



**El Dorado Hydroelectric Project
FERC Project No. 184**

2022 Water Temperature Monitoring Report

**EL DORADO IRRIGATION DISTRICT
2890 Mosquito Road
Placerville, CA 95667**

February 2023

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	METHODS	2
2.1	Site Selection.....	2
2.2	Temperature Loggers.....	3
2.3	Data Analysis	3
3.0	RESULTS AND DISCUSSION	4
3.1	Pyramid Creek (T1 & T2)	4
3.2	Echo Creek (T3 & T4)	5
3.3	Silver Fork American River Watershed (T5, T6, T30, T31, T29, & T7)....	5
3.4	South Fork American River (T8, T26, T9, T25, and T10).....	6
4.0	CONCLUSION	7
5.0	REFERENCES.....	7

APPENDICES

Appendix A – Figures

Appendix B – Datasheet data: 2022 Hourly, Daily Maximum, Daily Minimum, and Daily Mean Water Temperatures

List of Figures

Figure 1. Project 184- Temperature Monitoring Locations

Figure 2. Daily Mean Water Temperatures in Upper and Lower Pyramid Creek (T1 & T2).

Figure 3. Daily Maximum and Minimum Water Temperatures in Upper Pyramid Creek (T1).

Figure 4. Daily Maximum and Minimum Water Temperatures in Lower Pyramid Creek (T2).

Figure 5. Daily Mean Water Temperatures in Upper and Lower Echo Creek (T3 & T4).

Figure 6. Daily Maximum and Minimum Water Temperatures in Upper Echo Creek (T3).

Figure 7. Daily Maximum and Minimum Water Temperatures in Lower Echo Creek (T4).

- Figure 8. Daily Mean Water Temperatures in Silver Fork American River and Caples Creek (T5, T6, T7, T29, T30, & T31).
- Figure 9. Daily Maximum and Minimum Water Temperatures in Caples Creek (T5).
- Figure 10. Daily Maximum and Minimum Water Temperatures in Upper Silver Fork American River (T6).
- Figure 11. Daily Maximum and Minimum Water Temperatures in Lower Silver Fork American River (T7).
- Figure 12. Daily Maximum and Minimum Water Temperatures in Silver Fork American River near Fitch Rantz Bridge (T29).
- Figure 13. Daily Maximum and Minimum Water Temperatures in Silver Fork American River upstream of Caples Creek Confluence (T30).
- Figure 14. Daily Maximum and Minimum Water Temperatures in Caples Creek Upstream of Silver Fork American River Confluence (T31).
- Figure 15. Daily Mean Water Temperatures in South Fork American River (T8, T26, T9, T25, & T10).
- Figure 16. Daily Maximum and Minimum Water Temperatures in South Fork American River Upstream of Silver Fork American River Confluence (T8).
- Figure 17. Daily Maximum and Minimum Water Temperatures in South Fork American River above Kyburz Diversion Dam (T26).
- Figure 18. Daily Maximum and Minimum Water Temperatures in South Fork American River below Kyburz Diversion Dam (T9).
- Figure 19. Daily Maximum and Minimum Water Temperatures in South Fork American River near Bridal Veil Picnic Area (T25).
- Figure 20. Daily Maximum and Minimum Water Temperatures in South Fork American River above Akin Powerhouse (T10).

1.0 INTRODUCTION

The El Dorado Irrigation District (District) owns and operates the El Dorado Hydroelectric Project (Project No. 184 or Project), which is licensed by the Federal Energy Regulatory Commission (FERC). The Project No. 184 Monitoring Program¹ requires water temperature monitoring in stream reaches associated with Project No. 184 facilities. The specific monitoring requirements for water temperature monitoring are defined in the approved Project 184 Water Temperature Monitoring Plan (Plan; EID 2012).

Temperature monitoring is required during spring months to help evaluate breeding conditions for amphibians. Monitoring is also required during summer months to determine if coldwater beneficial uses are being met in designated Project reaches. Therefore, temperature data obtained for selected stream segments during this study will be used to meet the following objectives:

- Characterize the temperature in stream segments by continuously monitoring from April to October;
- Collect and analyze data to determine if water temperatures in the Project area protect coldwater habitat beneficial uses; and,
- Identify any project-controllable temperature resource measures that may be necessary for the protection, mitigation, and enhancement of beneficial uses, if applicable.

The majority of the Project area lies within the South Fork American River drainage which is part of the larger Sacramento River Basin. According to the Central Valley Region Basin Plan (CVRWQCB 2019), the designated beneficial uses for this basin include municipal water supply, power supply, contact recreation, non-contact recreation, canoeing and rafting, warm water fish habitat, coldwater fish habitat, coldwater fish spawning, and wildlife habitat. The designated beneficial uses for Lake Aloha, Silver Lake, and Caples Lake include municipal water supply, irrigation, stock watering, industrial process supply, power production, contact recreation, non-contact recreation, warm water and coldwater fish habitat, coldwater fish spawning, and wildlife habitat. Echo Lake and Echo Creek lie within the Lahontan Basin. The designated beneficial uses for these facilities include municipal water supply, groundwater

¹ Section 7 of the El Dorado Relicensing Settlement Agreement, U.S. Forest Service 4(e) Condition No. 37, and California State Water Resources Control Board Section 401 Clean Water Act Water Quality Certification Condition No. 13

recharge, navigation, recreation, commercial and sport fishing, coldwater fisheries, wild trout, and fish spawning (LRWQCB 2021).

Stream flow characteristics in watersheds within the Project area are highly variable due to seasonal variations in both precipitation and air temperature, which result in variations in surface water temperatures. This temperature monitoring program has been designed to provide information regarding water temperature in the vicinity of the Project and identify any project-controllable temperature concerns that can be addressed by project management to protect coldwater beneficial uses.

Monitoring conducted in 2022 represents the fourteenth continuous year of water temperature monitoring performed in accordance with the Plan. Results of the 2022 water temperature monitoring effort are presented herein. 2022 monitoring spreadsheet data (i.e., hourly, daily minimum, daily maximum and mean daily water temperatures) is available online at: <http://www.eid.org/our-services/hydroelectric/project-184/project-184-document-library>.

2.0 METHODS

2.1 Site Selection

This water temperature monitoring program was designed to monitor surface water temperatures above and below Project diversions throughout the Project area. The current Plan requires continuous recording temperature loggers at various locations from April 1 through October 31, provided safe access to the monitoring sites was possible. These sites include:

- T1 Pyramid Creek downstream of Lake Aloha Dam
- T2 Pyramid Creek upstream of South Fork American River
- T3 Echo Creek downstream of Echo Lake Dam
- T4 Echo Creek upstream of Upper Truckee River
- T5 Caples Creek downstream of Caples Lake Dam
- T6 Silver Fork American River downstream of Silver Lake Dam
- T7 Silver Fork American River upstream of South Fork American River
- T8 South Fork American River upstream of Silver Fork American River
- T9 South Fork American River downstream of Kyburz Diversion Dam
- T10 South Fork American River upstream of Akin Powerhouse
- T25 South Fork American River near Bridal Veil Picnic Area

In 2022, the District continued monitoring at additional sites not required in the Plan and are located along the South and Silver Fork American River and Caples Creek. These additional monitoring locations are intended to provide information regarding the water temperature characteristics along the length of the Silver Fork American River:

- T26 South Fork American River downstream of the Silver Fork American River confluence and upstream of the Kyburz Diversion Dam
- T29 Silver Fork American River near Fitch Rantz Bridge
- T30 Silver Fork American River upstream of Caples Creek confluence
- T31 Caples Creek upstream of Silver Fork American River Confluence

2.2 Temperature Recorders

Two Onset HOBO Water Temperature Pro V2 Data Loggers were installed at each monitoring location on or before April 1, 2022, with the exception of monitoring locations at T7 and T25 that were deployed on June 25, 2022, when the sites were safely accessible.

All data loggers were programmed to record water temperature at 1-hour intervals, 24-hours per day. At each location, one recorder was designated as logger A and the second as logger B, and the two loggers were deployed immediately adjacent to each other for redundancy purposes in the event one logger failed to record accurately or was dislodged. The loggers were housed in protective copper sleeves and secured to the stream bank or channel using stainless steel cable. Data were downloaded from recorders twice during the monitoring period using a HOBO waterproof data shuttle and/or transferred to a laptop computer. The data loggers were retrieved in early November.

2.3 Data Analysis

Hourly data were downloaded using HOBOWare Pro software from which daily maximum, minimum, and mean temperatures were recorded and calculated. Data were exported and compiled using Microsoft Excel. Daily maximum, minimum, and mean temperature data were reviewed for anomalies. Data from recorder A was utilized for the 2022 report unless anomalies were observed or recorder A was dislodged, in which case recorder B was utilized.

The thermal preference literature for salmonids (trout and salmon) is vast and widely variable depending upon genetic race of fish, acclimation temperatures,

oxygen levels, food supply, and myriad other factors (Mathews and Berg 1997, McCullough 1999, Myrick and Cech 2004, and Kupferberg et al. 2009). Based on this information, the generalized criteria for evaluating water temperatures for trout and other coldwater species including amphibians in this report is provided in Table 1.

Table 1. Criteria for evaluating water temperatures for trout and other coldwater species including amphibians in this report

Mean Daily Water Temperatures	Coldwater Species Response
< 20 °C	Optimal growth and survival
20 - 23 °C	Suitable; increased susceptibility to stressors
>23 - 26 °C	Physiological stress and behavioral shifts to compensate
> 26 °C	Adverse effects and potential mortality

3.0 RESULTS AND DISCUSSION

Results of 2022 temperature monitoring are summarized below for each monitoring location along with a general description of characteristics associated with each location. Figures showing the daily maximum, minimum, and mean water temperatures are presented in Appendix A and a link to an electronic format is provided in Appendix B.

3.1 Pyramid Creek (T1 & T2)

Pyramid Creek is a south-facing watershed located along the east side of the Sierra Nevada crest. Pyramid Creek flows out of Lake Aloha and is the highest elevation watershed monitored in this study. T1 is located in Pyramid Creek in the outflow channel just below the Lake Aloha main dam. T2 is located in Pyramid Creek upstream of the Highway 50 crossing in Twin Bridges, CA. Logger A data was utilized for both sites in this report.

The T1 site was accessed and the temperature data was downloaded in August, but the site was not accessible in November for final data retrieval due to significant snowfall in October. Consequently T1 temperatures were recorded from April 1st through August 30th.

Daily mean water temperatures at T1 and T2 are shown in Figure 2. Figure 3 shows the daily maximum and minimum water temperatures at T1. Figure 4 shows the daily maximum and minimum water temperatures at T2.

Water temperatures recorded in Pyramid Creek at water temperature monitoring sites T1 and T2 were within the optimal and suitable range for trout and other coldwater species, including amphibians throughout the monitoring period. No anomalies were recorded.

3.2 Echo Creek (T3 & T4)

Echo Creek flows out of the southeast end of Echo Lake and into the Upper Truckee River near the town of Myers, CA. This east-facing watershed is the only watershed in the Project area that is not within the American River drainage. T3 is located near the Echo Creek gage station approximately 100 meters downstream of the Echo Lake Dam. T4 is located upstream of the confluence with the Upper Truckee River and adjacent to the South Upper Truckee Road crossing. Logger A data was utilized for both sites in this report.

Both data loggers A and B at the T3 monitoring site were exposed to the atmosphere on October 26, 2022. The resulting in temperature variations above and below typical water temperatures recorded for this site. This circumstance does not significantly alter the overall data set for T3 since it occurred within the last six days of the monitoring period.

Daily mean water temperatures at T3 and T4 are shown in Figure 5. Figure 6 shows the daily maximum and minimum water temperatures at T3. Figure 7 shows the daily maximum and minimum water temperatures at T4.

Water temperatures recorded in Echo Creek at monitoring sites T3 and T4 were within the optimal range for trout and other cold water species, including amphibians throughout the monitoring period.

