REPORT

Mill Creek Aggregates Pit Surface Water

Appendix A of the 2024 Coordinated Monitoring Report

Submitted to:

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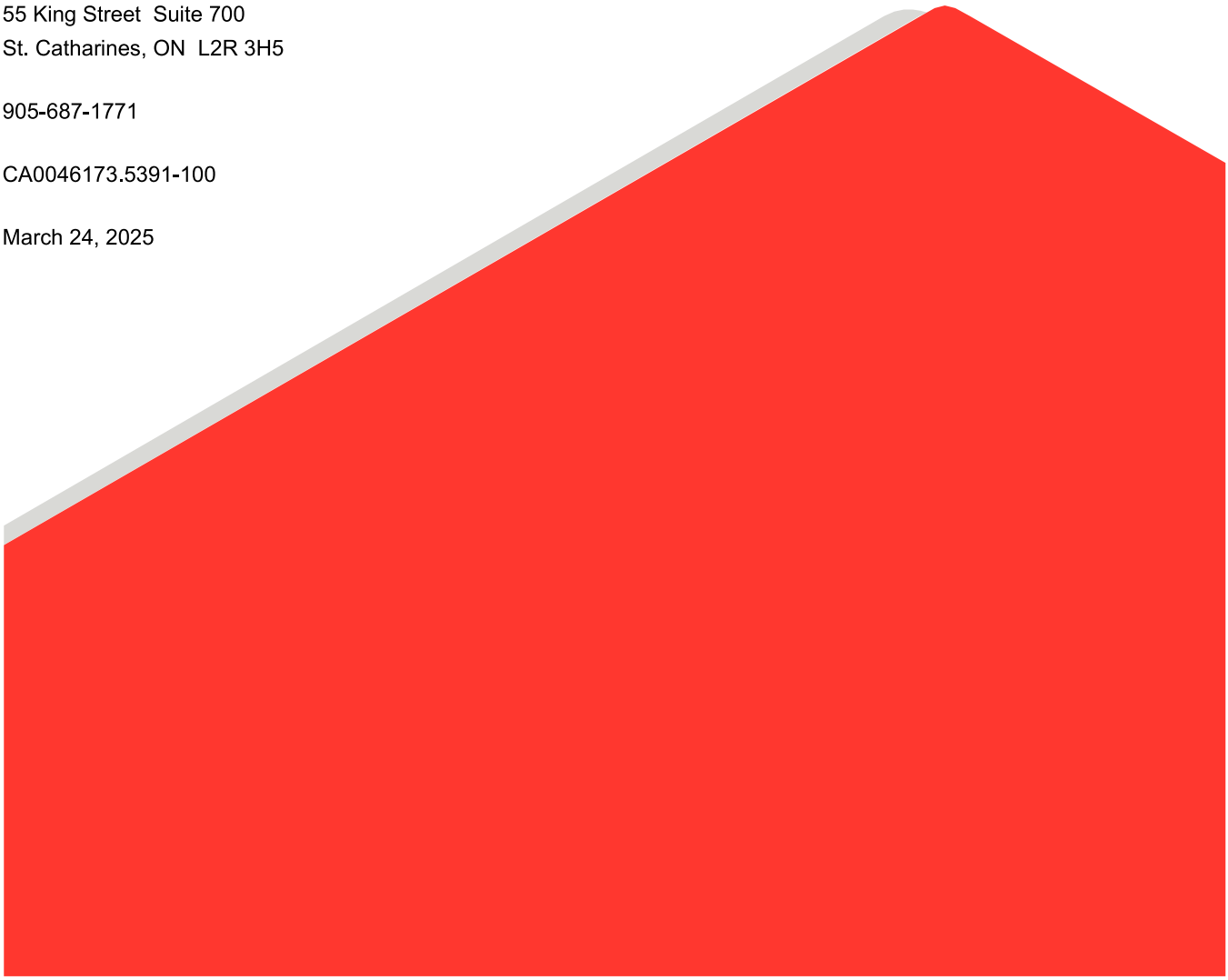

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1.0 INTRODUCTION

1.1 Background

The University of Guelph owns approximately 185.5 ha of land situated in Part Lot 24, Concession 1, and Part Lots 21, 22, 23, and 24, Concession 2, Township of Puslinch, in the County of Wellington. Dufferin Aggregates, a CRH Company, leases the property from the University of Guelph. The property, called the Mill Creek Aggregates Pit (Site), is licenced by the Ministry of Natural Resources (MNR) as a Category 3 Class 'A' Pit Below Water for extraction of the aggregate resource from above and below the water table (Licence #5738).

The northwest corner of the property is traversed by Mill Creek and by two tributary creeks, Galt Creek and Pond Creek. Various reaches of Mill Creek are documented as supporting naturally sustaining brown trout and brook trout populations. Brown trout spawning is documented as occurring in the section of Mill Creek on the Mill Creek Aggregates Pit property. Approximately half of the University property on the north side of Township Road 2 is within the regulatory flood line of Mill Creek. There is also a substantial area of wetland adjacent to Mill Creek and the tributary streams which is part of the larger Galt Creek Swamp, an area that is designated as a Provincially Significant Wetland (formerly a Class 1 Wetland) by the MNR.

A surface water monitoring program is conducted to satisfy operating license conditions 21(a), 21(c), 23 and 25. This report presents the surface water monitoring results for the period of January 1 through December 31, 2024, including a comparison to long term trends and available historical data.

1.2 Objective and Scope

The principal objectives of the 2024 Annual Surface Water Monitoring Program are:

- To comply with the pertinent requirements of the surface water monitoring program;
- To provide an assessment of the potential effects of on-site aggregate extraction activities on the local surface water setting; and
- To document results in an annual monitoring report and use to prepare the annual coordinated report for the Mill Creek Aggregates Pit operation.

This annual monitoring report includes the collation of the surface water monitoring data collected since 1993, a presentation of the results, and an analysis and discussion of the 2024 monitoring data. The accompanying summary document entitled "Mill Creek Coordinated Monitoring Report January 1 to December 31, 2024" integrates the monitoring results from the hydrogeology, surface water, and fisheries monitoring programs. This report forms **Appendix A** (Mill Creek Surface Water Monitoring Program) of the Coordinated Monitoring Report.

2.0 MONITORING PROGRAM

2.1 Climate Data

Daily precipitation and air temperature data are obtained from the Grand River Conservation Authority (GRCA) climate station located at Shade's Mills Conservation Area in the city of Cambridge, Ontario. It is noted that manual data recorded by GRCA are presented in this report, rather than the automated hourly climate data, which is consistent with past reports prepared for the Site. Data collected from the Kitchener/Waterloo climate station operated by Environment and Climate Change Canada (ECCC) were used to infill missing precipitation data.

In addition, automated air temperature data are measured using a barometric data logger at two locations on-Site (Air Temperature Stations 1 and 2), as shown in **Figure 1**. Measurements are recorded hourly using the data logger and the data are downloaded and reviewed monthly. The climate data from the Shade's Mills Conservation Area climate station are used to verify the on-Site recorded air temperature data.

As reported in the 2023 Surface Water Report, the barometric data logger installed at Air Temperature Station 1 failed in December 2023 and was subsequently replaced on February 27, 2024.

2.2 Mill Creek Discharge Monitoring

Four surface water monitoring stations (SWM1, SWM2, SWM3 and SWM4) were established on the Site in 1993. The locations of these stations are shown on **Figure 1**. Water level data have been obtained from SWM1 and SWM2 continually since 1993, while approval to discontinue monitoring at SWM3 and SWM4 was granted by the MNR in 2013. The original location of station SWM2 was on the north side of Concession Road 2; however, in 2012, the station was relocated to the south side of Concession Road 2 due to property access issues. A new rating curve was developed for the relocated station; and the assumption was that flow estimates from the relocated SWM2 monitoring station would be directly comparable to the estimates collected from the former SWM2 location, since the locations were in close proximity to each other, and no additional surface water inputs enter the creek between the two locations.

The surface water monitoring stations consist of a 5 cm (2 inch) diameter steel pipe, installed to a depth of approximately 1 m below the stream bed. The pipe which extends above the stream bed is perforated to allow pressure equalization. The pipe extends above the stream bed to a level below the low water level of the creek. Since the pipe remains submerged, potential for vandalism or tampering with the monitor is reduced.

2.2.1 Water Level Data Collection

Automated surface water levels at SWM1 and SWM2 are measured hourly using data loggers installed within the steel pipe. The data loggers rest on a stainless-steel bolt inserted through the pipe, so that the data logger sits approximately at the elevation of the stream bed. The data are downloaded and reviewed monthly. The surface water level data are used to estimate stream discharge using rating curves.

The automated water level data are compensated for barometric pressure, using the atmospheric pressure data measured by the barometric data logger located at Air Temperature Station 1. Back-up barometric pressure data are also measured at Air Temperature Station 2.

2.2.2 Manual Stream Flow Measurements

Rating curves for SWM1 and SWM2, which were previously developed, are continually updated to improve the accuracy of discharge calculations. In 2024, manual flow measurements at SWM1 and SWM2 were collected by WSP on the following dates, which cover a wide range of seasonal and flow conditions.

January 15	May 13	September 10
February 27	June 4	October 2
March 13	July 9	November 4
April 5	August 13	December 2

Stream flow measurements were measured at established stream transects at each surface water monitoring location. Evenly spaced measurements were recorded along each transect to obtain a cross-sectional profile of the wetted channel. The number of measurements at each cross-section was determined by dividing the width of the channel by 10. At each measurement location, the depth of water and velocity were recorded. Velocity measurements were obtained using a portable velocity meter. Where the measured water depth was equal to, or less than, 0.5 m, velocity measurements were recorded at 60% of the total depth above the stream bed. Where the measured water depth was greater than 0.5 m, velocity measurements were recorded at 20%, 60% and 80% of the total depth and the average of the velocity measurements was used to calculate stream discharge. To calculate stream discharge, the cross-sectional area between measurement points was multiplied by the velocity measurement for that area. The sum of each of the calculated flow values provided the total stream discharge.

The variability of stream discharge measurements using this method was most recently evaluated by WSP in September 2024, by replicating discharge measurements at the same location immediately following the original measurement. In 2024, the observed variation observed using this method was +/- 8%.

