchery staff monitored daily air temperatures and precipitation in 2021. Appendix B provides weather data.

## **Forks Creek Hatchery Annual Report**

### *RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*

March 16, 2022

#### **Data Quality Assurance and Quality Control**

Forks Hatchery staff maintained the logger at Site 5 on the following dates:

- Logger 10186039 removed and re-deployed on January 1, 2020 (logged once every 30 minutes)
- Logger 10186039 removed on January 25, 2021 (logged once every 30 minutes)
- Logger 10186038 deployed on January 27, 2021 (logged once every 30 minutes)
- Logger 10186038 removed and re-deployed on July 8, 2021
- Logger 21202571 deployed on December 3, 2021 (logged once every minute)
- Logger 21202571 removed December 31, 2021

No data were collected at Site 5 from July 8 to December 3, 2021. The temperature logger was deployed but failed to collect data.

The influent temperature data logger was removed from Site 2, downloaded, and re-deployed on the following dates:

- Logger 10186041 removed and re-deployed on January 1, 2020 (logged once every 30 minutes)
- Logger 10186041 removed January 22, 2021 (logged once every 30 minutes)
- Logger 10186041 re-deployed January 25, 2021 (logged once every 30 minutes)
- Logger 10186041 removed July 8, 2021 (logged once every 30 minutes)
- Logger 21011493 deployed July 8, 2021 (logged once every minute)
- Logger 21011493 removed and re-deployed August 7, 2021

No data were collected at Site 2 from August 7 to December 31, 2021. The temperature logger was deployed but failed to collect data.

Air temperatures recorded on the temperature loggers during the exchange were not used to calculate the daily maximum temperatures used in this report. Raw data in provided two separate Excel spreadsheets.

The Forks Creek staff performed optional checks of the effluent and receiving water temperature using a handheld thermistor once each week. Appendix B provides a comparison of temperature measurements from a handheld Hanna thermistor with data collected from the HOBO temperature loggers.

#### **Temperature Monitoring Results**

Figure 2 summarized maximum daily air and water temperatures at Forks Creek Hatchery in 2021. Temperature measurements collected with the handheld Hanna thermistor were substituted for missing continuous temperature data.