3.3 Silver Fork American River Watershed (T5, T6, T7, T29, T30, & T31)

The Silver Fork American River (Silver Fork) watershed is the largest tributary in the Project area. This north-facing watershed near the Sierra Nevada crest includes Caples Lake, Kirkwood Lake, and Silver Lake drainages located between the South Fork American and Mokelumne watersheds. T5 is located in Caples Creek near the gage station below Caples Lake Dam. T6 is located in the Silver Fork downstream of Silver Lake Dam. T30 is located in the Silver Fork upstream of the confluence with Caples Creek near Forgotten Flat. T31 is located in Caples Creek upstream of the footbridge near the confluence with the Silver

Fork. T29 is located in the Silver Fork near Silver Fork Campground (near Fitch Rantz Bridge) and downstream of the Caples Creek confluence. T7 is located in the Silver Fork upstream from the confluence with the South Fork American River.

The data loggers at T7 were deployed on June 25, 2022, due to inaccessibility to the monitoring location. T7 is located in a segment of the water course has multi-threaded channels that branch out before merging with the South Fork American River. The T7 monitoring location was relocated approximately 25 meters downstream in an attempt to record water temperatures that are representative of the Silver Fork.

Daily mean water temperatures in the Silver Fork watershed (T5, T6, T7, T29, T30, and T31) are shown in Figure 8. The daily maximum and minimum water temperatures for the individual sites in the Silver Fork watershed are shown in Figures 9-14. Logger A data was used for all Silver Fork watershed sites for this report.

Water temperatures recorded throughout the Silver Fork American River watershed were within the optimal range and suitable range for trout and other coldwater species, including amphibians throughout the monitoring period.

3.4 South Fork American River (T8, T26, T9, T25, & T10)

The South Fork American River (SFAR) drains the west side of the Sierra Nevada and is the mainstem river within the Project area. T8 is located approximately 0.5 miles upstream of the Kyburz Diversion Dam and upstream of the Silver Fork confluence. This location is the furthestmost upstream monitoring location in the mainstem of the SFAR. T26 is located immediately upstream of the Kyburz Diversion Dam and downstream of the Silver Fork confluence. T9 is located downstream of the Kyburz Diversion Dam. T25 is located east of the Bridal Veil Picnic Area in the middle of the Project reach. T10 is located at the downstream end of the Project area and upstream of the Akin Powerhouse.

The data loggers at T26 were deployed on June 25, 2022, due to inaccessibility to the monitoring location. The T26 data loggers or affixed to a large boulder located in the middle of the SFAR and are inaccessible during high flows.

Daily mean water temperatures in the SFAR watershed (T8, T9, T10, T25, and T26) are shown in Figure 15. The daily maximum and minimum water

temperatures for the individual sites in the SFAR watershed are shown in Figures 16-20. Logger A data was used for sites T8, T9, T10, and T25. Logger B data was used for site T26.

The 2022 SFAR watershed temperatures generally increase from T8 to T10 with the approximate 2,100 foot drop in elevation and are consistent with data trends over the fourteen years of monitoring. Water temperatures for T8, T9, and T26 located in the upper segment of the SFAR monitoring area were within the optimal range for coldwater species for the duration of the monitoring period. Water temperatures in the middle and lower reaches of the Project T25 and T10 respectively, were appropriate for the warmer water transitional species assemblage present in this reach (Moyle 2002).

Using hourly data to compare the difference in average temperatures above and below the Kyburz Diversion Dam (between T26 and T9 respectively), there was a high degree of correlation between the hourly data sets. There was no difference in the average temperatures between T26 and T9 during the 2022 monitoring period and the maximum difference in temperature between T26 and T9 was 0.5 °C.

4.0 CONCLUSION

Overall, water temperatures measured in the Project area were within the optimal and suitable range for trout and other coldwater species, including amphibians throughout the study period.

Water temperatures in the middle (T25) and lower (T10) reaches of the Project area warm naturally at lower elevations. The upper reaches of the Project area support cold water species assemblages (e.g., rainbow trout assemblage; Moyle 2002), while the middle and lower reaches are grading into warmer water, and have a transitional species assemblage (pikeminnow-hardhead-sucker assemblage) reflective of this natural change and incrementally warmer water caused by higher ambient air temperatures.

5.0 REFERENCES

EID 2012. Project 184 Water Temperature Monitoring Plan. Version 6.0. October.

CVRWQCB 2019. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board: Central Valley Region (CVRWQCB), the Sacramento River Basin and the San Joaquin River Basin (5th Edition, Revised). Sacramento, California. February.

LRWQCB 2021. Water Quality Control Plan for the Lahontan Region North and South Basins: Lahontan Regional Water Quality Control Board (LRWQCB). South Lake Tahoe, California. May (Adopted).

Mathews, K, and Berg, N. 1997. Rainbow Trout Responses to Water Temperature and Dissolved Oxygen Stress in Two Southern California Stream Pools. *Journal of Fish Biology*. 50:50-67.

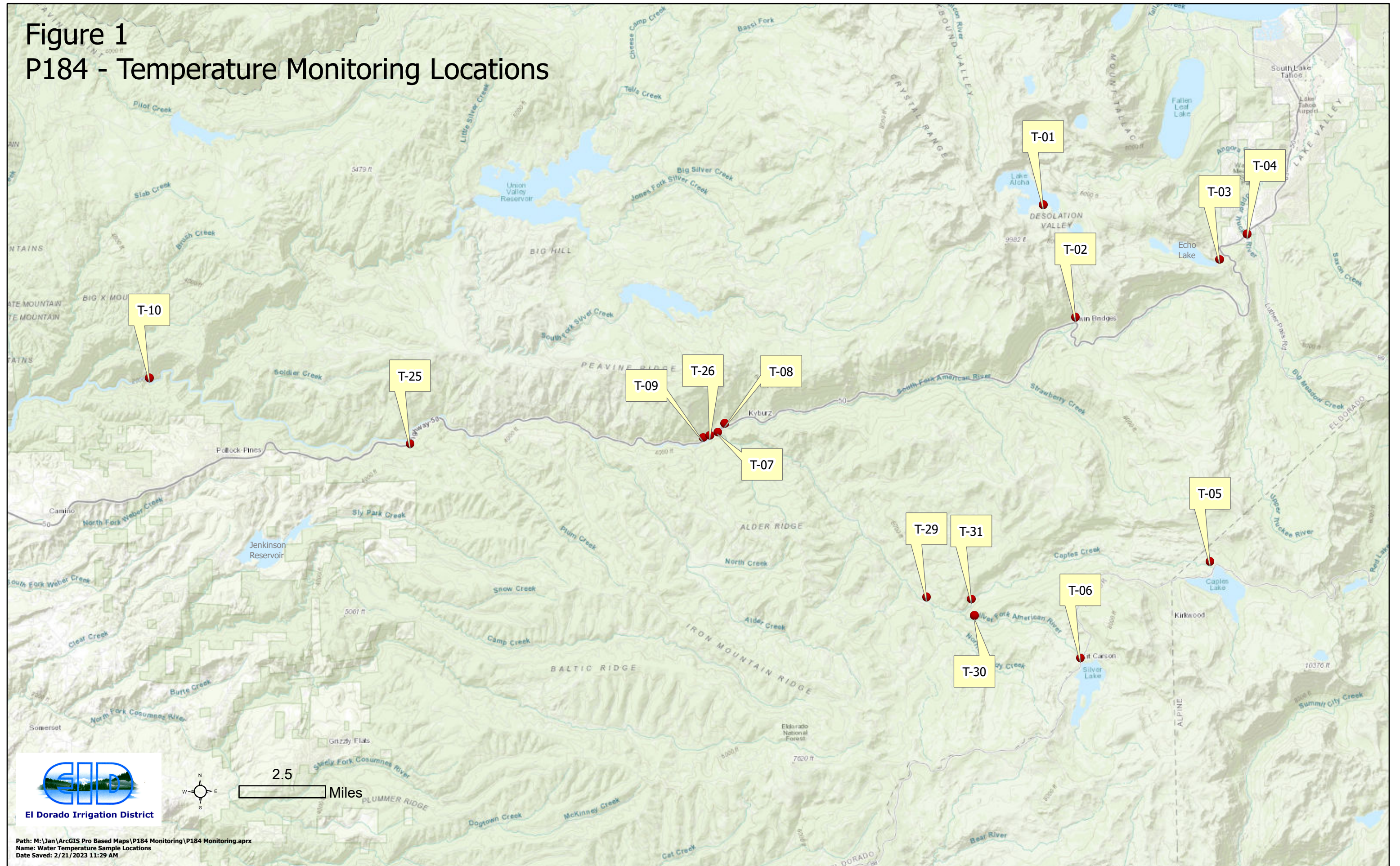
McCullough, D. 1999. A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids, with Special Reference to Chinook Salmon. EPA 910-R-99-010. U.S. Environmental Protection Agency, Region 10. 291pp.

Myrick, C, and Cech J. 2004. Temperature Effects on Juvenile Anadromous Salmonids in California's Central Valley: What Don't We Know. *Reviews in Fish Biology and Fisheries*. 14:113-123.

Kupferberg, S, Catenazzi, A, Lunde, K, Lind, A, and Palen, W. 2009. Parasitic Copepod (*Lernaea cyprinacea*) Outbreaks in Foothill Yellow-legged Frogs (*Rana boylei*) Linked to Unusually Warm Summers in Northern California. *Copeia*. 3:529-537.

Moyle, B. 2002. *Inland Fishes of California*. Second Edition. University of California Press. Berkeley. 502 pp.

Figure 1 P184 - Temperature Monitoring Locations



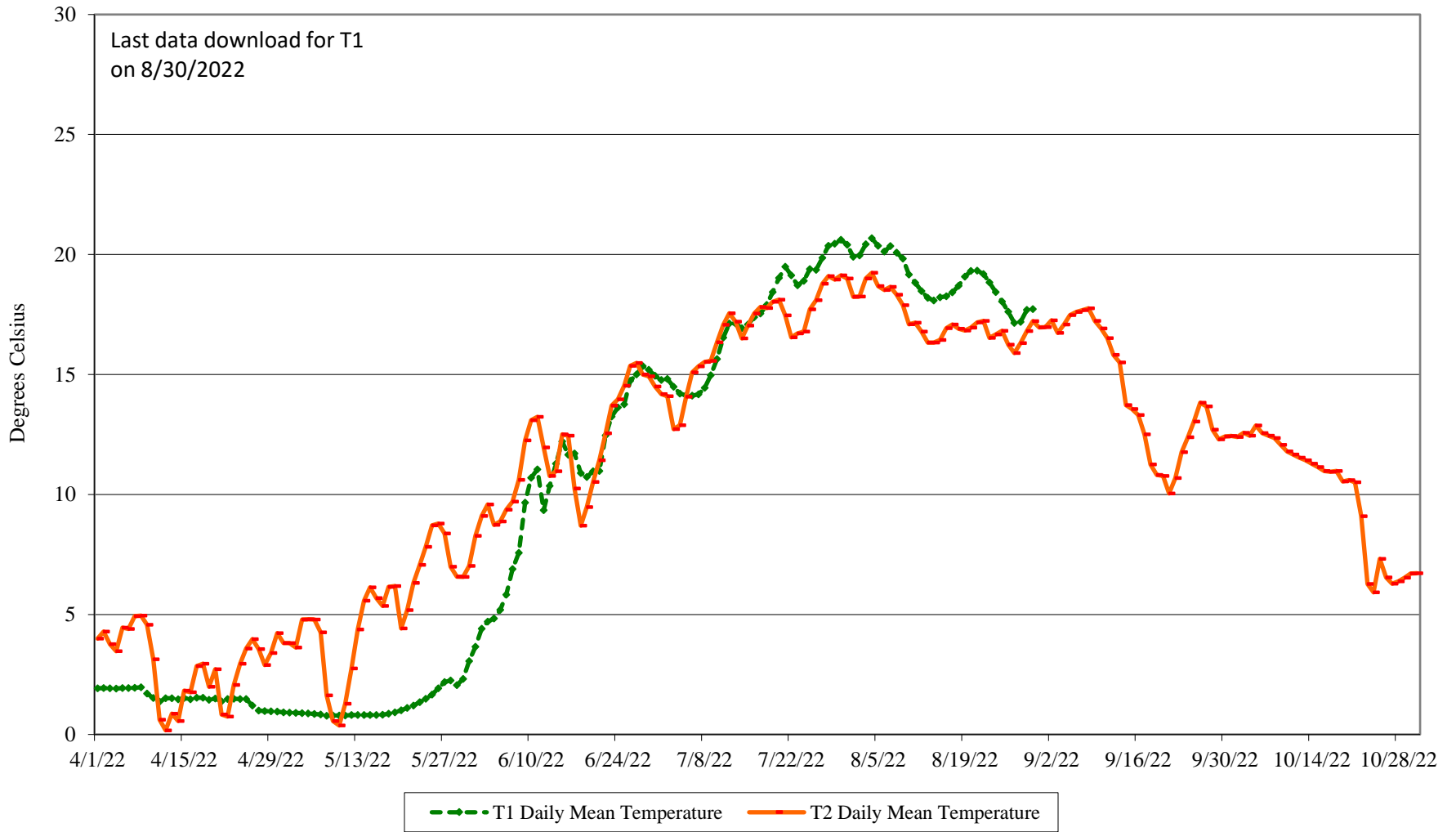


Figure 2. Daily Mean Water Temperatures in Upper and Lower Pyramid Creek (T1 & T2).