2.2.3 Rating Curve Development

Rating curves for SWM1 and SWM2 have been developed using data collected since 2010 and 2014, respectively. Flow measurement data collected prior to 2014 at SWM2 have been excluded due to a change in data loggers at this monitoring station (Stantec, 2019).

The rating curves use the manual stream flow measurements and the water level data recorded by the data logger at the time of the stream flow measurement. An equation derived from the rating curves is used to convert the continuous depth readings from the data loggers to an estimate of stream flow.

2.3 Mill Creek Temperature Monitoring

Hourly water temperature is recorded by the data loggers installed at SWM1, SWM2, SWM3 and SWM4. The water temperature data were downloaded monthly.

3.0 ANNUAL MONITORING RESULTS

3.1 Climate Data

The 2024 daily climate data from the GRCA Shade's Mills climate station are presented in **Table A-1** (**Appendix A**). Monthly climate data (2000 to 2024) from the GRCA Shade's Mills climate station are presented in **Table A-2** (temperature) and **Table A-3** (precipitation). **Tables A-2 and A-3** include the 30-year climate normal temperature and precipitation data, which are calculated from the GRCA Shade's Mills climate station using climate data collected between 1991 and 2020.

3.1.1 Air Temperature

Graphs of the 2024 air temperature data are provided in **Appendix A**. **Figures A-1 to A-5** present the data recorded at on-Site with barometric data loggers, while **Figures A-11 to A-15** present the data recorded at the GRCA Shade's Mills climate station.

A graph presenting the 2024 average monthly air temperature recorded at the Kitchener/Waterloo climate station compared to the 30-year (1991-2020) climate normal monthly temperatures is presented in **Figure 3-1**, below. As shown in the figure, the average monthly air temperature values recorded in each month in 2024 were warmer than the 30-year normal values.

As shown in **Table A-2** (**Appendix A**), the mean monthly air temperature in 2024 was 10.6°C, which is appreciably warmer than the 30-year average (8.3°C) and warmer than observed in 2021, 2022 and 2023 (10.1°C, 8.9°C and 8.3°C, respectively).

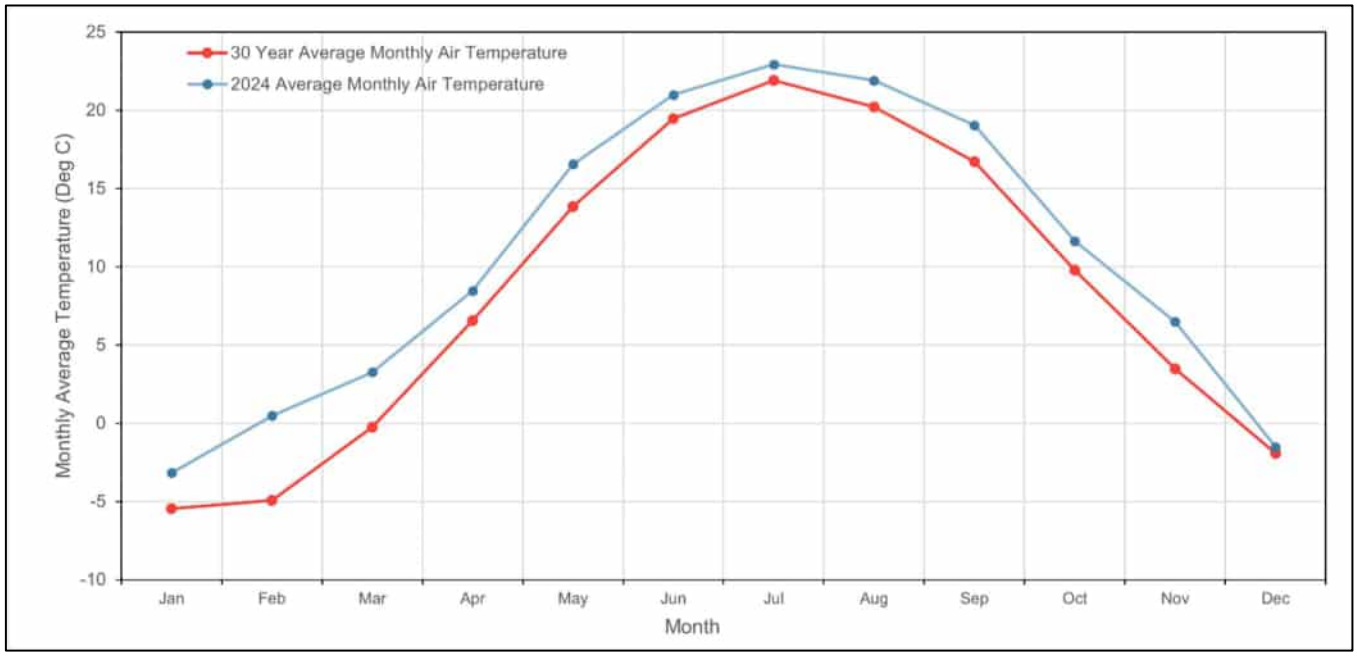

Figure 3-1: 2024 Average Monthly Air Temperature Compared to 30-Year Normal

3.1.2 Precipitation

Graphs presenting the 2024 total daily precipitation recorded at the GRCA Shade's Mills climate station are presented in **Figures A-6 to A-10** (**Appendix A**).

A graph of the 2024 total monthly precipitation compared to the 30-year average (1991-2020) monthly precipitation is presented in **Figure 3-2**, below. As shown in the figure, total monthly precipitation amounts received during January, April, July and August were considerably higher than the 30-year normal values for each month. The total monthly precipitation amounts received during February, September, October and November were considerably lower than the 30-year normal values for each month. The monthly precipitation recorded in the remaining months were similar to the 30-year normal values. The 2024 total monthly precipitation was higher than the 30-year average for the month in seven months of the year.

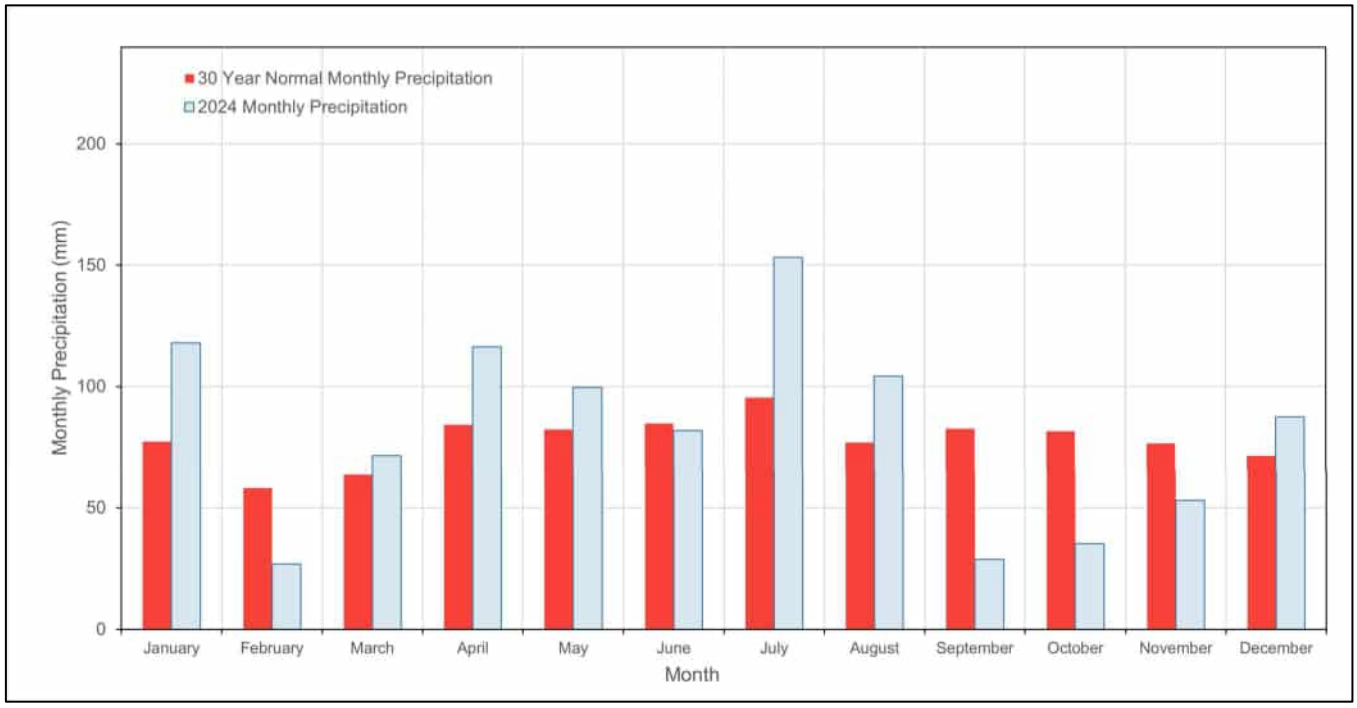

Figure 3-2: 2024 Total Monthly Precipitation Compared to 30-Year Normal

As shown in **Table A-3**, **Appendix A**, the total annual precipitation recorded at the GRCA Shade's Mills Climate Station in 2024 was 976 mm, which is 4% higher than the 30-year normal annual precipitation (935 mm) and similar to the total precipitation received in 2023 (983 mm).

3.2 Mill Creek Discharge Monitoring

3.2.1 Rating Curves

A table presenting the data used to prepare the SWM1 and SWM2 rating curves is provided in **Appendix B**. The rating curves for SWM1 and SWM2 are presented in **Figures 3-3 and 3-4**, respectively.