**Forks Creek Hatchery Annual Report**  
*RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*  
March 16, 2022

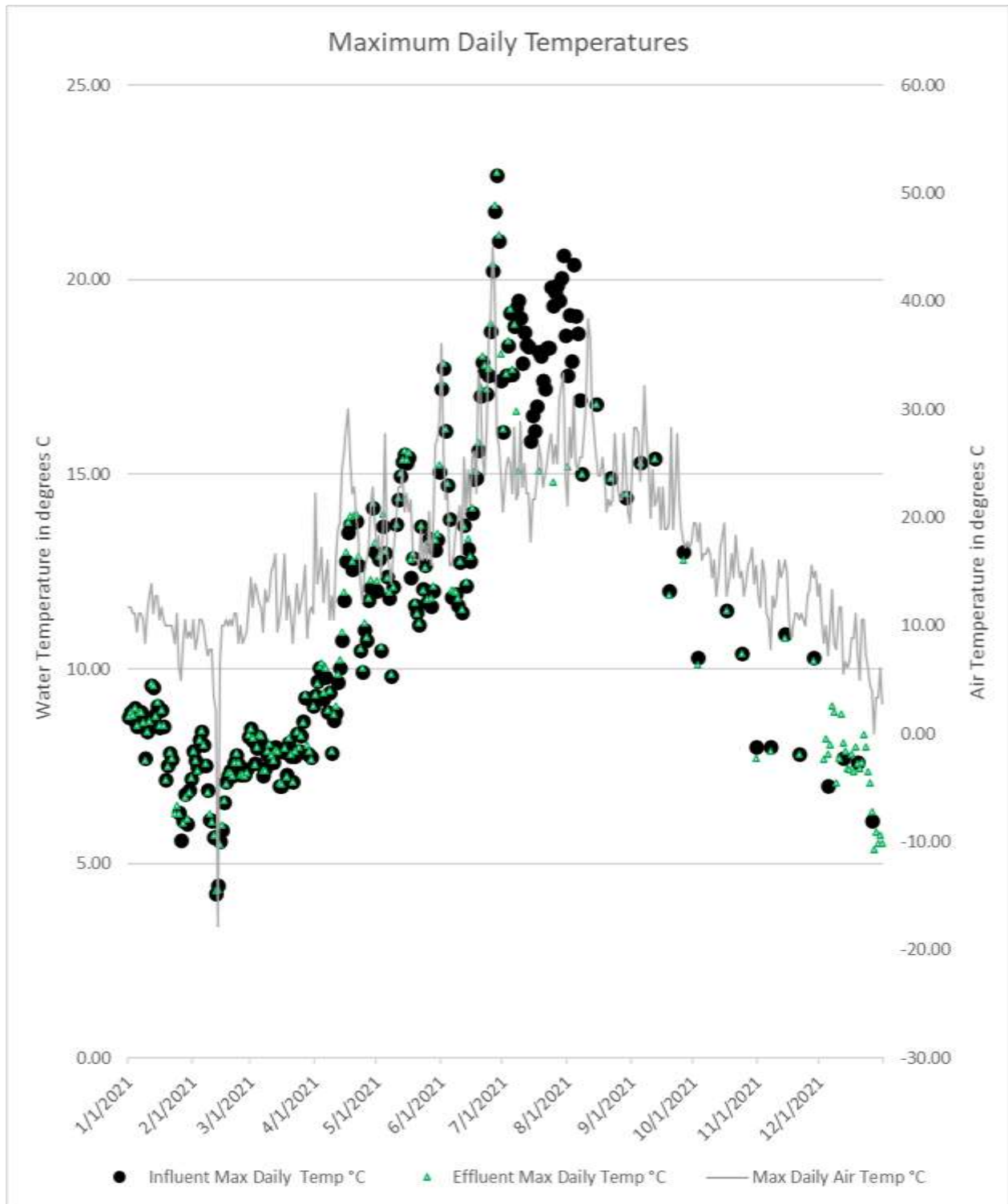


Figure 2. Maximum daily water and air temperatures in 2021 at Forks Creek Hatchery.

**Forks Creek Hatchery Annual Report**  
*RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*  
March 16, 2022

Figure 3 shows the maximum daily temperature of the influent and effluent during the warmer summer months.