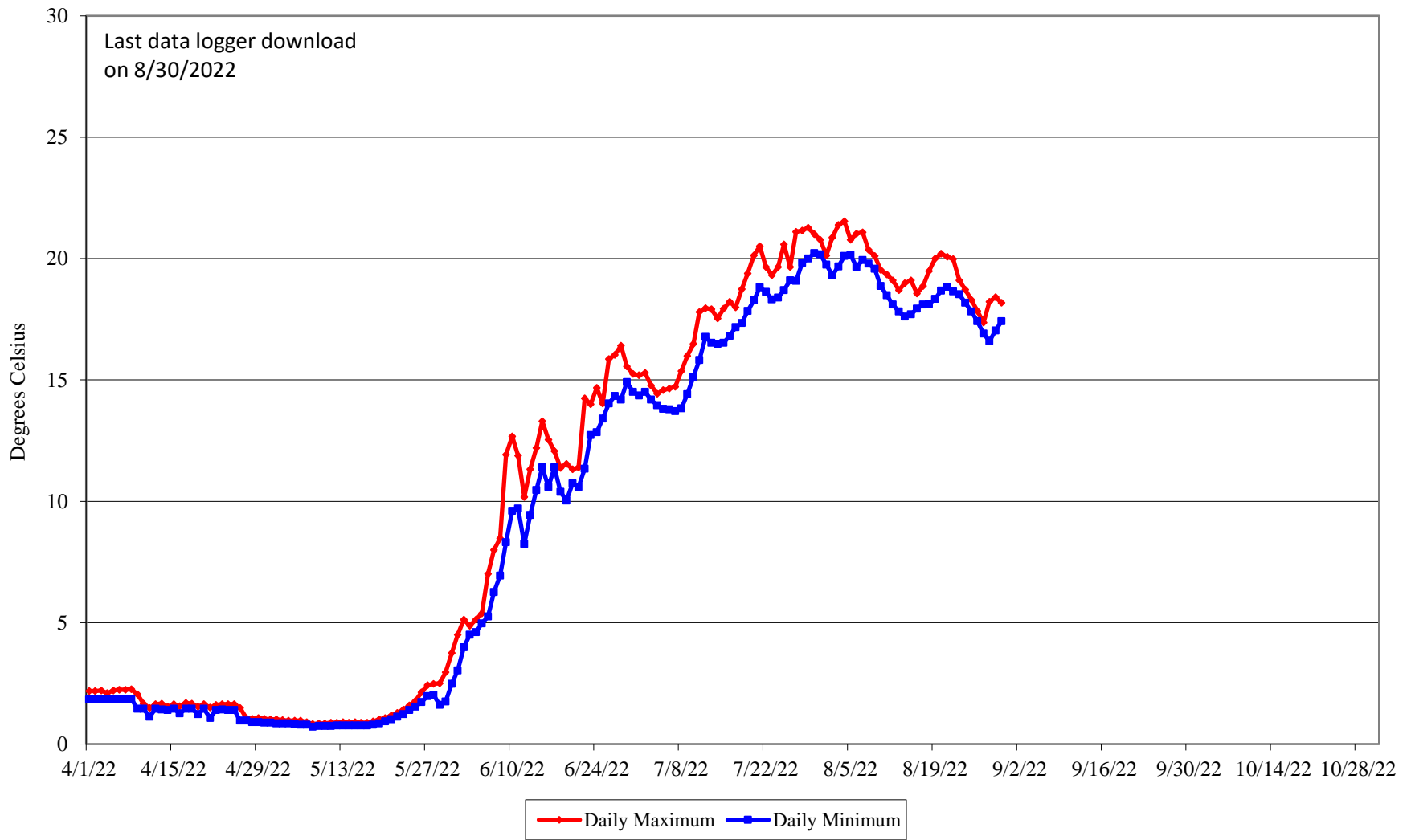


Figure 3. Daily Maximum and Minimum Water Temperatures in Upper Pyramid Creek (T1)

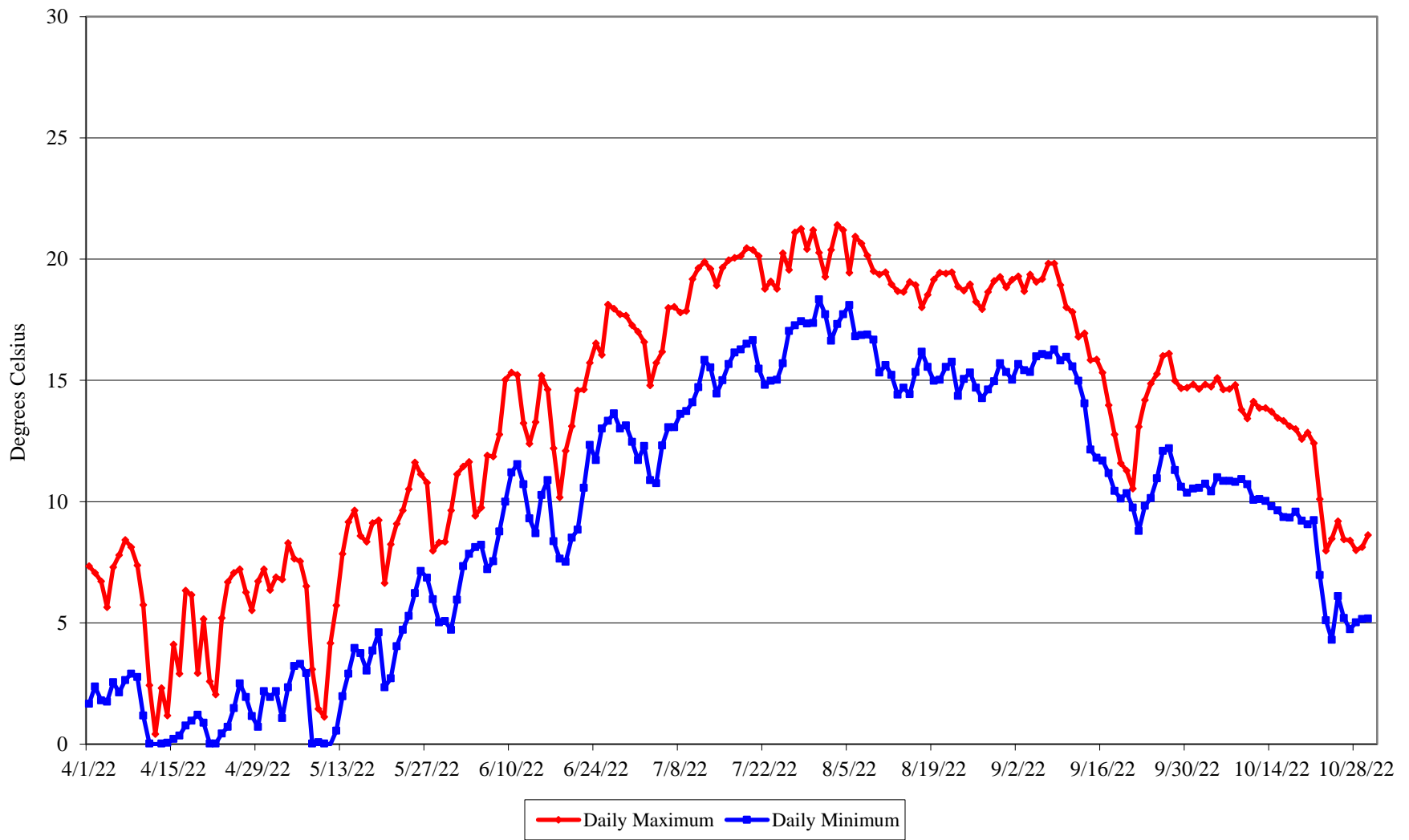


Figure 4. Daily Maximum and Minimum Water Temperatures in Lower Pyramid Creek (T2)

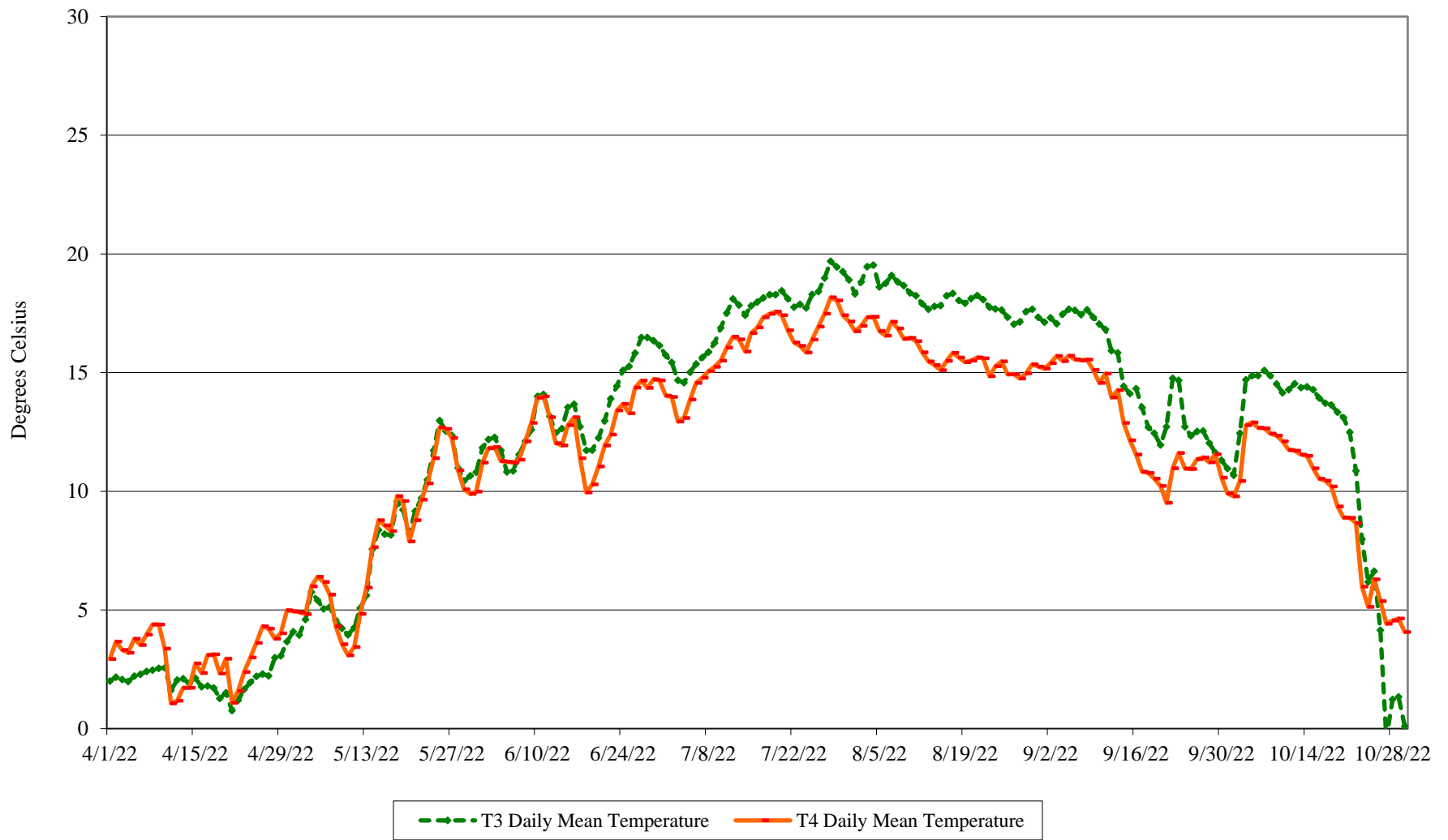


Figure 5. Daily Mean Water Temperatures in Upper and Lower Echo Creek (T3 & T4)