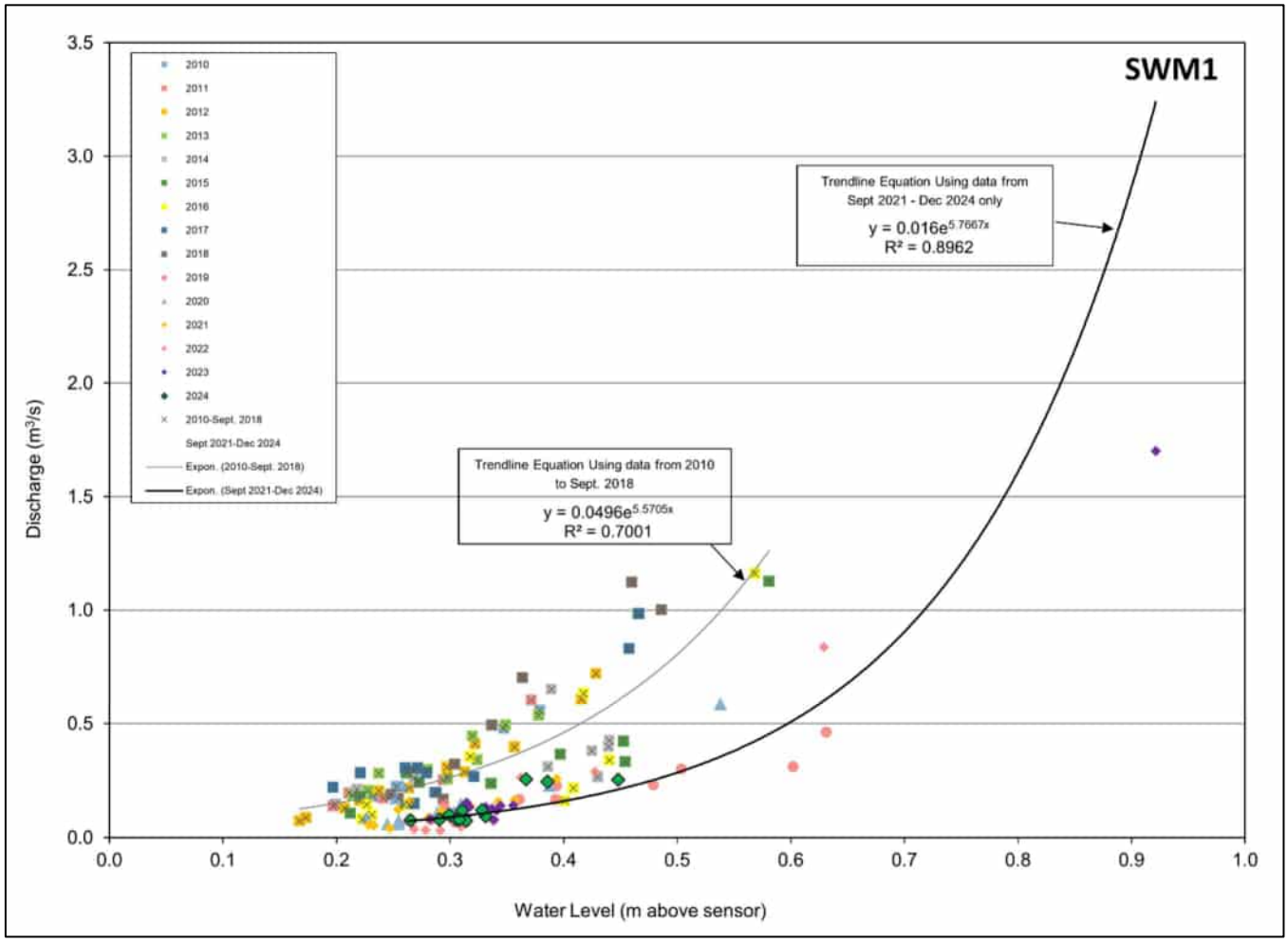

Figure 3-3: SWM1 Rating Curve

SWM1 is located at the farthest upstream monitoring location for the Site, within Mill Creek. A total of 153 manual stream flow measurements have been collected at SWM1 since 2001.

As noted in the 2019, 2020 and 2021 Surface Water Reports (WSP, 2020, 2021 and 2022), a beaver dam located downstream of SWM1 was discovered in 2018 and was removed in September 2021. The beaver dam was interpreted to be causing unrepresentative water levels/discharge and, as such, the stream flow measurements collected while the beaver dam was present were inconsistent with the rating curves developed prior to the presence of the beaver dam. Since the dam was removed in September 2021, the manual stream flow data points continued to be shifted compared to the rating curve developed with data collected prior to October 2018. Since the previously established rating curve formula would result in an over-estimation of 2024 stream flow, a new rating curve formula was fitted to the manual stream flow data points collected since the beaver dam was removed (September 2021 through December 2024), as shown in **Figure 3-3**. Stream flow calculations based on the 2024 water level data were completed using the new formula.

As shown in **Table B-1** (**Appendix B**), the depth of the water above the logger at SWM1 at the time of the manual flow measurements in 2024 ranged from 0.27 m to 0.45 m. Within this 0.18 m difference in water level, flow measurements ranged between 0.074 m^3/s and 0.256 m^3/s.

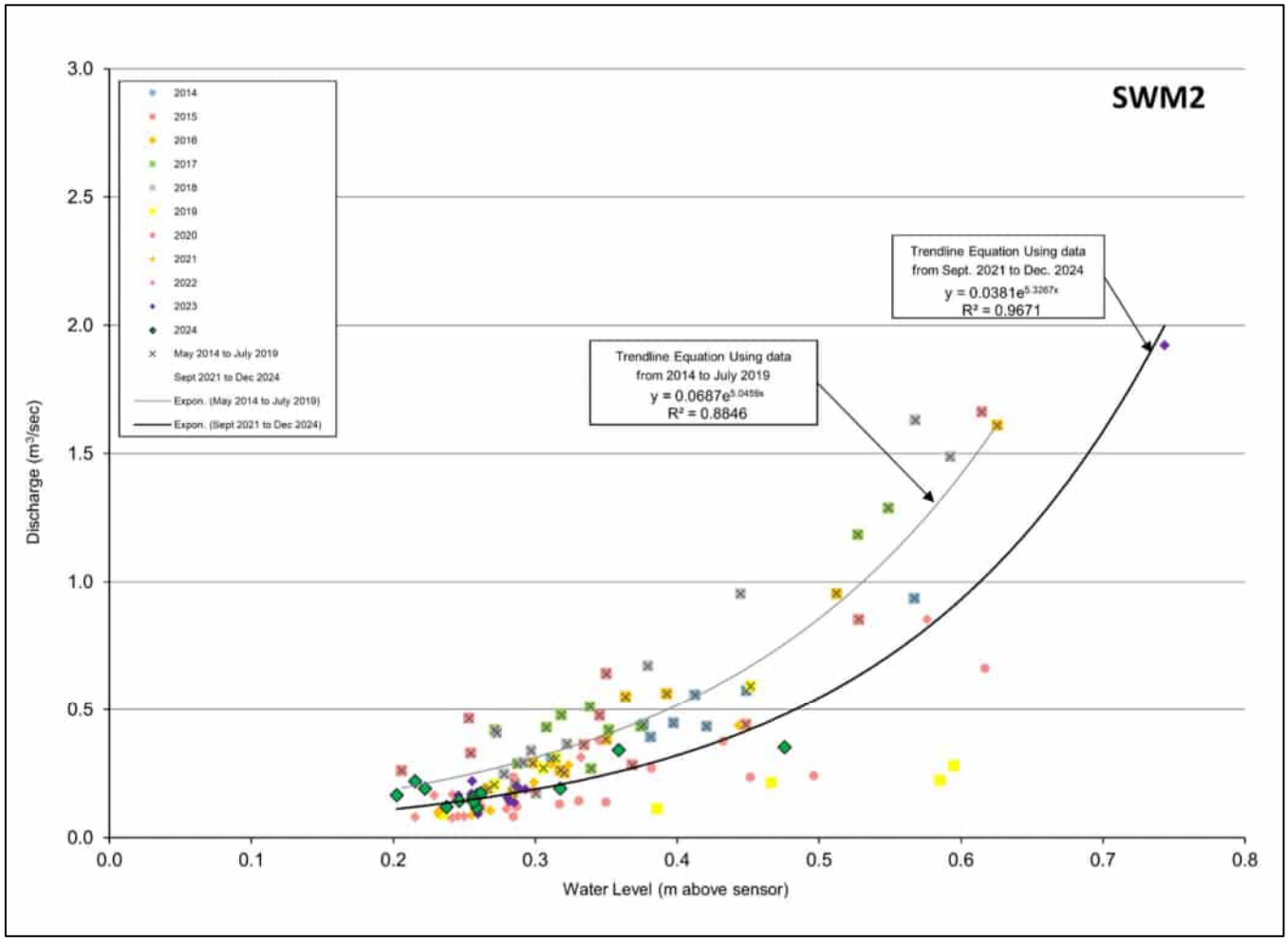

Figure 3-4: SWM2 Rating Curve

SWM2 is located within Mill Creek, at the downstream end of the Site. As shown in **Figure 1**, additional flow inputs from Galt Creek and Pond Creek enter Mill Creek between SWM1 and SWM2. A total of 118 manual stream flow measurements have been collected at SWM2 since 2014.

As noted in the 2019, 2020 and 2021 Surface Water Reports (WSP, 2020, 2021 and 2022), a beaver dam located downstream of SWM2 was discovered in 2019 and was removed in September 2021. The beaver dam was interpreted to be causing unrepresentative water levels/discharge and, as such, the stream flow measurements collected while the beaver dam was present were inconsistent with the rating curves developed prior to the presence of the beaver dam. Since the dam was removed in September 2021, the manual stream flow data points continued to be shifted compared to the rating curve developed with data collected prior to August 2019. Since the previously established rating curve formula would result in an over-estimation of 2024 stream flow, a new formula was fitted to the manual stream flow data points collected since the beaver dam was removed (September 2021 through December 2024), as shown in **Figure 3-4**. Stream flow calculations based on the 2024 water level data were completed using the new formula.

As shown in **Table B-1** (**Appendix B**), the depth of the water above the logger at SWM2 at the time of the 2024 manual flow measurements ranged between 0.20 m and 0.48 m above the data logger. Within this 0.28 m difference in water level, the flow measurement ranged between 0.116 m^3/s and 0.352 m^3/s.

The formulas generated using the rating curves, which are used to estimate the flow rates for the 2024 water level data, are shown in **Table 3-1**, below. The table also includes the correlation (R^2 value) for the rating curves. R^2 values can range between 0 and 1, with a higher value indicating a better relationship between logger depth and stream flow.