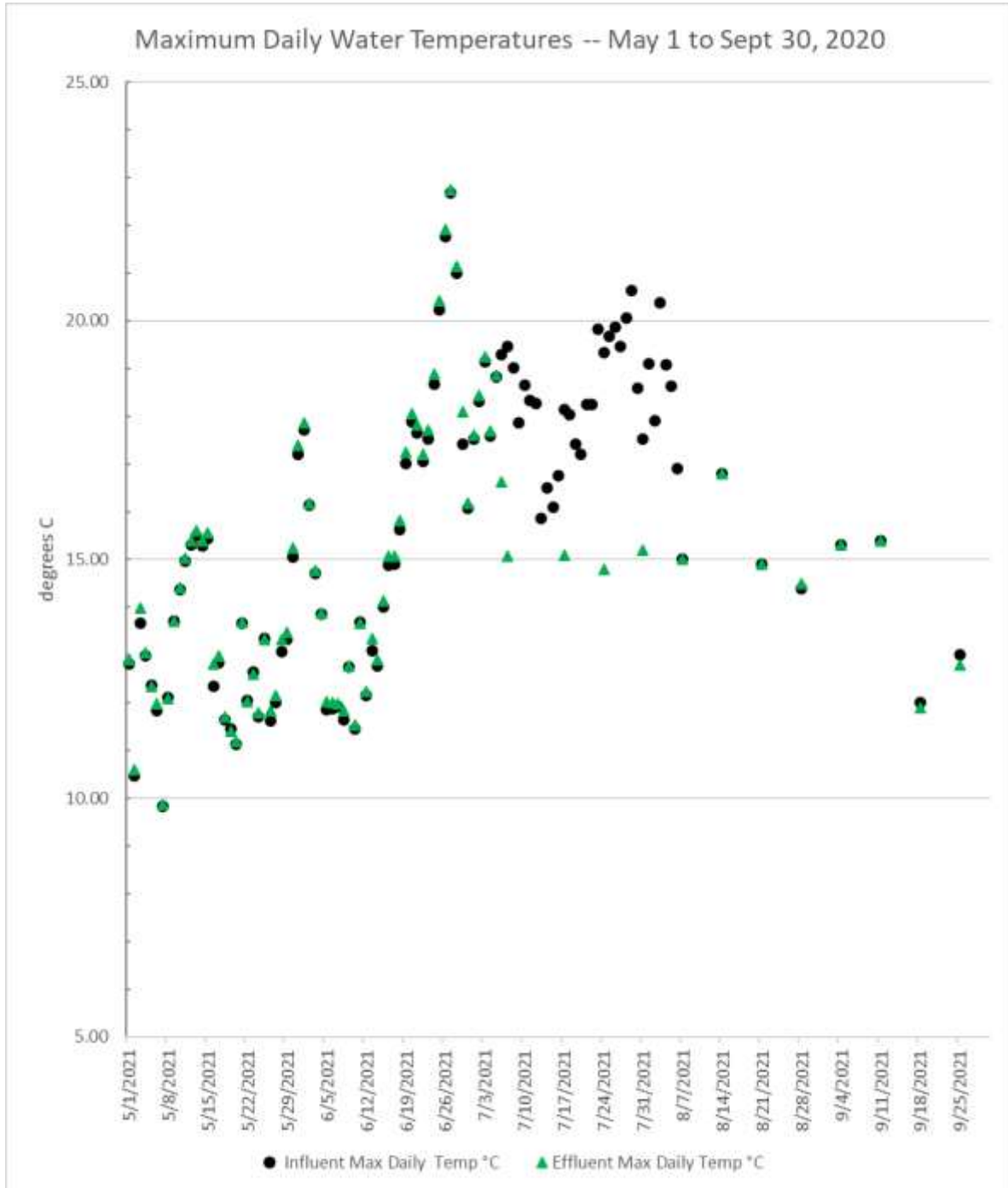


Figure 3. Forks Creek Hatchery influent and effluent water temperatures from May 1 to September 30, 2021.

**Forks Creek Hatchery Annual Report**  
*RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*  
March 16, 2022

Figure 4 shows the net difference -the effluent temperature minus the influent temperature.