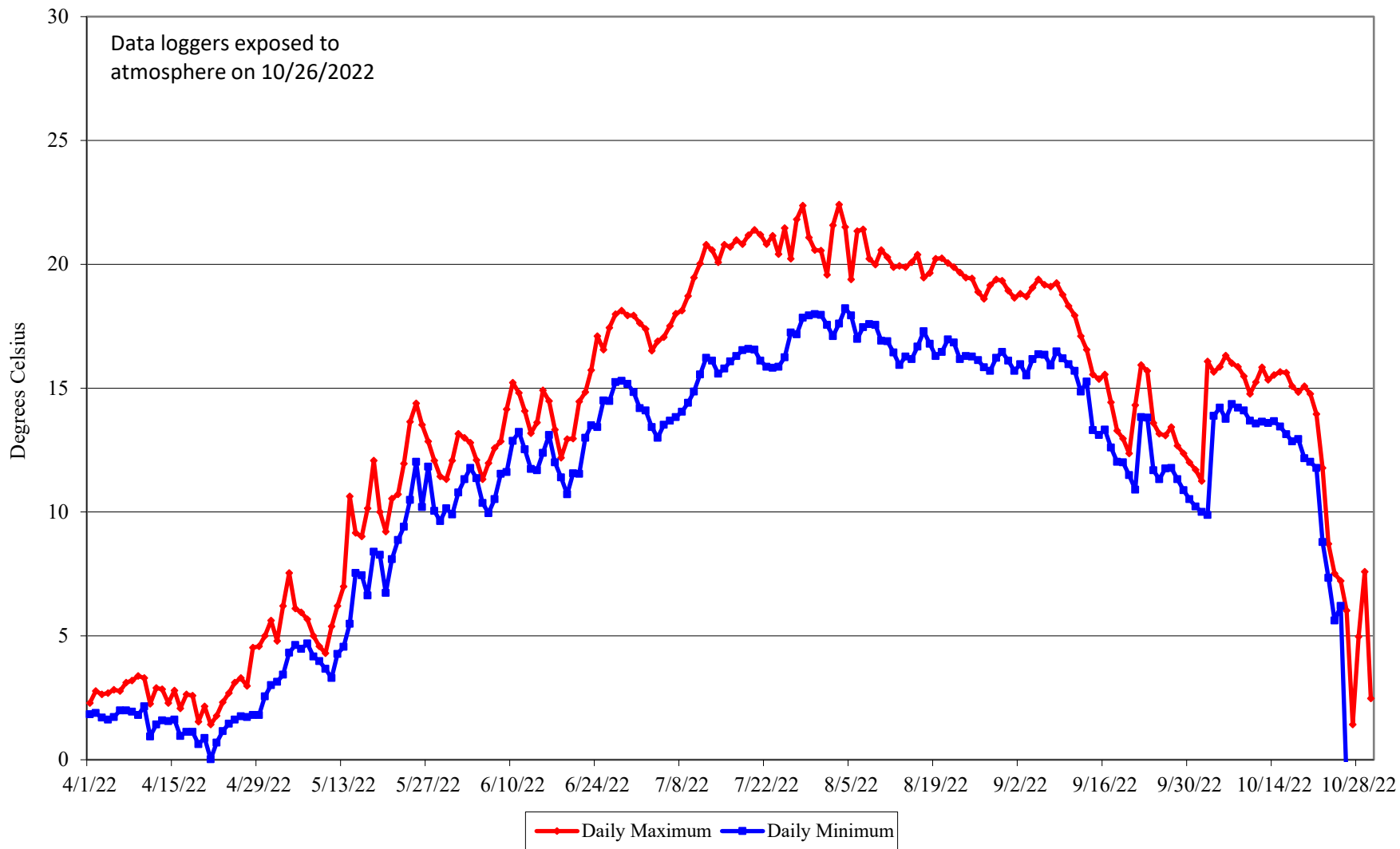


Figure 6. Daily Maximum and Minimum Water Temperatures in Upper Echo Creek (T3)

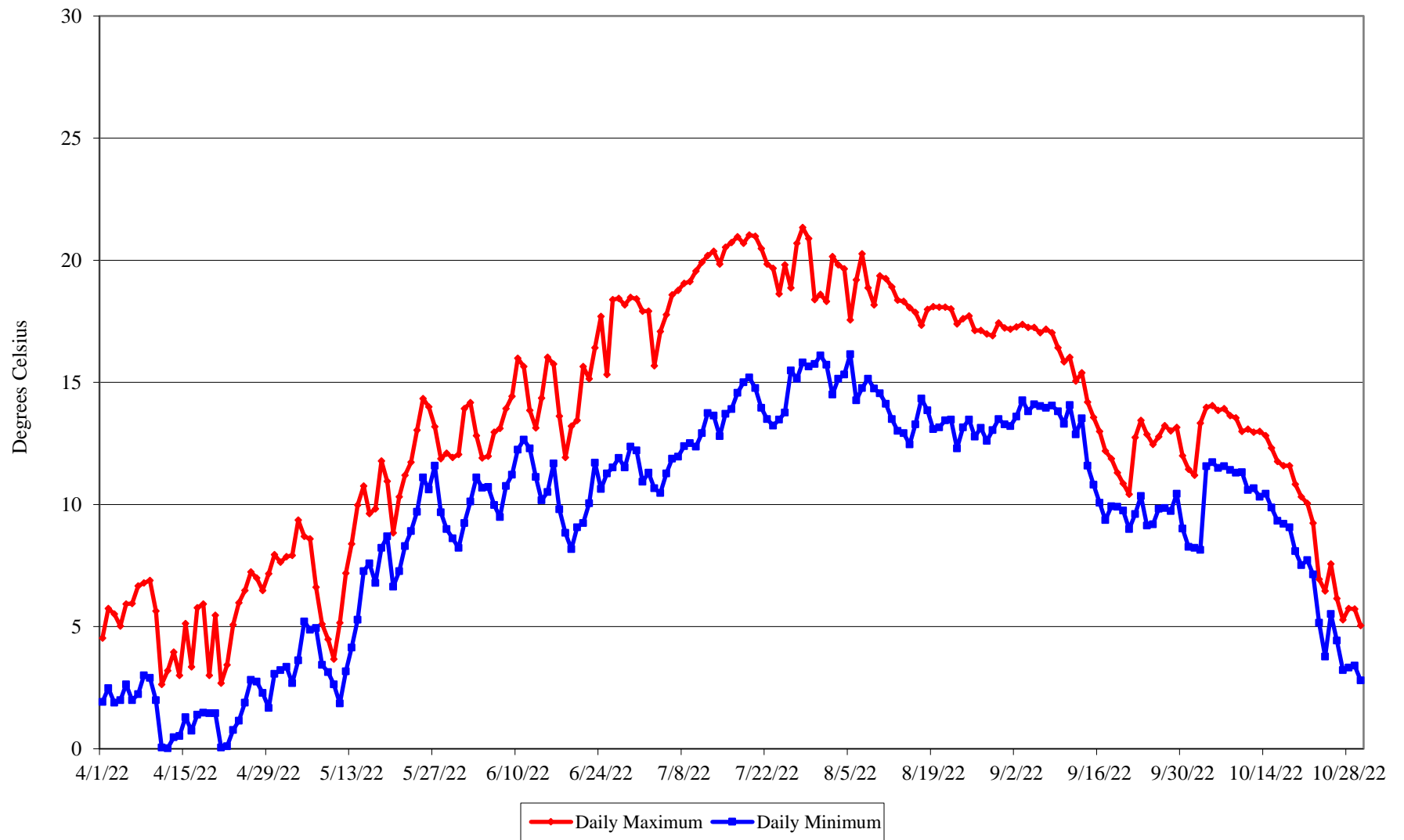


Figure 7. Daily Maximum and Minimum Water Temperatures in Lower Echo Creek (T4)

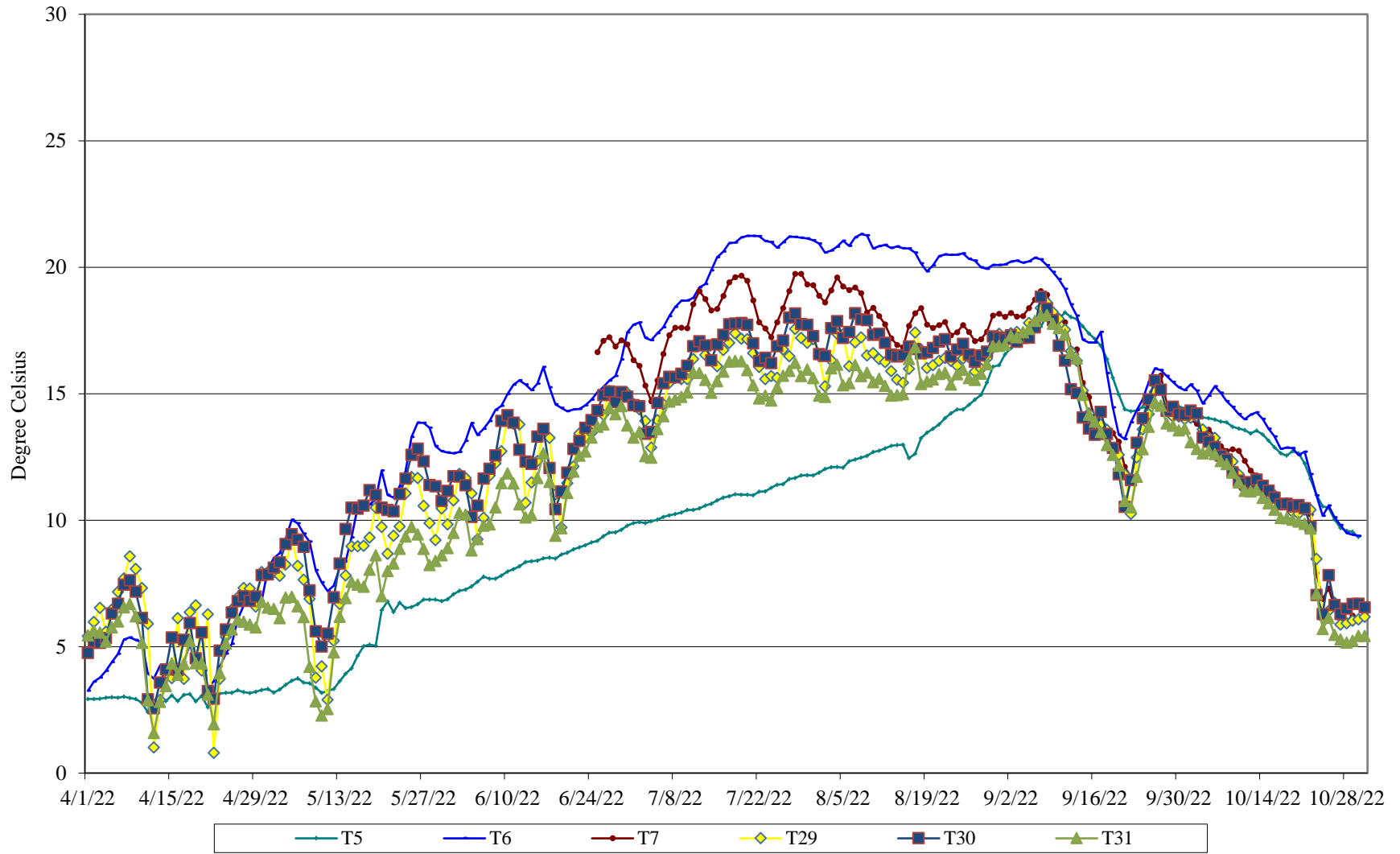


Figure 8. Daily Mean Water Temperatures in Silver Fork American River and Caples Creek (T5, T6, T7, T29, T30, T31)