Table 3-1: Rating Curve Formulas Used to Estimate Stream Discharge for 2024 Water Level Data

SWM1	SWM2
$y = 0.016e^{5.7667x}$ $R^2 = 0.8962$	$y = 0.0381e^{5.3267x}$ $R^2 = 0.9671$
n = 40	n = 40

3.2.2 Quality Assurance and Quality Control

Stream discharge measurements and automated water level/temperature data were plotted on graphs to visually identify any potentially erroneous data. Periodically, an individual data logger measurement will be inconsistent compared to adjacent measurements, which typically corresponds to the data logger recording a reading while the data logger has been brought to ground surface for data download. In these instances, the individual data reading is excluded from the dataset.

Duplicate data loggers were maintained at several monitoring locations to ensure that a data back-up is available in the event of a data logger failure. In addition, if a data logger cannot be downloaded in the field and is required to be shipped to the manufacturer or returned to the office for maintenance/download, the duplicate data logger will continue to provide data during that time. The required hourly water level, water temperature and air temperature data were successfully collected in 2024.

3.2.3 Mill Creek 2024 Discharge Trends

The 2024 hourly discharge rates at SWM1 and SWM2, calculated using the 2024 rating curve formulas presented in **Table 3-1**, are presented in **Figure 3-5**, below. More detailed monthly figures are presented in **Figures C-1 to C-24** (**Appendix C**). As observed historically at the Site, the calculated flow at SWM2 is typically greater than, and proportional to, the flow calculated at SWM1.

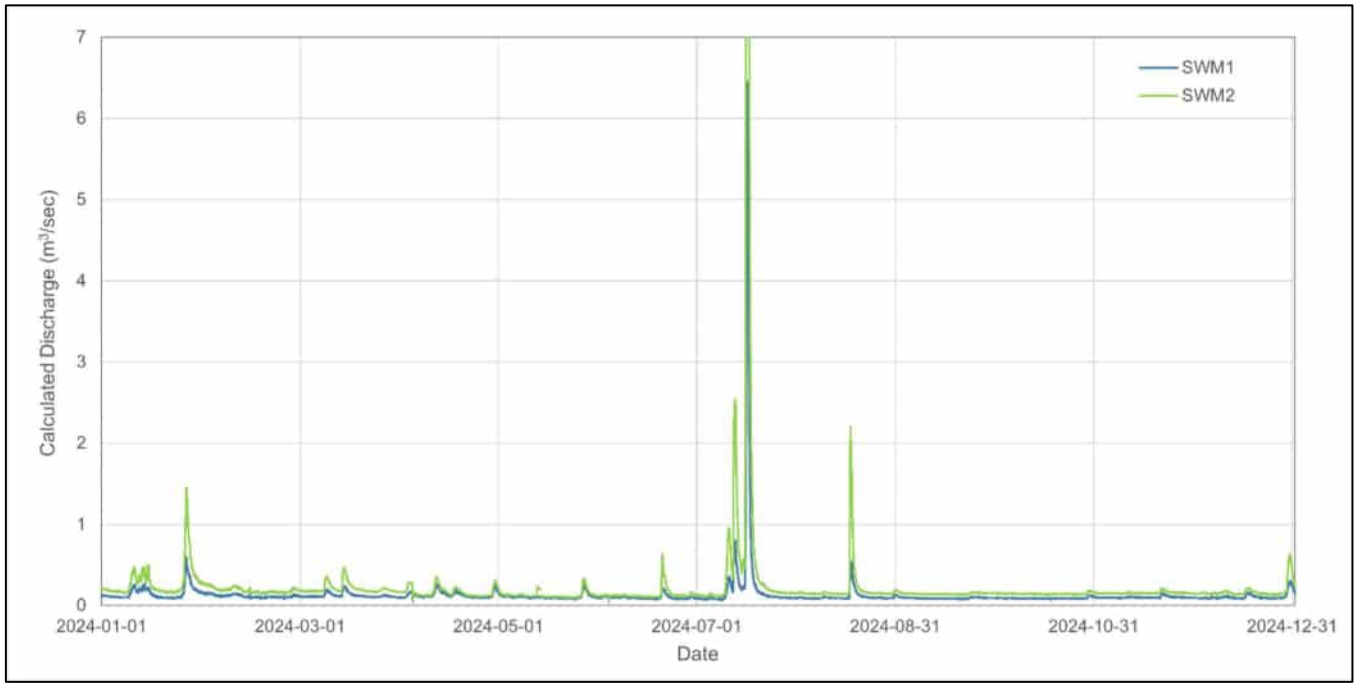

Figure 3-5: 2024 Calculated Hourly Stream Discharge at SWM1 and SWM2

The 2024 minimum and maximum calculated instantaneous stream discharge at stations SWM1 and SWM2, and the dates when these discharges occurred, are summarized in **Table 3-2**, below.

Table 3-2: 2024 Minimum and Maximum Instantaneous Stream Discharge Recorded at SWM1 and SWM2

	SWM1		SWM2	
	Discharge (m^3/s)	Date	Discharge (m^3/s)	Date
Minimum Stream Discharge	0.062	5-Apr-2024	0.038	4-Jun-2024
Maximum Stream Discharge	6.45	17-Jul-2024	14.02	17-Jul-2024

It is noted that the accuracy of flow estimates generated using rating curves decreases with higher flow levels because higher flow levels are typically greater than the range of flows measured to develop the rating curve. For example, as shown in **Table B-1** (**Appendix B**), the maximum manual flows measured at SWM1 and SWM2 in 2024, which are used to develop the rating curve, are 0.256 m^3/s and 0.352 m^3/s, respectively, but the 2024 flow data presented in **Figure 3-5** show occasions where the calculated flows are higher than these values.

3.2.4 Effects of Precipitation on Mill Creek Flow

Daily precipitation data recorded at the GRCA's Shade's Mills climate station are illustrated with the calculated average daily stream discharge at SWM1 and SWM2, in **Figures 3-6 and 3-7**, below. It is noted that the daily average flows shown below differ from the hourly flow measurements presented in **Figure 3-5**.

The plot of precipitation data with the flow data shows a strong correlation, as increased flows were often observed shortly after precipitation events. In the drier months, rainfall events did not always result in increases in discharge, which is likely attributed to higher soil infiltration and vegetative cover.

The maximum daily average flow at both SWM1 and SWM2 in 2024 occurred on July 17. A total of 56 mm of rain was recorded at the GRCA Shade's Mills Conservation Area on July 17, with an additional 18.4 mm between July 15 and 16. The maximum average daily flow rates measured at SWM1 and SMW2 (4.25 and 10.33 m^3/s, respectively) are interpreted to be overestimated due to the lower accuracy of the rating curve formula at higher flows, as discussed in Section 3.2.3.