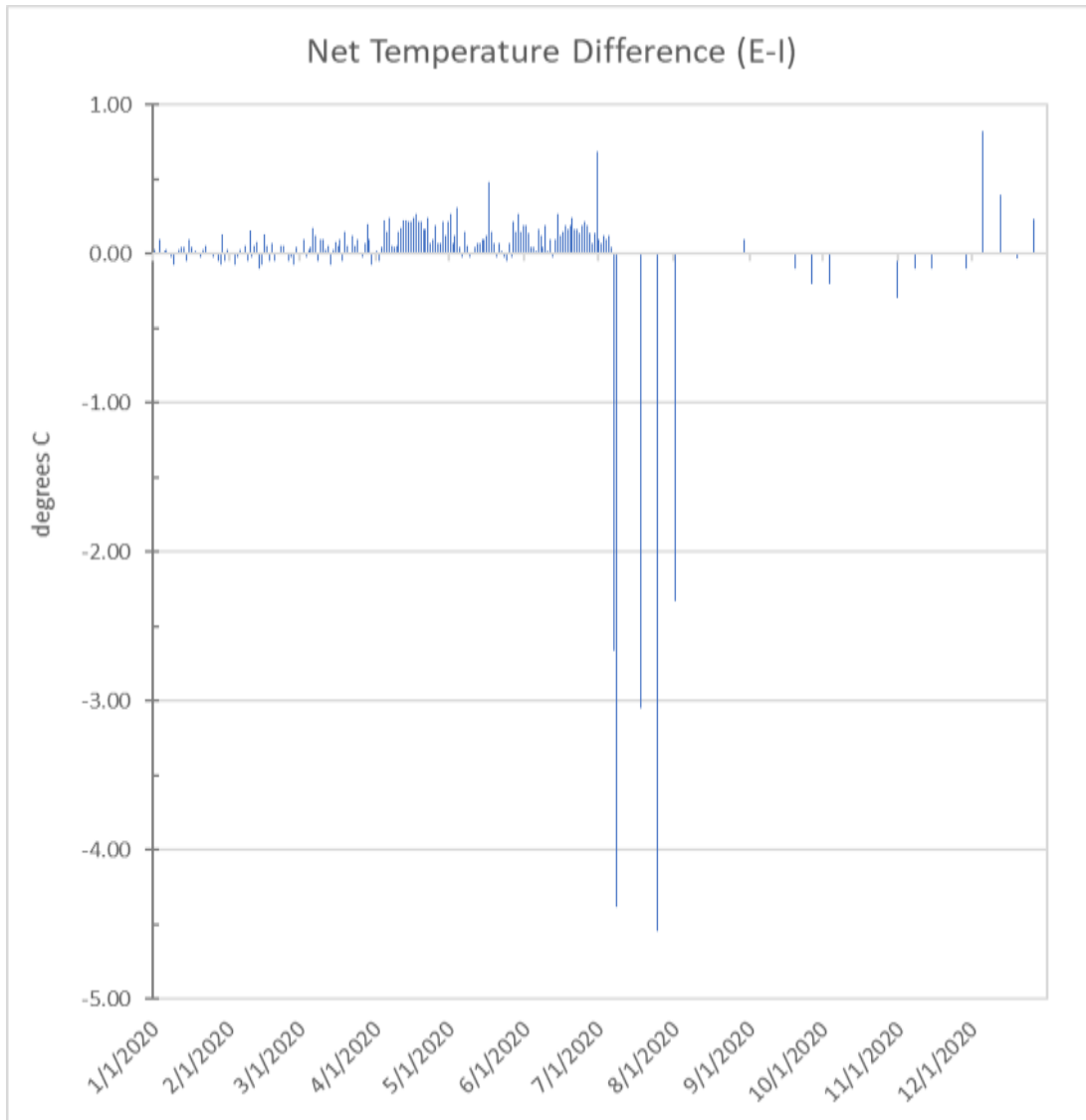


Figure 4. Net temperature difference (effluent temperature minus influent temperature) in 2021.

For 2021, continuous data exist for:

- Effluent Site 5 from January 1-July 8 and December 1-31
- Influent Site 2 for January 1-22, January 25-August 8

The temperature data points in between the continuous data are from the spot checks with handheld Hanna thermistor. The median difference HOBOT Onset temperature data logger and the Hanna thermistor (HOBOT-Hannah) is -0.13°C.

## Forks Creek Hatchery Annual Report

### RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

#### Stream Discharge Information

Stream discharge for Forks Creek at the Hatchery is not measured. Figure 5 shows the 2021 discharge record for the USGS stream gaging station located several miles from the hatchery on the Willapa River at Willapa, Washington.