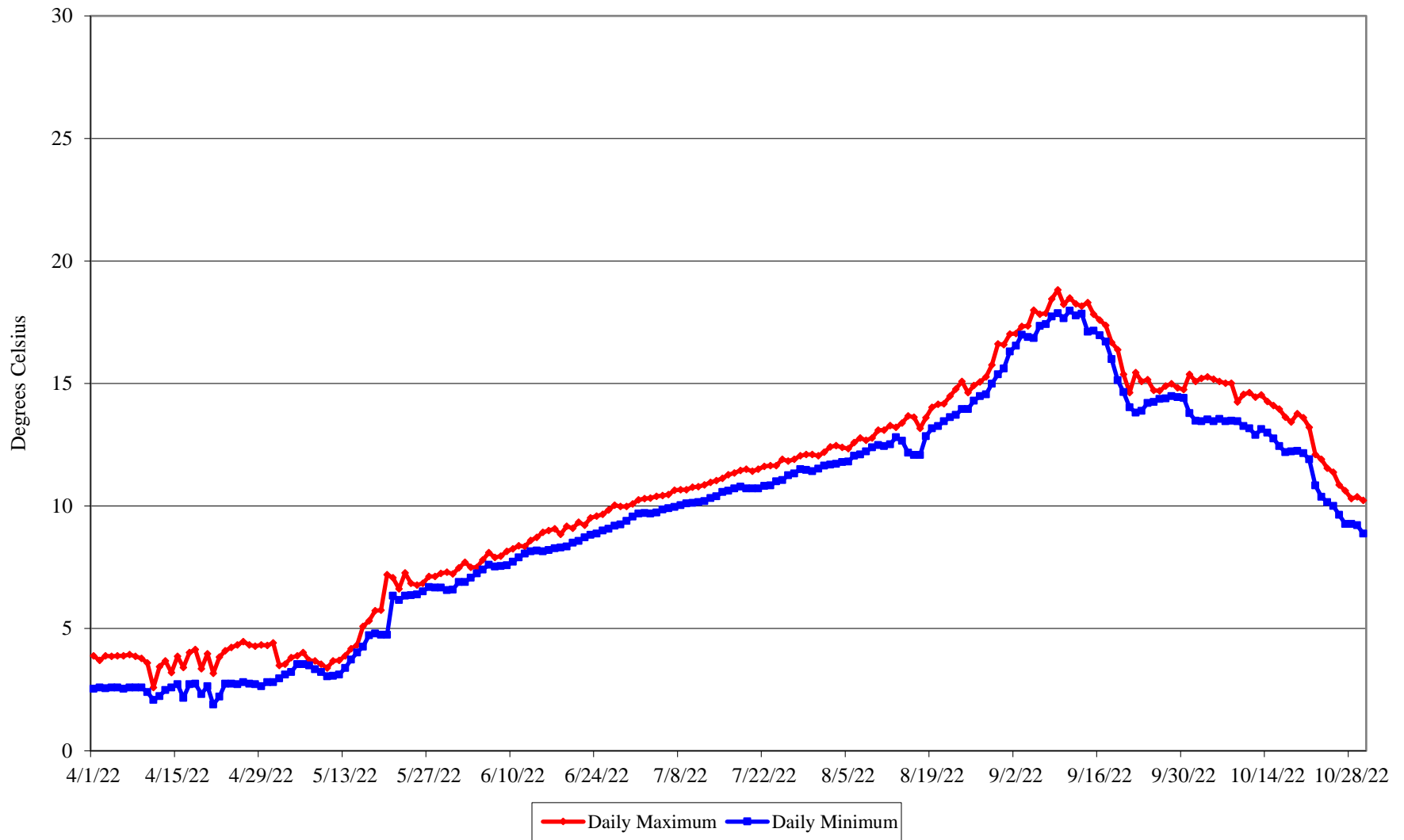


Figure 9. Daily Maximum and Minimum Water Temperatures in Caples Creek (T5)

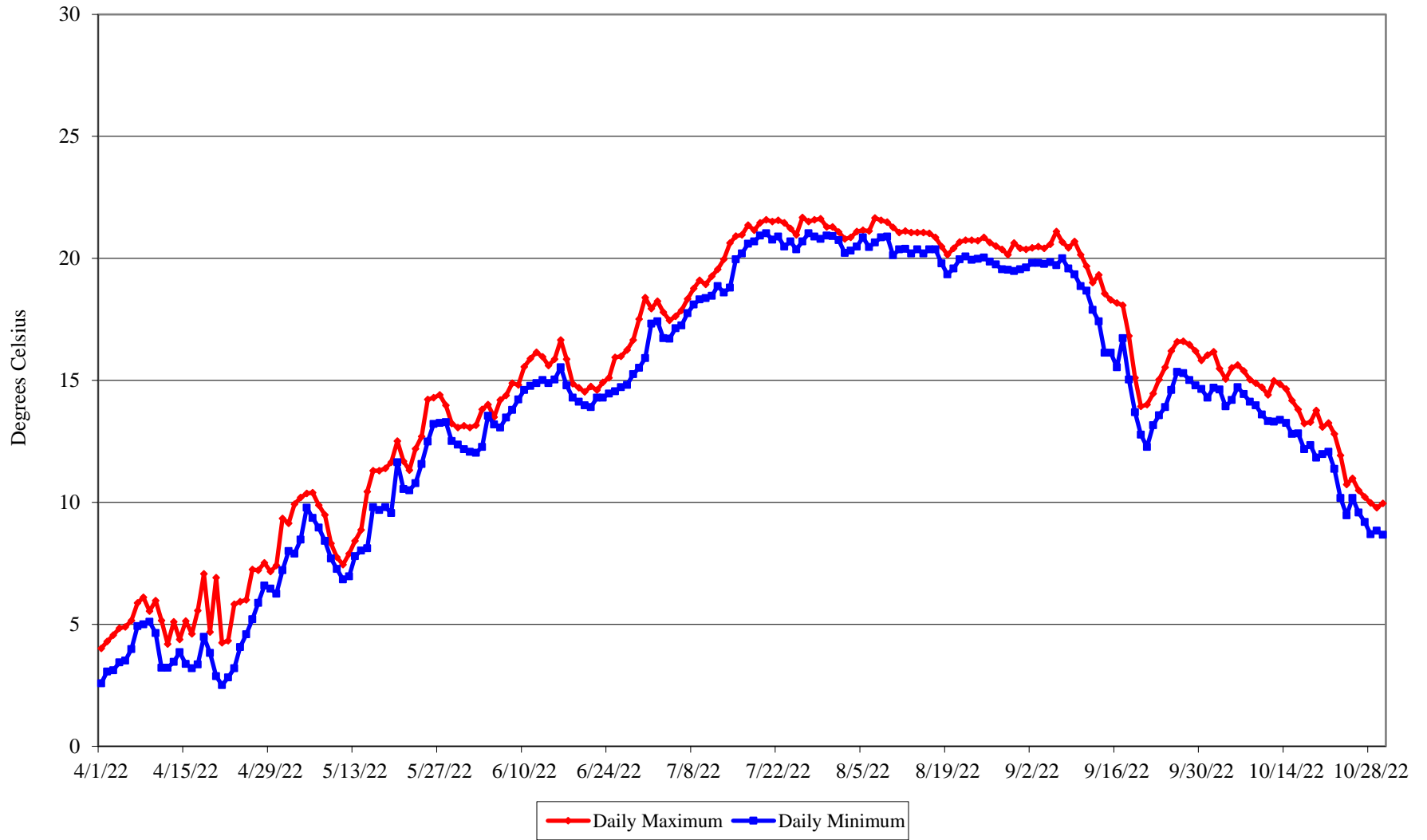


Figure 10. Daily Maximum and Minimum Water Temperatures in Upper Silver Fork American River (T6)

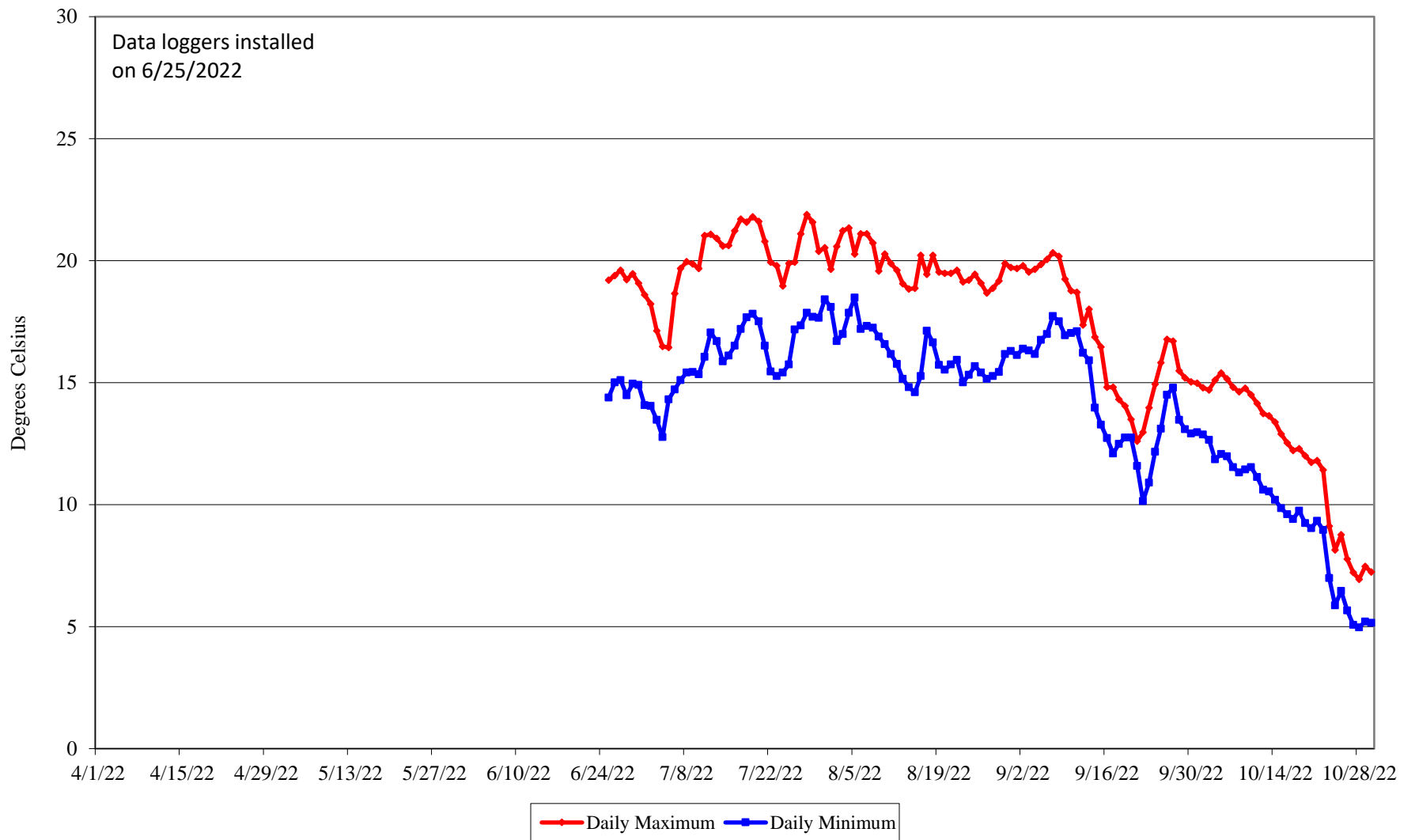


Figure 11. Daily Maximum and Minimum Water Temperatures in Lower Silver Fork American River (T7)