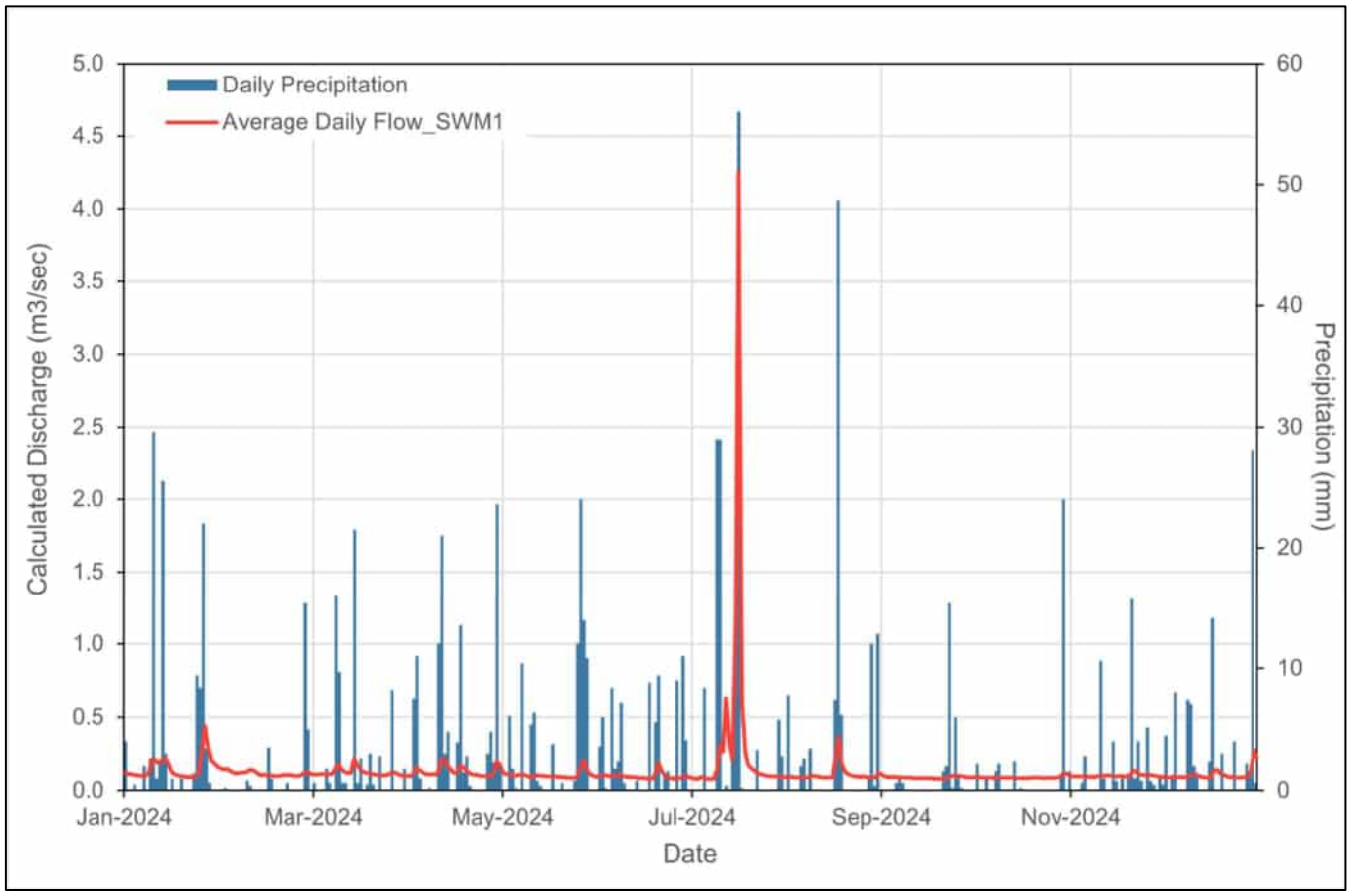

Figure 3-6: 2024 SWM1 Daily Average Flow and Daily Precipitation

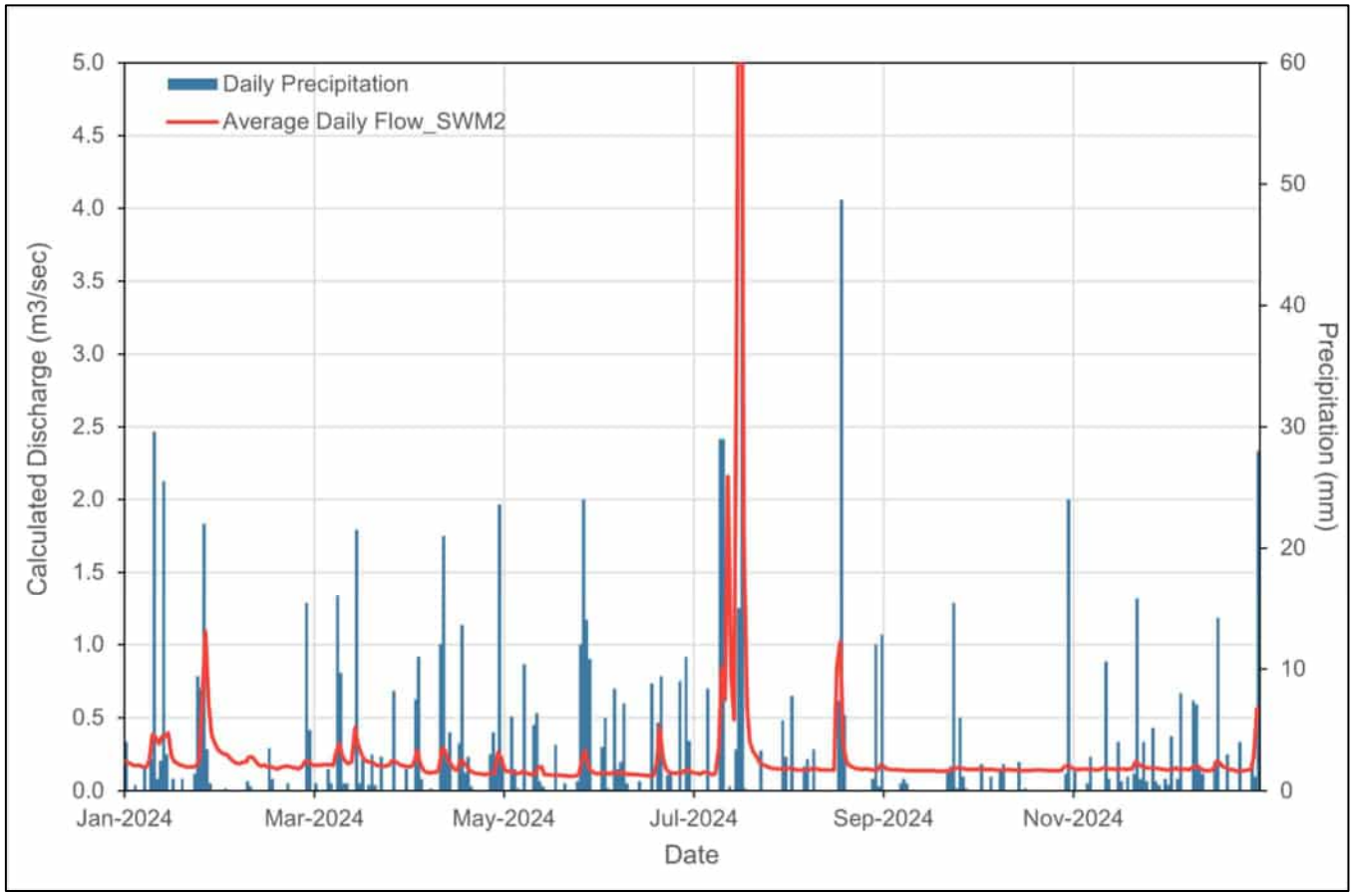

Figure 3-7: 2024 SWM2 Daily Average Flow and Daily Precipitation

3.2.5 Long Term Flow

The 7-day low flow is a standard hydrological value which represents the average flow rate of the 7-day period of lowest flow for each year. The 7-day low flow at SWM2 is used to compare low flows over time for the Site. In 2024, the 7-day low flow at SWM2 was 0.104 m^3/s, which occurred from May 19 to 25. As shown in Table A-1, the daily precipitation data indicate that only 6 mm of precipitation was recorded between May 13 and May 25, 2024, and a multi-day rainfall event totalling more than 60 mm began on May 26, 2024. In the absence of rainfall and runoff, the 7-day low flow likely represents baseflow conditions.

The SWM2 7-day low flow values since 2000 are presented in **Figure 3-8**, below. The 2024 7-day low flow at SWM2 is similar to the 7-day low flow values recorded in 2007 and each year since 2020. The average of the SWM2 7-day low flow values from 2000 to 2023 is 0.203 m^3/s. The 2024 7-day low flow of 0.104 m^3/s is considerably lower than the historical average. The lower 7-day low flow values recorded since 2020 are attributed to the lower-than-normal amount of precipitation received in 2020, 2021, 2022 and the first half of 2023. Lower flows at SWM2 may also be related to the presence of a beaver dam located approximately 50 m upstream of SWM2, which was observed to be intact throughout 2024.

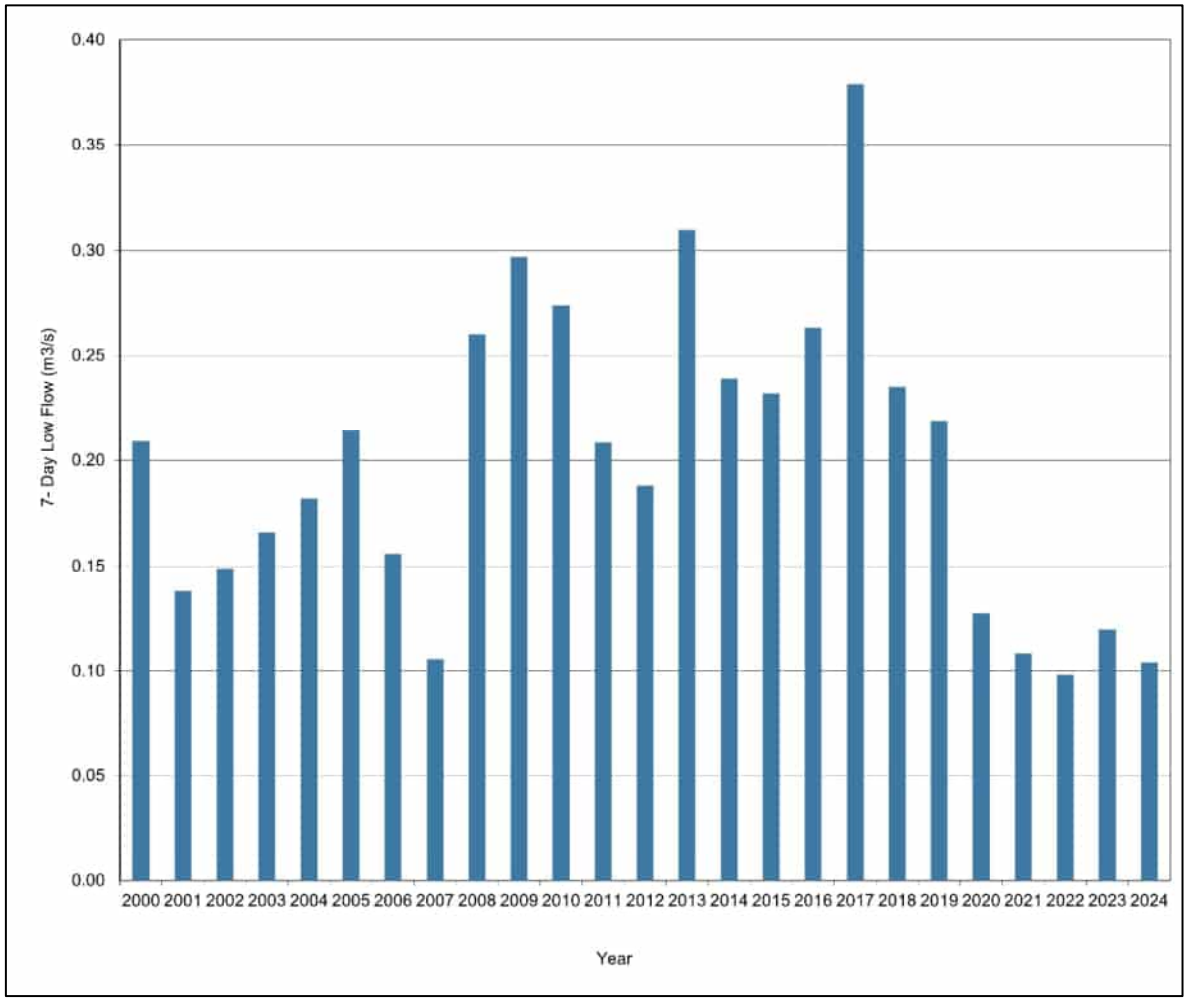

Figure 3-8: 7-Day Low Flow at SMW2 (2000-2024)

As completed in previous years, the 7-day low flow during the 2024 summer months (June 21 through September 22) was calculated. The summer 7-day low flow at SWM2 (0.120 m^3/s) occurred from July 3 to 9 and was below the historical average (0.206 m^3/s). The 2024 summer 7-day low flow was slightly higher than the full year 7-day low flow observed in mid-May, which reflects the lack of precipitation recorded in the spring months and the significant increase in precipitation observed in July/August.

The historical summer 7-day low flow values from SWM2 are plotted with the total summer precipitation (June 21 through September 22) and average summer air temperature (mean of the daily mean temperatures from June 21 to September 22) in **Figures 3-9 and 3-10**, respectively.

As shown in **Figure 3-9**, there is an apparent relationship between total summer precipitation and summer 7-day low flow. A linear regression of the data presented in the figure (2000 to 2024) indicates that there is a positive correlation between stream flow and summer precipitation at SWM2 (R^2 = 0.1754).