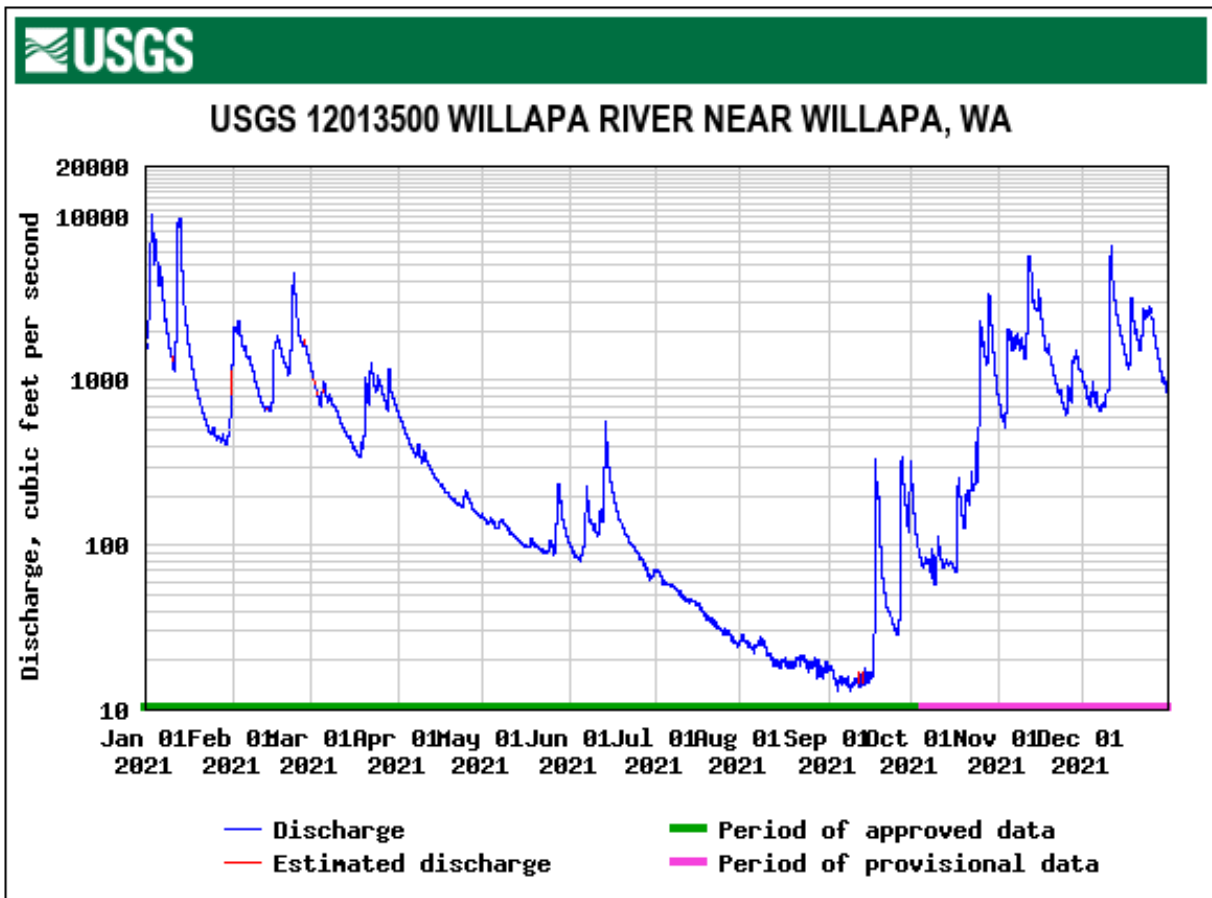


Figure 5. 2020 Discharge Record at Willapa River near Willapa, WA.

#### Forks Hatchery Air Temperature and Rainfall Records

Figure 6 shows the daily maximum air temperatures and precipitation recorded at Forks Hatchery. The raw weather data is provided in Appendix C.