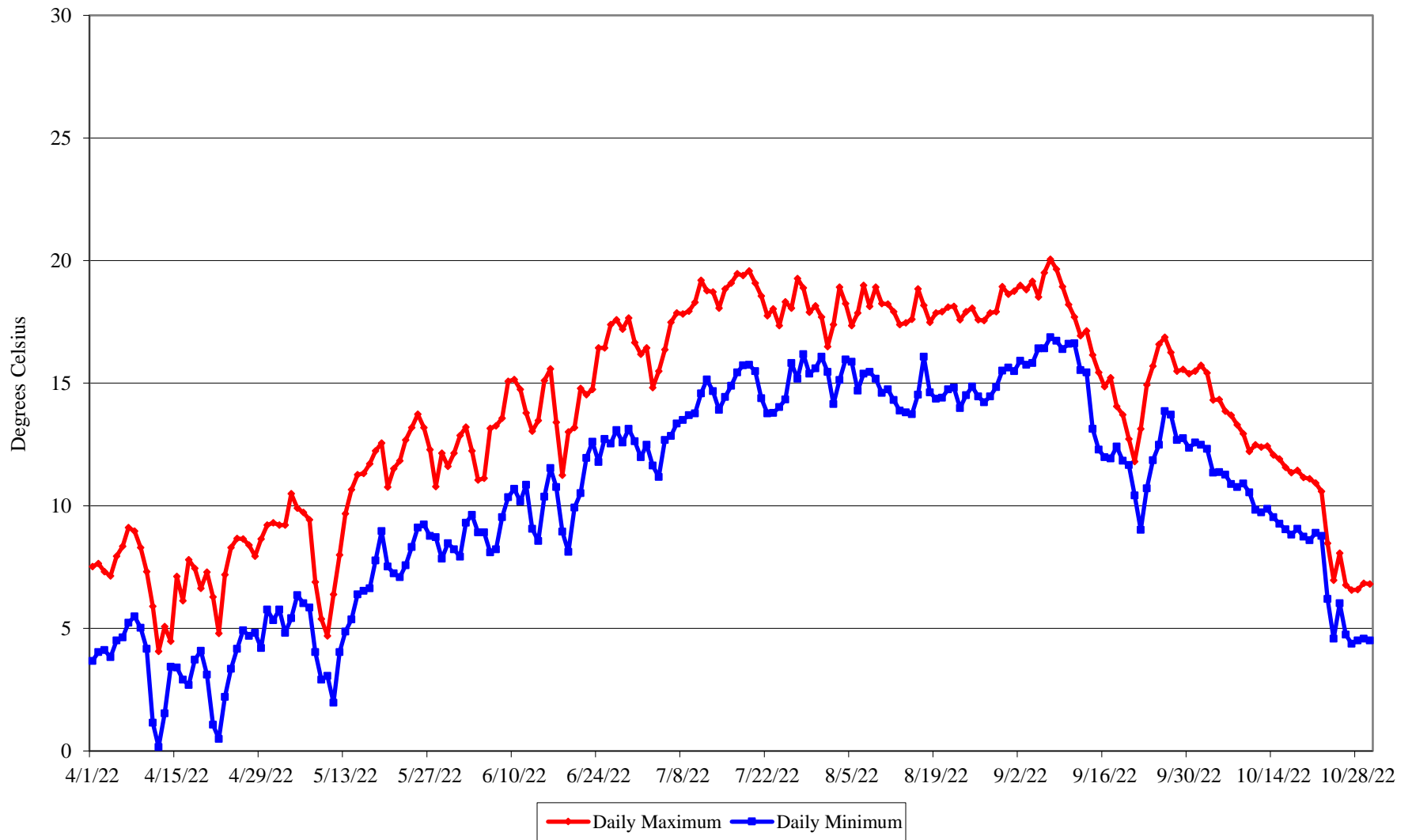


Figure 12. Daily Maximum and Minimum Water Temperatures in Silver Fork American River near Fitch Rantz Bridge (T29)

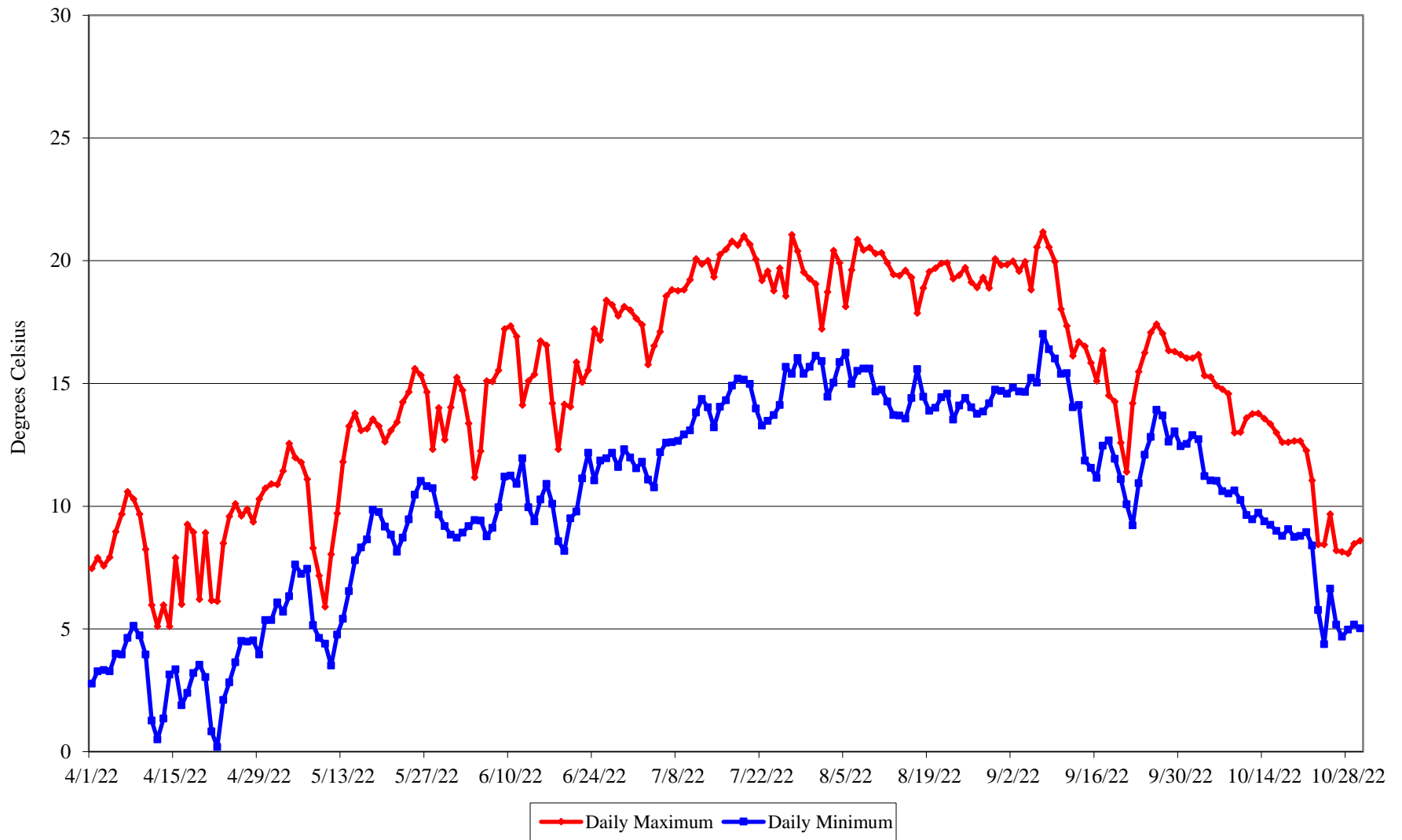


Figure 13. Daily Maximum and Minimum Water Temperatures in Silver Fork American River upstream of Caples Creek Confluence (T30)

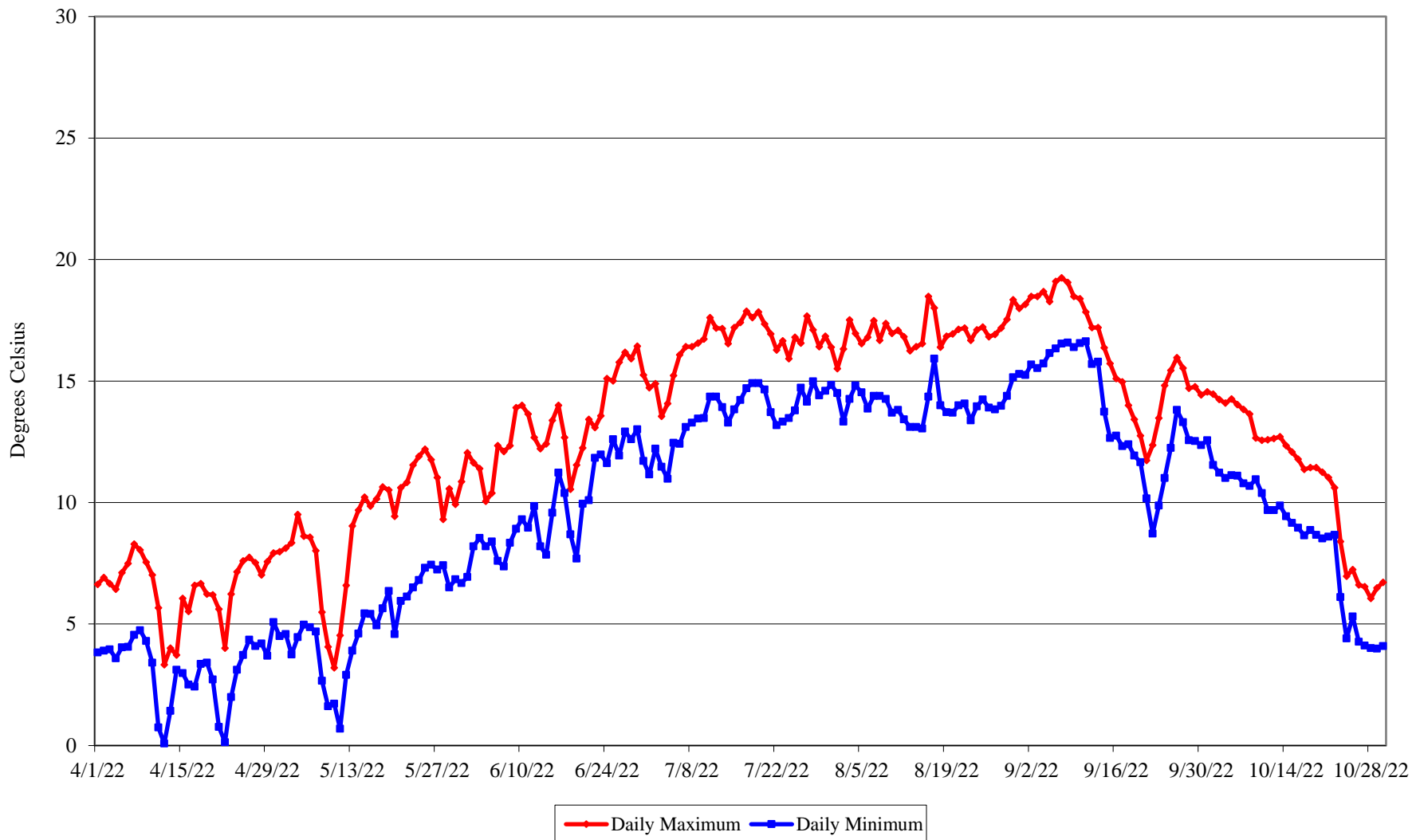


Figure 14. Daily Maximum and Minimum Water Temperatures in Caples Creek upstream of Silver Fork American River Confluence (T31)