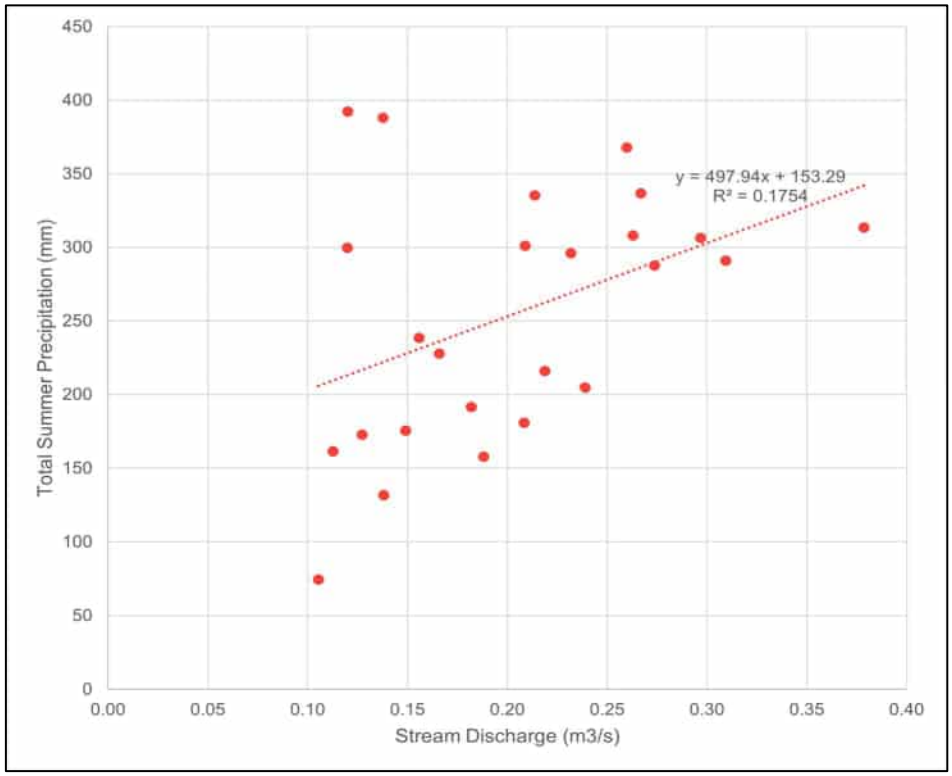

Figure 3-9: Total Summer Precipitation Versus Summer 7-Day Low Flow at SWM2 (2000-2024)

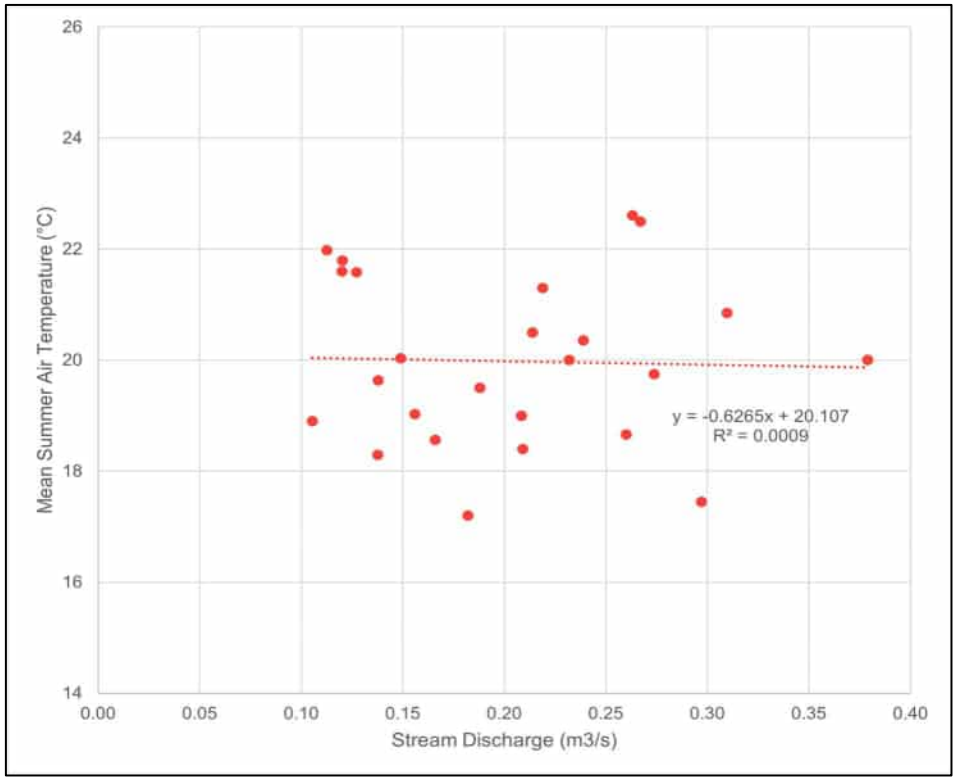

Figure 3-10: Mean Summer Air Temperature Versus Summer 7-Day Low Flow at SWM2 (2000-2024)

As shown in **Figure 3-10**, there is no apparent relationship between mean summer air temperature and summer 7-day low flow, which is confirmed by the linear regression of the data (R^2= 0.0009).

Regression analysis can identify potential relationships between the predictor variable (climate related variables) and the response variable (7-day low flow). Regression analysis includes calculating the P-value. A P-value of <0.05 is indicative of a statistically significant relationship between variables. Regression plots and statistical data output for these relationships are provided in **Appendix D**. As shown in **Appendix D**, the calculated P-value for the relationship between summer stream flow and summer precipitation is 0.047, indicating a statistically significant relationship. The calculated P-value for the relationship between summer stream flow and summer temperature is 0.908, which does not indicate a statistically significant relationship. These analyses are consistent with previous observations that summer stream flow in Mill Creek is influenced by summer precipitation.

3.2.6 Historical Mill Creek Discharge Trends

The 2024 instantaneous minimum and maximum stream discharge values from SWM1 and SWM2 are presented in **Table 3-2** in **Section 3.2.3** and are presented graphically in **Figures 3-11 and 3-12**, respectively.

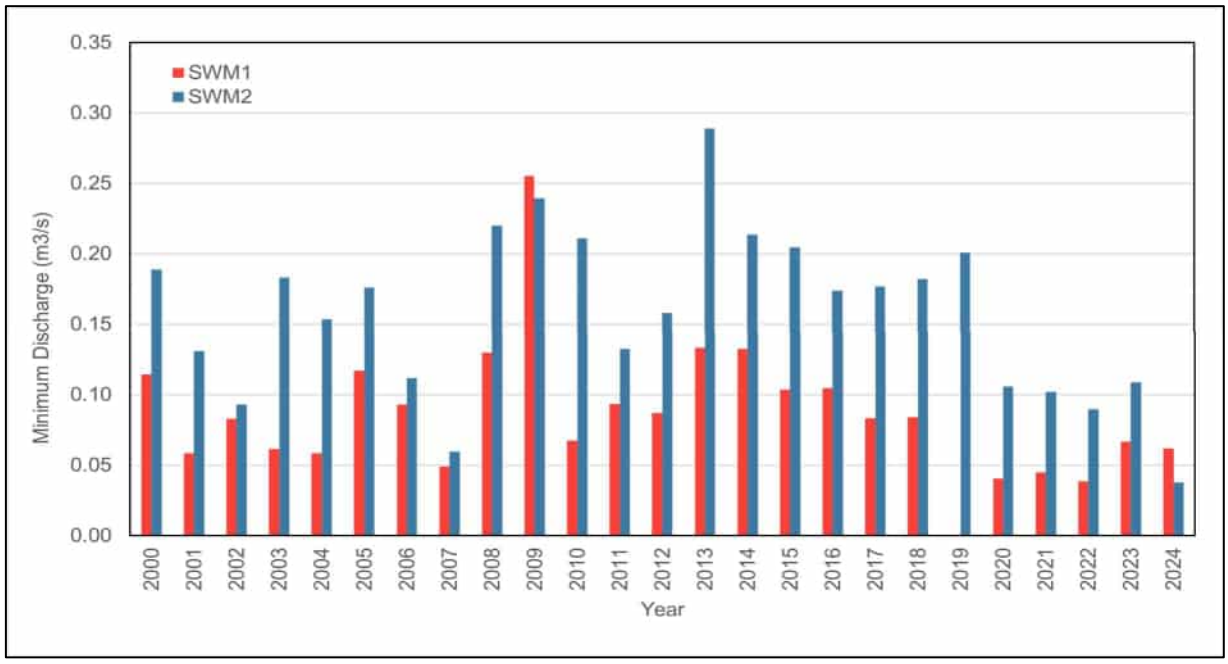

Figure 3-11: SWM1 and SWM2 Instantaneous Minimum Stream Discharge (2000-2024)

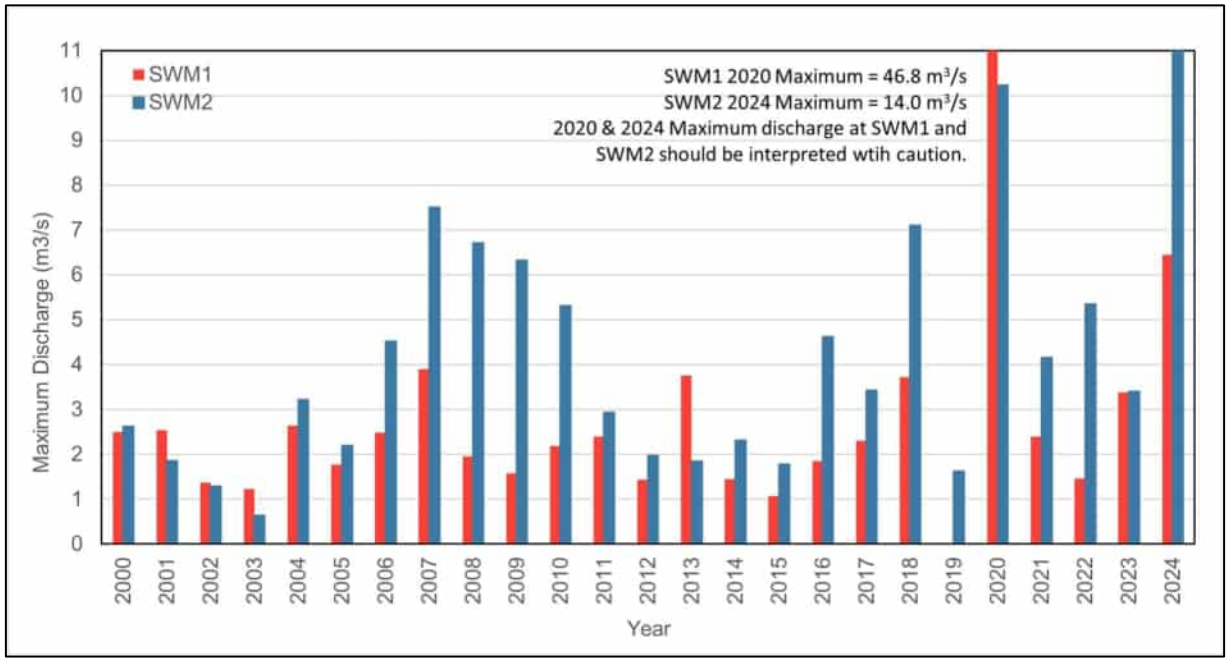

Figure 3-12: SWM1 and SWM2 Instantaneous Maximum Stream Discharge (2000-2024)