## Forks Creek Hatchery Annual Report

### RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

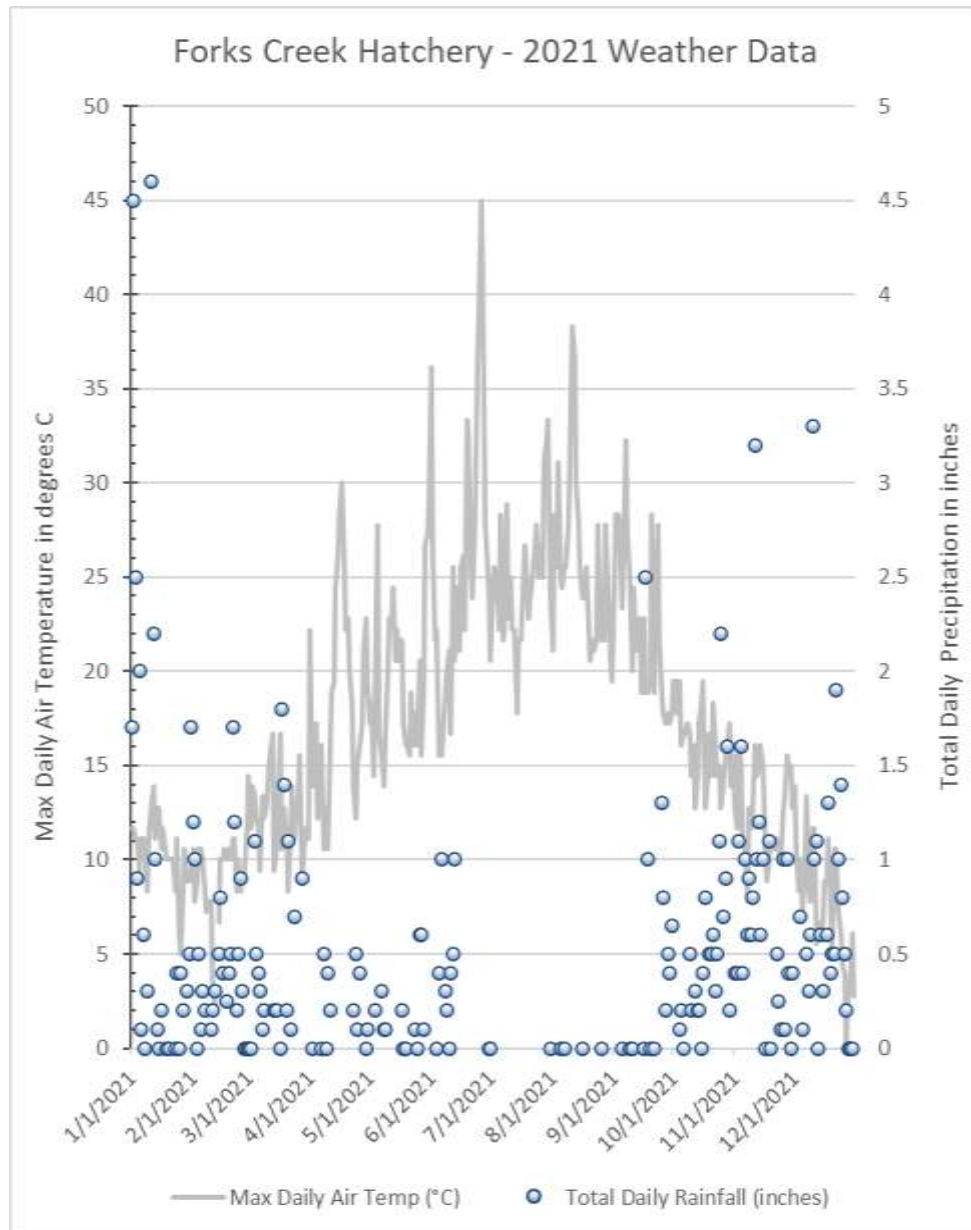


Figure 6. 2021 Weather data collected at Forks Creek Hatchery.

## Conclusions

Forks Creek Hatchery had some problems with temperature monitoring in 2021. Temperature data loggers failed to collect continuous temperature for part of the year at both the influent and effluent sites. The hatchery was short-staffed and training new personnel, due to the continuing challenges of the COVID-19 pandemic. Staff was unaware the loggers were not properly functioning. Likely they had not been launched correctly and were not checked routinely after they were deployed.

## **Forks Creek Hatchery Annual Report**

*RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*

March 16, 2022

Forks Creek Hatchery will be added to the 2022 WDFW Hatchery Continuous Temperature Sampling and Analysis Plan (SAP). The SAP and Monitoring Log has been provided to the hatchery, along with the recommendation to download temperature data loggers monthly to detect problems earlier. WDFW request that Forks Creek report daily maximum temperatures on the DMRs, rather than an annual report. Direct reporting by hatchery staff would encourage Forks Creek to download loggers more regularly to meet quarterly DMR deadlines.

## Forks Creek Hatchery Annual Report

### RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

#### Appendix A. Comparison of Hanna thermistor to HOBO Temperature Logger Data

Date	Time	Pump intake		Intake Difference	Effluent		Effluent Difference
		HANNA	HOBO		HANNA	HOBO	
1/31/2021	10am	6.7	7.041	0.341	6.7	6.94	0.24
2/7/2021	9am	7.3	7.066	-0.234	7.3	7.041	-0.259
2/15/2021	11am	5.6	5.411	-0.189	5.6	5.257	-0.343
2/21/2021	9am	7.2	7.015	-0.185	7.3	6.965	-0.335
2/28/2021	10am	7.5	7.368	-0.132	7.4	7.217	-0.183
3/7/2021	9am	6.5	6.661	0.161	6.5	6.687	0.187
3/14/2021	9am	6.8	7.066	0.266	6.8	7.015	0.215
3/21/2021	9am	6.3	6.306	0.006	6.4	6.23	-0.17
3/28/2021	10am	6.9	7.519	0.619	6.8	7.469	0.669
4/5/2021	9am	9.7	5.872	-3.828	9.6	5.719	-3.881
4/11/2021	8am	5.4	4.921	-0.479	5.3	5.05	-0.25
4/18/2021	10am	10.2	10.026	-0.174	10.1	9.46	-0.64
4/25/2021	10:15am	9.3	9.345	0.045	9.2	9.213	0.013
5/9/2021	10am	9.1	9.977	0.877	9.1	9.731	0.631
5/24/2021	9:30am	11.1	11.904	0.804	11.1	10.761	-0.339
5/30/2021	10am	9.9	10.394	0.494	9.9	10.222	0.322
6/7/2021	2:30pm	11.7	11.783	0.083	11.7	11.71	0.01
6/13/2021	12pm	12	11.832	-0.168	12	11.929	-0.071
6/27/2021	9am	16.5	16.82	0.32	16.5	16.796	0.296
7/4/2021	7:30am	16.1	14.912	-1.188	16.1	14.984	-1.116