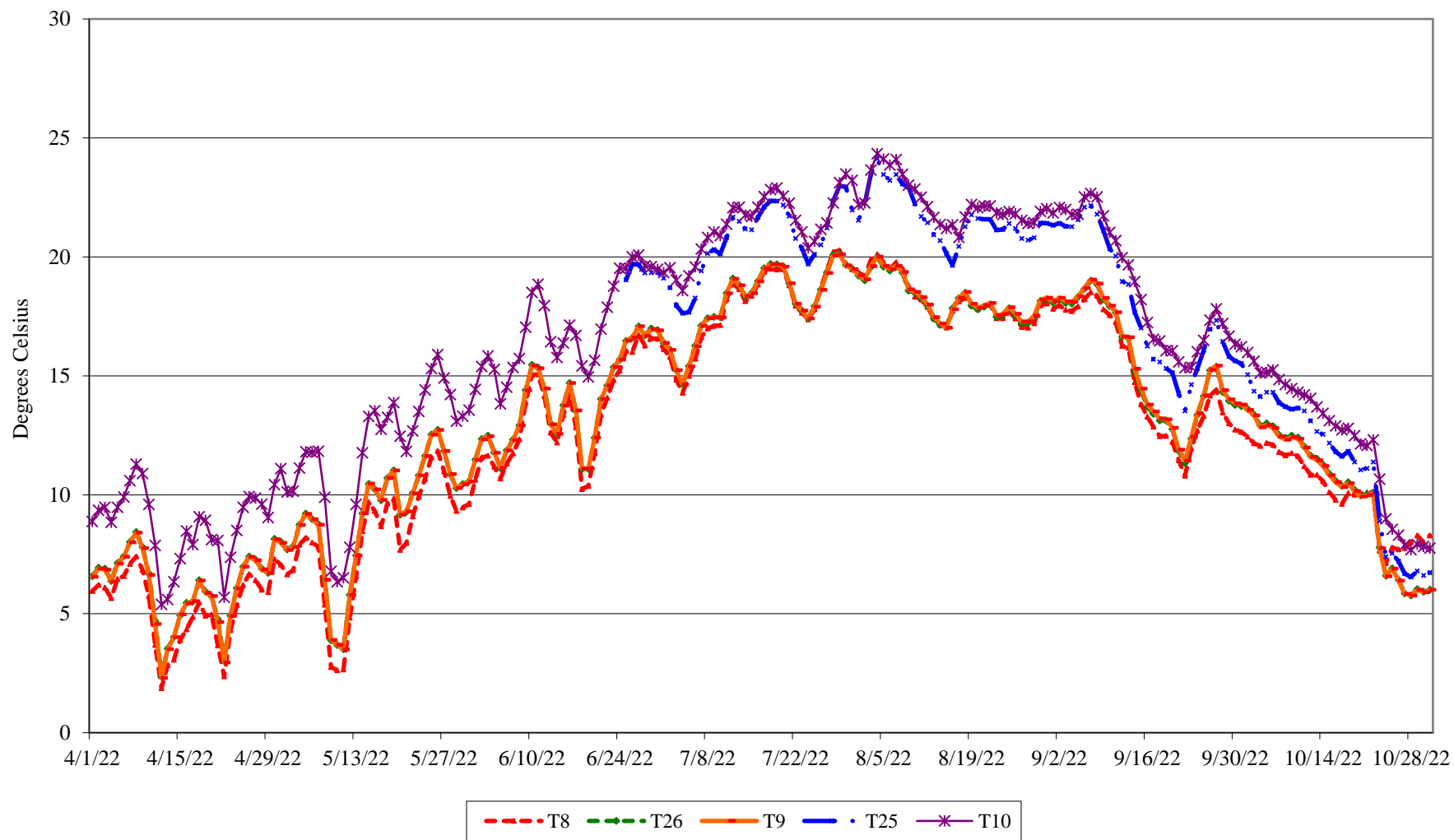


Figure 15. Daily Mean Temperatures in South Fork American River (T8, T26, T9, T25, & T10)

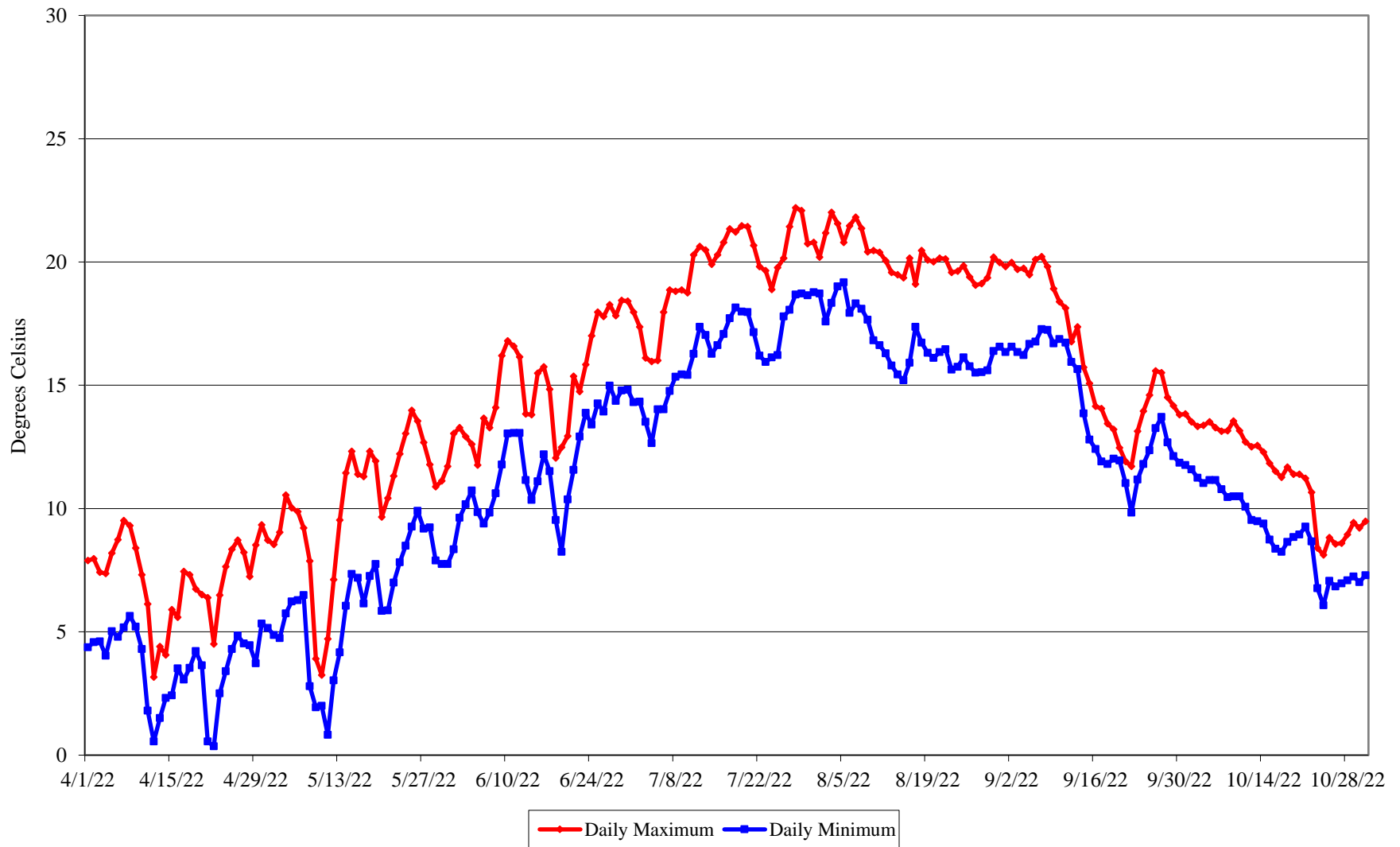


Figure 16. Daily Maximum and Minimum Water Temperatures in South Fork American above Silver Fork American River Confluence (T8)

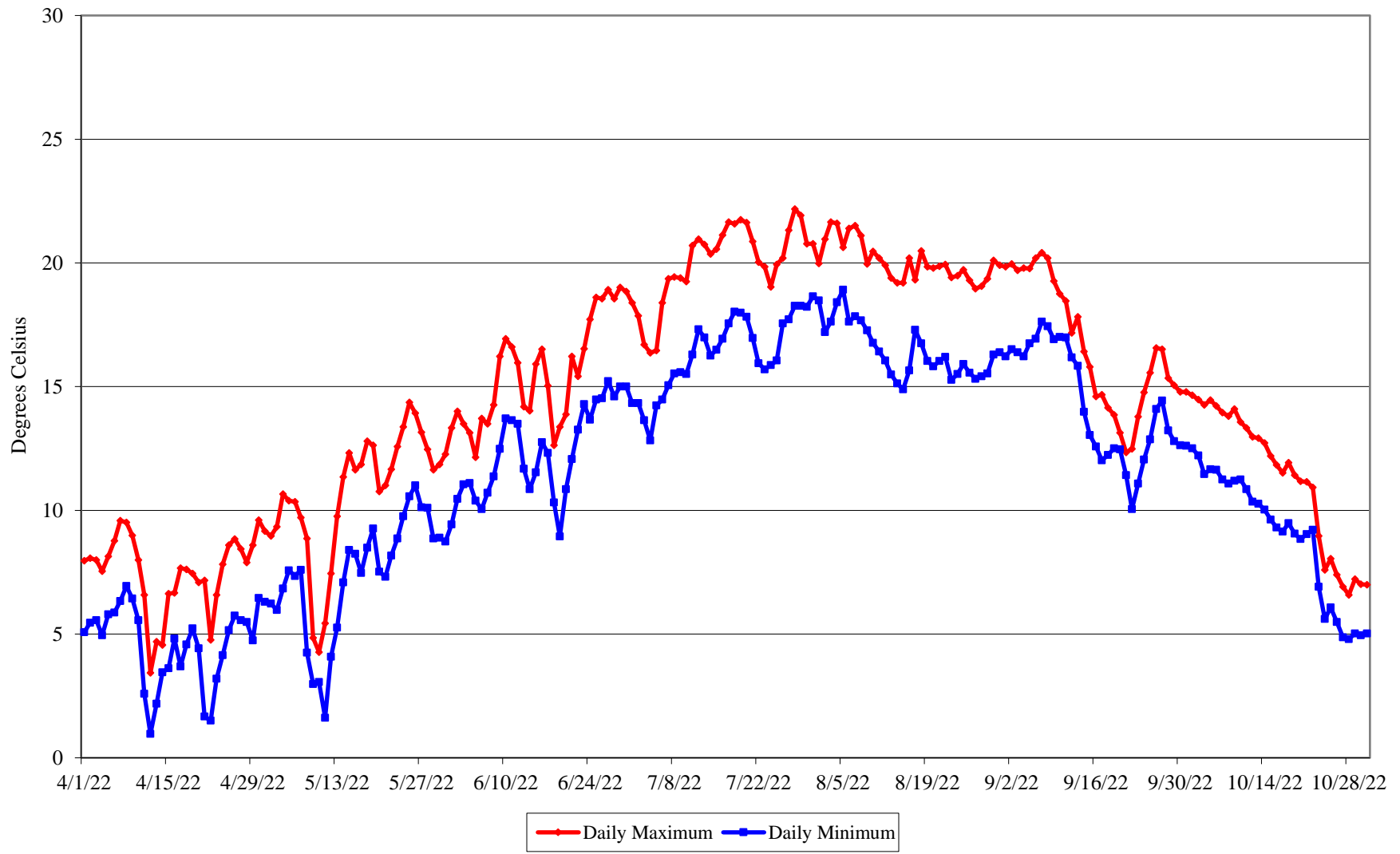


Figure 17. Daily Maximum and Minimum Water Temperatures in South Fork American River above Kyburz Diversion Dam (T26)