As shown in the figures, the 2024 minimum instantaneous stream discharge value at SWM1 was within the historical range of values recorded since 2000, and the 2024 minimum instantaneous stream discharge value at SWM2 was lower than the historical range of values recorded since 2000. The lower minimum stream discharge value in 2024 may be attributed to the presence of a beaver dam approximately 50 m upstream of SWM2. As discussed in Section 3.2.3, the 2024 maximum instantaneous stream discharge values are appreciably elevated compared to the typical ranges of values reported historically and should be interpreted with caution due to the limitations of applying the rating curve formulas to high flow. Similar elevated maximum instantaneous stream discharge values were reported in 2020, which followed a significant rainfall event similar to the event observed in July 2024.

A graph presenting the daily average stream discharge at SWM2 from 2003 to 2024 is provided in **Figure 3-13**, below.

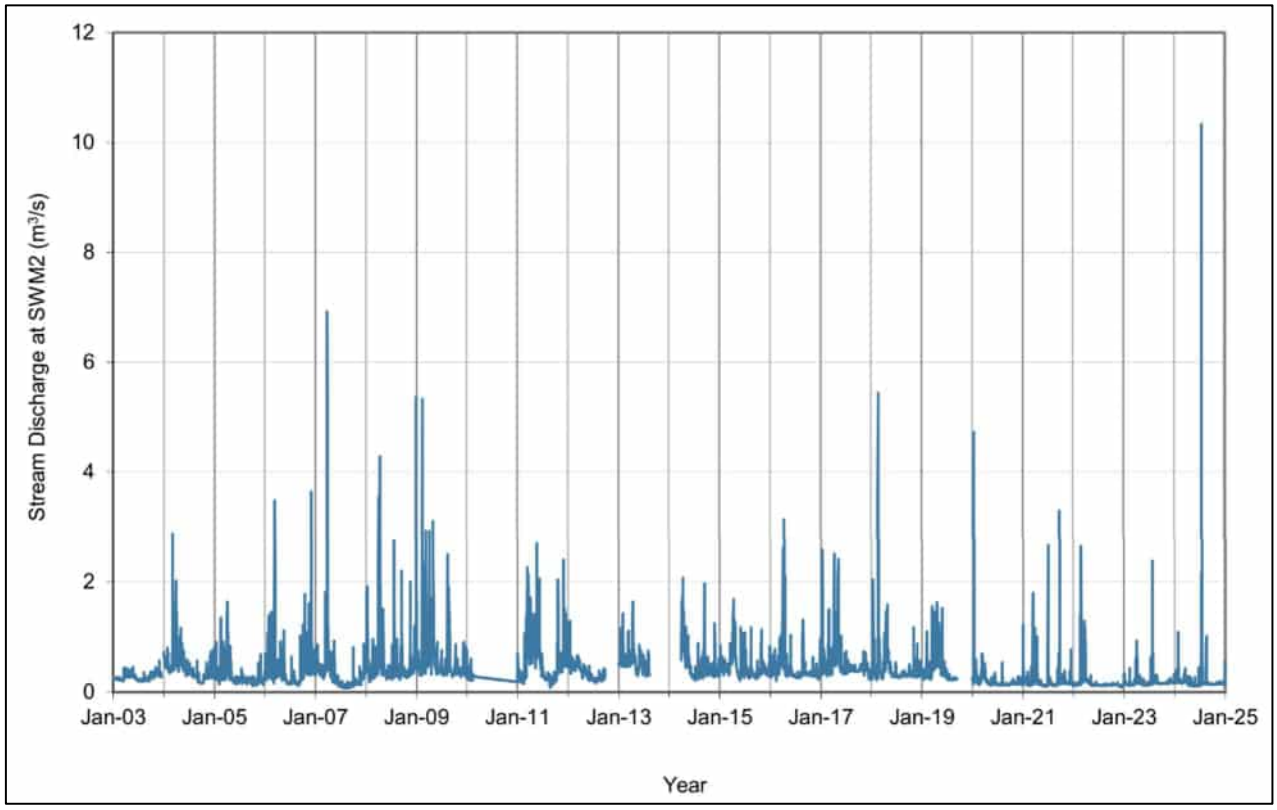

Figure 3-13: SWM2 Historical Daily Average Stream Discharge (2000-2024)

The daily average stream flow at SWM2 during the summer (June 21 to September 22) is presented in **Figure 3-14** along with annual and summer precipitation data. The flow data are presented as log transformed, in a box and whisker plot (boxplot). Boxplots are useful when comparing two or more datasets and allow for the visualization of flow data between years. The data were log transformed because variability in flow is high and the data are not normally distributed. The log-transformation provides clearer data representations and facilitates interpretation.

In **Figure 3-14**, data within the box represent 50% of the summer daily average flows, and data outside the box represent those daily average flows in the upper and lower quartiles (maximum and minimum calculated flows). The horizontal line within the box represents the median flow for the summer months.

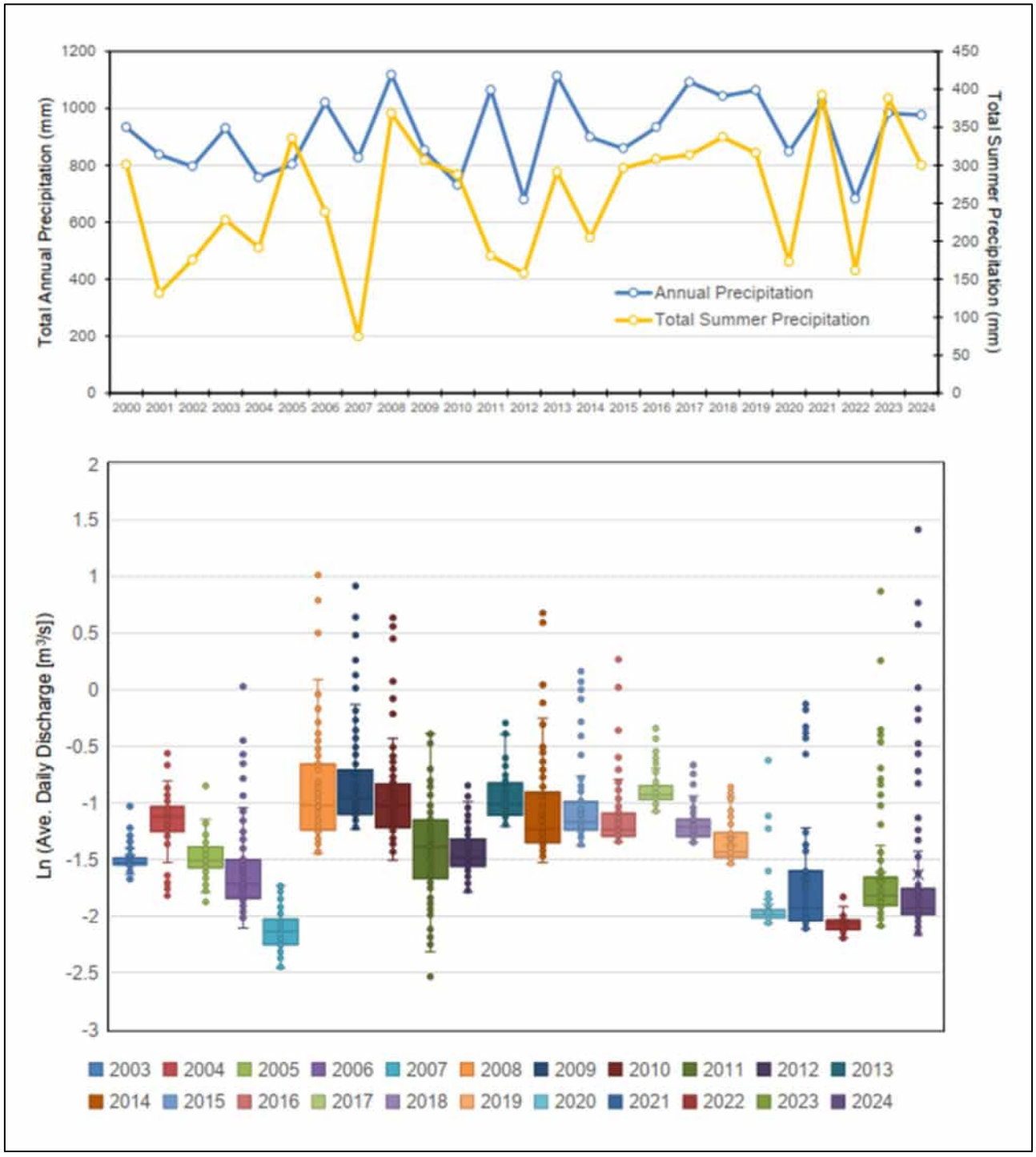

Figure 3-14: SWM2 Discharge Through Summer Months (2003-2024)

In 2024, the boxplot indicates that the daily average flow was often slightly lower than observed in 2023 and that summer discharge fluctuated within a large range in 2024. **Figure 3-14** also shows that a long-term fluctuating trend in daily average summer flows has occurred in Mill Creek since 2003, rather than an increasing or

decreasing trend. There is a general correlation between the summer precipitation and the average summer discharge at SWM2.