## Forks Creek Hatchery Annual Report

RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

7/18/2021	10am	15.1	13.353	-1.747	15.1		
7/25/2021	9am	14.8	14.29	-0.51	14.8		
8/1/2021	10am	15.1	15.509	0.409	15.2		
8/8/2021	8am	15			15		
8/15/2021	10am	16.8			16.8		
8/22/2021	9am	14.9			14.9		
8/29/2021	1pm	14.4			14.5		
9/5/2021	10am	15.3			15.3		
9/12/2021	10am	15.4			15.4		
9/19/2021	9am	12			11.9		
9/26/2021	1pm	13			12.8		
10/3/2021	11am	10.3			10.1		
10/17/2021	9am	11.5			11.5		
10/24/2021	11am	10.4			10.4		
10/31/2021	11am	8			7.7		
11/7/2021	1pm	8			7.9		
11/14/2021	9am	10.9			10.8		
11/21/2021	11am	7.8			7.8		
11/28/2021	10am	10.3			10.2		
12/5/2021	1pm	7	6.788	-0.212	6.9		
12/12/2021	9am	7.7	7.67	-0.03	7.7		
12/19/2021	11am	7.6	7.192	-0.408	7.6		
12/26/2021	9am	6.1	5.898	-0.202	6.1		

# Forks Creek Hatchery Annual Report

## RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY

March 16, 2022

**Appendix B. Weather Data collected at Forks Creek Hatchery in 2021 (Min and Max Temperature in °F and inches of precipitation)**

DAY	JAN			FEB			MAR			APR			MAY			JUN		
	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN
1	53	49	1.7	51	42	1.2	58	41		72	32		63	40		97	57	
2	53	40	4.5	46	34	1	53	32		57	37	T	65	42		79	54	
3	52	41	2.5	48	36	T	57	34		59	38		58	46		71	45	
4	52	41	0.9	51	41	0.5	56	44	1.1	63	38		66	39	0.2	72	51	T
5	49	42	2	51	40	0.1	54	40	0.5	54	30		82	46		60	50	0.4
6	52	43	0.1	50	42	0.3	53	40	0.4	58	32		62	44		60	48	1
7	52	41	0.6	47	34	0.2	49	30	0.3	61	38	T	60	43	0.3	62	47	
8	51	32		45	31		56	32	0.1	51	39	0.5	57	44	0.1	66	43	0.3
9	47	32	0.3	46	28		54	36	0.2	55	31	T	62	42	0.1	68	44	0.2
10	52	42	T	46	32	0.1	55	31		51	32	0.4	68	44		70	48	T
11	55	48	4.6	38	32	0.2	59	30		61	32	0.2	73	47		62	49	0.4
12	57	45	2.2	36	32	0.3	60	31		66	31		73	48		78	51	0.5
13	52	40	1				62	32		67	32		76	52		69	54	1
14	55	39	0.1	44	33	0.5	49	32	0.2	76	33		69	48		76	50	
15	55	38		50	40	0.8	51	28	0.2	79	35		72	50		70	52	
16	51	37	0.2	50	40	0.4	54	31		83	39		69	42		78	50	
17	53	41	T	51	37		62	32	T	86	40		71	46	0.2	79	48	
18	51	33	T	50	39	0.25	51	38	1.8	78	40		63	39	T	72	52	
19	50	33	T	51	40	0.4	55	45	1.4	72	40		61	40	T	92	56	
20	50	35	T	50	39	0.5	52	39	0.2	73	47		61	45		90	56	
21	50	36		52	47	1.7	47	39	1.1	68	46		60	49		78	58	
22	50	27		52	41	1.2	52	34	0.1	65	43		66	54		75	57	
23	47	32	T	47	33	0.2	57	34		57	44	0.2	61	53		82	57	
24	52	34	0.4	50	33	0.5	52	44	0.7	54	47	0.5	64	53	0.1	97	59	
25	43	33	T	47	42	0.9	54	38		59	44	0.1	61	51	T	102	64	
26	41	36	0.4	48	34	0.3	56	39		61	44	0.4	69	52	0.6	113	66	
27	47	37	0.2	49	34	T	60	42		63	41		60	52	0.6	106	63	
28	51	32		53	41	T	48	40	0.9	70	43		66	43	0.1	82	63	
29	48	3	0.3				52	32		73	47	T	80	44		80	63	
30	49	43	0.5				53	32		67	49	0.1	81	49		75	63	T
31	48	44	1.7				52	32					84	52				
AVG	50.6	37.1	Total Rain	48.1	36.9	Total Rain	54.3	35.6	Total Rain	65.3	38.8	Total Rain	67.2	46.4	Total Rain	78.7	53.9	Total Rain
MAX	57.0	49.0	24.2	53.0	47.0	11.6	62.0	45.0	9.2	86.0	49.0	2.4	84.0	54.0	2.3	113.0	66.0	3.8
MIN	41.0	3.0		36.0	28.0		47.0	28.0		51.0	30.0		57.0	39.0		60.0	43.0	