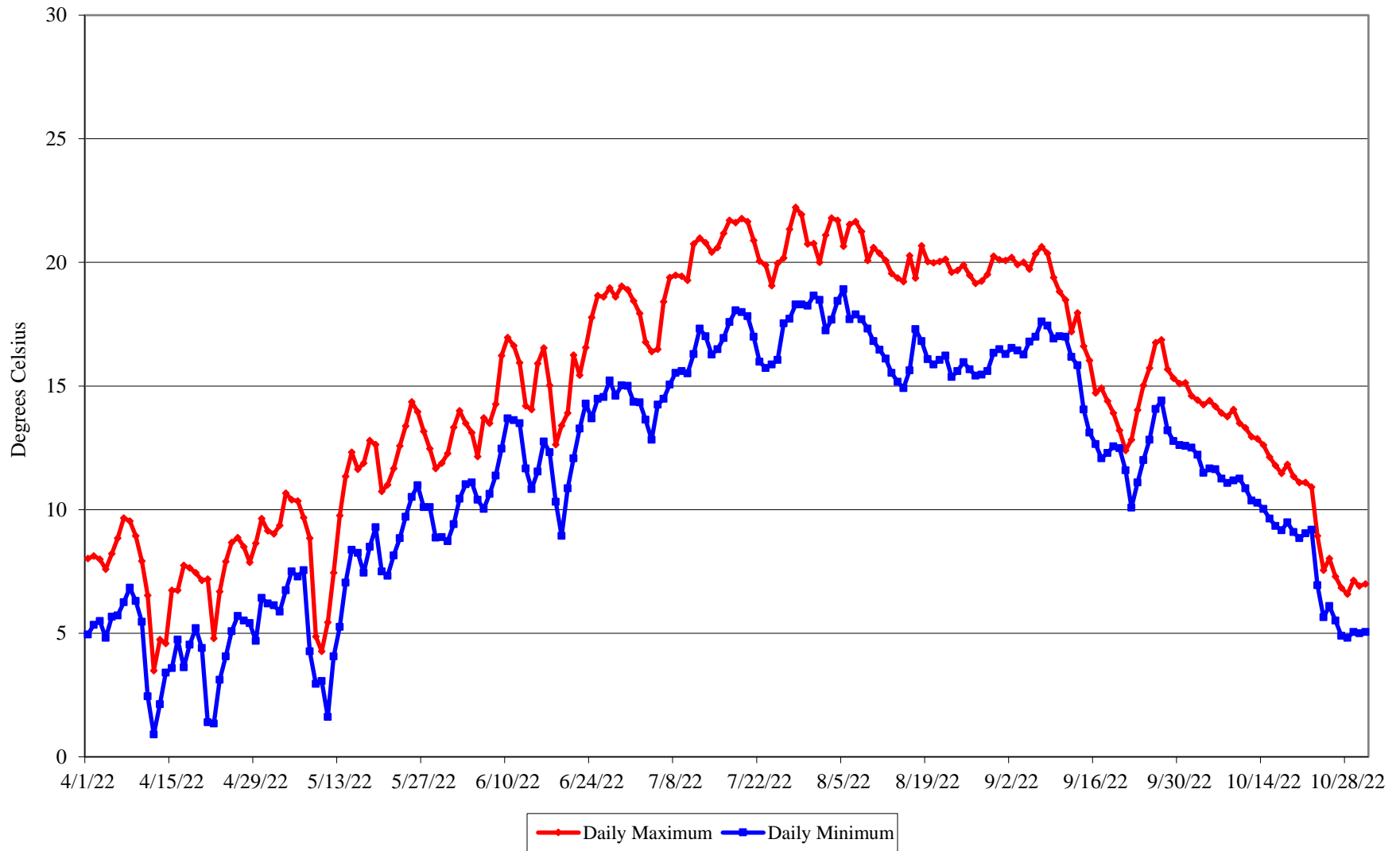


Figure 18. Daily Maximum and Minimum Water Temperatures in South Fork American River below Kyburz Diversion Dam (T9)

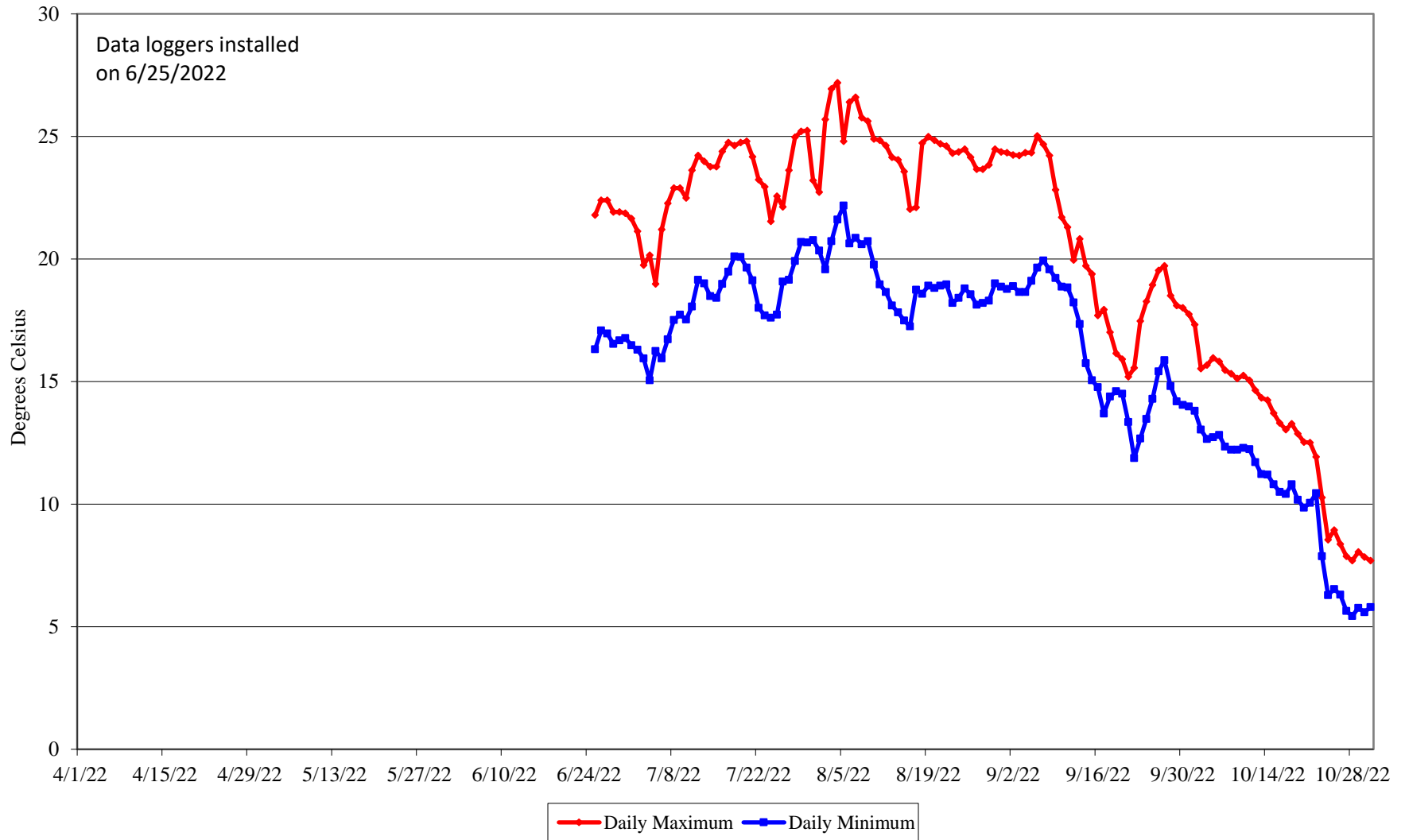


Figure 19. Daily Maximum and Minimum Water Temperatures in South Fork American River near Bridal Veil Picnic Area (T25)

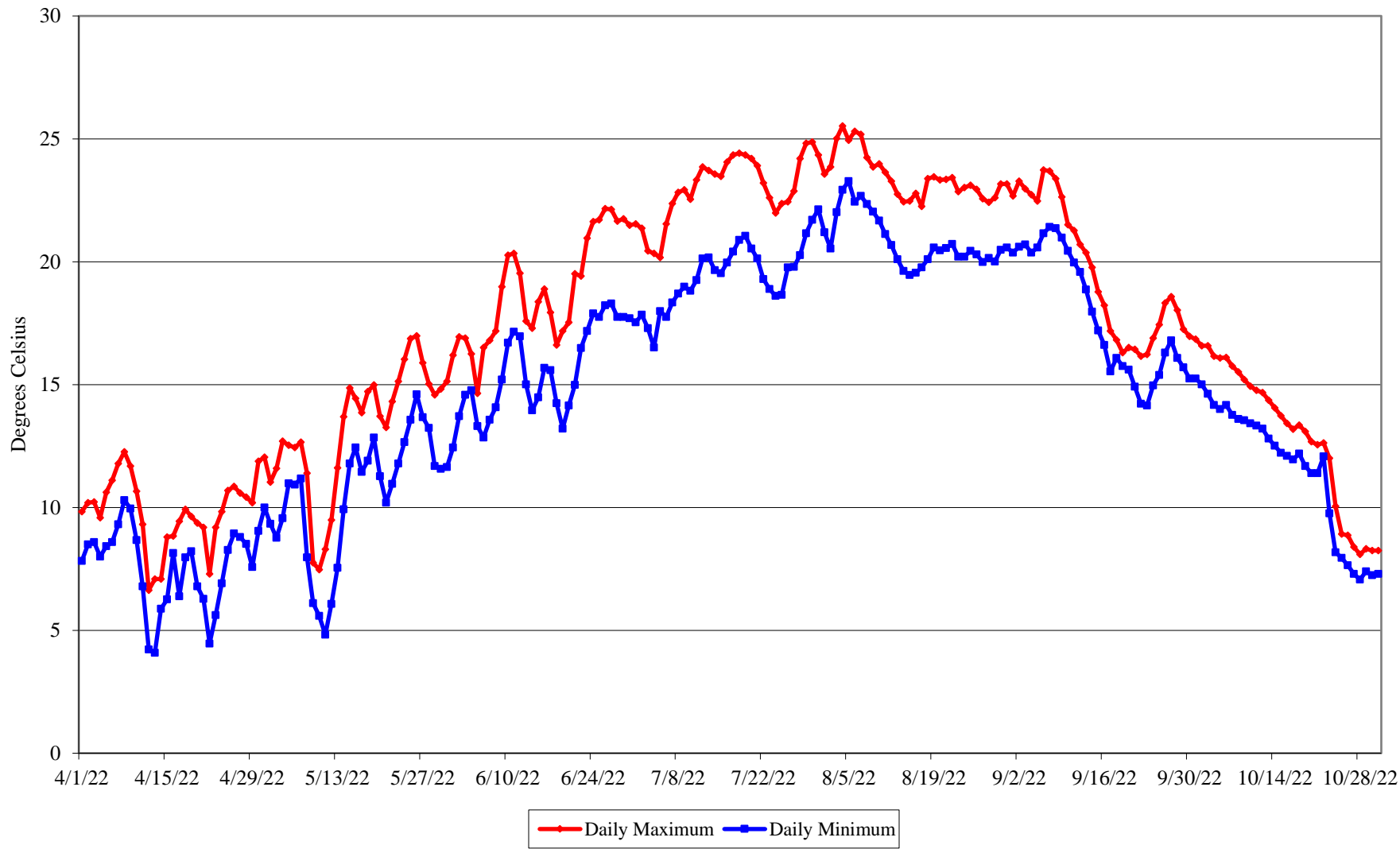


Figure 20. Daily Maximum and Minimum Water Temperatures in South Fork American River above Akin Powerhouse (T10)

Appendix B:

Spreadsheet data: 2021 Hourly, Daily Maximum,
Daily Minimum, and Daily Mean Water
Temperatures

<https://www.eid.org/our-services/hydroelectric/project-184/project-184-document-library>