**Forks Creek Hatchery Annual Report**  
 RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY  
 March 16, 2022

DAY	JUL			AUG			SEP			OCT			NOV			DEC		
	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN	MAX	MIN	RAIN
1	69	60	T	70	58		76	44		67	43		55	40	0.4	57	48	
2	76	60		83	53		83	44		67	43		53	44	0.4	51	35	
3	78	60		78	54		83	45		64	47		61	48	1.1	47	35	
4	77	58		88	56		82	49		67	46	0.1	59	47	1.6	50	35	0.7
5	72	59		77	56	T	74	51	T	61	45	0.2	52	43	0.4	45	34	0.1
6	83	59		76	61		79	48		62	39	T	51	41	1	50	40	
7	71	57		78	56	T	90	48		62	40		46	37	0.6	56	45	0.5
8	72	58		78	55		81	55		63	41		55	37	0.9	47	36	0.3
9	84	57		82	55		77	54	T	62	45	0.5	53	39	0.6	46	37	0.6
10	73	54		87	55		68	52	T	58	38	0.2	55	40	0.8	53	38	3.3
11	77	57		101	59		76	53		61	35		61	53	3.2	53	38	1
12	72	56		98	61		70	46		55	35	0.3	58	46	1	42	38	1.1
13	72	56		86	62		71	45		58	41	0.2	59	45	1.2	44	34	T
14	64	56		82	63		73	44		63	48	0.2	61	57	0.6	43	35	0.6
15	71	56		78	62		66	40		65	53	T	59	40	1	44	34	0.3
16	71	55		75	57	T	73	40	T	67	54	0.4	51	32	T	48	33	
17	74	50		75	54		66	54	2.5	55	44	0.8	48	34		48	34	0.6
18	80	48		78	57		66	52	1	58	39		50	42	1.1	52	39	1.3
19	78	51		75	60		67	49	T	62	39	0.5	52	43	T	45	37	0.4
20	73	55		69	59		83	47		58	49	0.5	52	37		41	39	0.5
21	75	54		71	58		66	51	T	65	50	0.6	51	31		51	39	0.5
22	77	50		70	48		73	49		61	51	0.3	52	33	0.5	51	41	1.9
23	80	52		71	47		82	48		58	51	0.5	51	35	0.25	45	39	1
24	82	55		82	48		71	56		59	50	1.1	50	45	0.1	43	36	1.4
25	77	55		73	53		66	52	1.3	55	50	2.2	55	35	1	40	32	0.8
26	80	60		71	59	T	64	52	0.8	57	46	0.7	56	48	0.1	39	24	0.5
27	77	51		71	52		63	54	0.2	60	46	0.9	60	48	1	32	32	0.2
28	88	53		82	49		64	52	0.5	61	50	1.6	58	52	0.4	38	31	T
29	90	55		76	47		63	51	0.4	63	37	0.2	59	52	T	38	34	T
30	92	56		69	50		64	52	0.65	57	36		55	49	0.4	43	33	T
31	75	60	T	67	47					60	35					37	24	
AVG	76.8	55.6	Total Rain	78.0	55.2	Total Rain	72.7	49.2	Total Rain	61.0	44.1	Total Rain	54.6	42.4	Total Rain	45.8	35.8	Total Rain
MAX	92.0	60.0	0.0	101.0	63.0	0.0	90.0	56.0	7.4	67.0	54.0	12.0	61.0	57.0	19.7	57.0	48.0	17.6
MIN	64.0	48.0			47.0		63.0	40.0		55.0	35.0		46.0	31.0		32.0	24.0	

## **Forks Creek Hatchery Annual Report**

*RECEIVING WATER AND WASTEWATER TREATMENT FACILITY EFFLUENT TEMPERATURE STUDY*

March 16, 2022

-Page Intentionally Left Blank-

END OF REPORT