Based on the results of the 2024 and historical surface water monitoring program, there is no indication that aggregate extraction on the Dufferin Aggregates Mill Creek Pit Property, or the resulting ponds, are affecting stream flow in Mill Creek.

3.3 Mill Creek Temperature Monitoring

Ongoing water temperature monitoring is important to ensure that fish habitat is not impacted by operations at the Mill Creek Pit. Fish habitat can be impacted by elevated water temperatures because higher temperatures will reduce the capacity of water to hold oxygen. These effects are further discussed in Technical Appendix C of the Mill Creek Coordinated Monitoring Report.

Table 3-3, below, presents the maximum water temperatures recorded at the four surface water monitoring stations between 2003 and 2024. As shown in the table, there is no evident increasing or decreasing trend of maximum surface water temperature over the long-term, although temperatures at SWM4 have shown an overall declining trend since 2013. The maximum temperatures recorded at SWM1, SWM2 and SWM4 in 2024 at each station are within 1 degree of the long-term average for each station. The maximum temperature at SWM3 in 2024 is 3 degrees warmer than the long-term average for the station, and is the highest temperature recorded since 2003. Station SWM3 is located on the Pond Creek tributary, upstream of where Pond Creek empties into Mill Creek.

Table 3-3: Maximum Recorded Surface Water Temperature (2003-2024)

Monitoring Year	SWM1		SWM2		SWM3		SWM4	
	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)
2003	26	26-June	25	25-June	19	26-June	19	26-June
2004	24	20-July	23	3-Aug	17	13-May	19	4-July
2005	27	11-June	24	15-July	19	15-July	22	14-July
2006	27	1-Aug	25	1-Aug	16	15-July	19	1-Aug
2007	24	27-June 3-Aug	23	27-June	18	8-June	20	25-Aug
2008	25	9-June 17-July	23	9-June	19	8-June 24-July	19	9-June
2009	24	24-June	22	24-June	18	23-June	20	20-Aug
2010	26	8-July	24	8-July	18	23-July	20	24-July
2011	27	21-July	25	21-July	18	8-June	20	8-June
2012	25	17-July	22	6-July	17	19-June	18	21-June
2013	27	17-July	24	17-July	16	10-July	20	19-July
2014	24	30-June	22	30-June	17	10-Sept	18	10-Sept

Monitoring Year	SWM1		SWM2		SWM3		SWM4	
	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)	Temperature (^{0}C)	Date(s)
2015	24	29-July	22	30-July	16*	15-Aug	17*	15-Aug
2016	25	13-July	23	22-July	19	25-Aug	19	25-Aug
2017	23	21-July	22	24-July	16	18-May	17	18-May
2018	26	1-July	24	1-July	14	6-July	17	30-June
2019	25	20-July	23	20-July	17	20-July	17	20-July
2020	26	09-July	23	09-July	16	2-Aug	16	27-July
2021	25	06-July	24	28-June	18	29-June	16	29-Aug
2022	24	07-Aug	23	22-June	17	22-June	15	21-July
2023	24	05-July	22	05-July	16	13-July	17	27-July
2024	24	19-June	24	19-June	20	16-July	19	17-July
Average	25		23		17		18	

* Temperature logger data displayed atypical daily variability. Temperature should be interpreted with caution (Stantec, 2019).
2003 through 2018 data obtained from 2018 Surface Water Monitoring Report (Stantec, 2019).

The 2024 hourly surface water temperature data recorded at the surface water monitoring stations are presented in **Figures 3-15 and 3-16**, below. These data are also presented on more detailed figures (monthly), which are provided in **Appendix E**.

As shown in **Figure 3-15**, below, the surface water at SWM1 is typically warmer than the water at SWM2 in the summer months, which is consistent with previous observations. This difference is attributed to additional surface water inputs from the two colder tributaries which enter Mill Creek between SWM1 and SWM2, groundwater input along this reach, and shade provided by dense vegetation along Mill Creek on the Site.

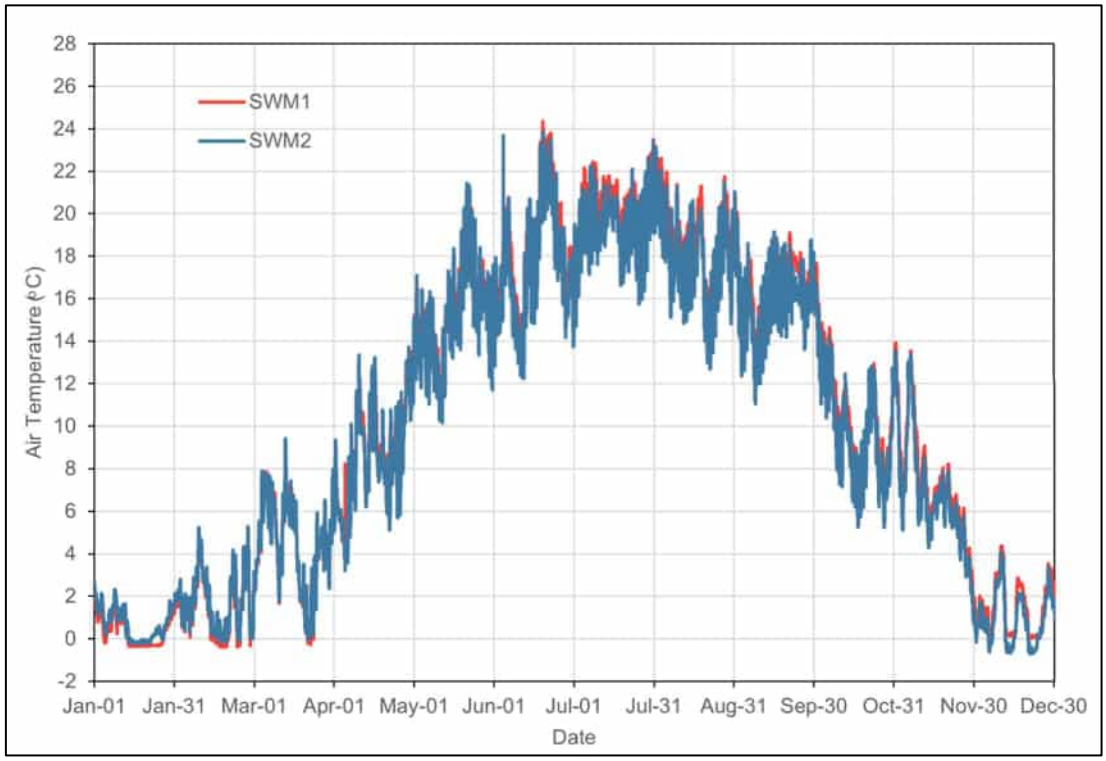

Figure 3-15: 2024 Hourly Water Temperature at SWM1 and SWM2

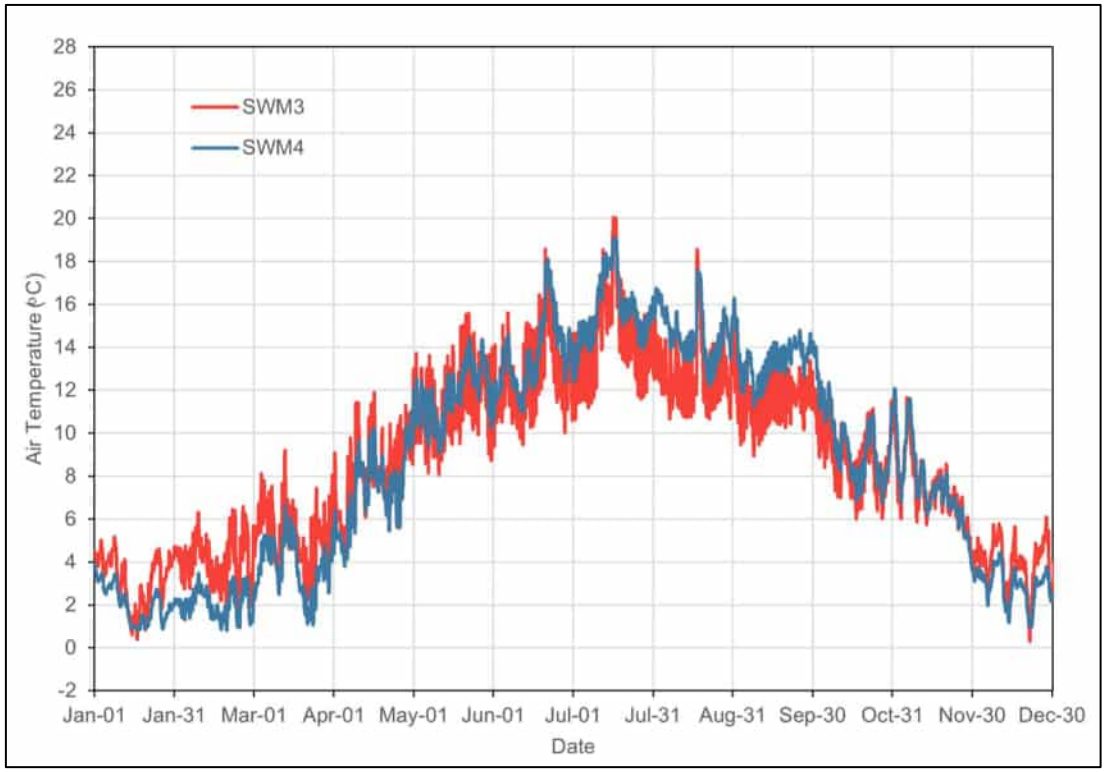

Figure 3-16: 2024 Hourly Water Temperature at SWM3 and SWM4

The water temperatures measured at SWM3 (Pond Creek) and SWM4 (Galt Creek) in 2024 (**Figure 3-16**) were more stable and showed less of an effect from air temperatures, compared to SWM1 and SWM2. This is consistent with historical results, where the maximum water temperatures observed at SWM3 and SWM4 are consistently lower than those observed at SWM1 and SWM2. The water temperatures recorded at SWM3 during the winter months are consistently warmer than those measured at SWM4, which is attributed to an increased groundwater influence in Pond Creek compared to Galt Creek.

Based on the 2024 monitoring data, there is no evidence that activities at the Mill Creek Pit have impacted water temperatures in Mill Creek.

The following four figures (**Figures 3-17 to 3-20**) present the 2024 hourly air temperature data from the on-Site barometric data logger with the hourly water temperatures at each respective surface water station.

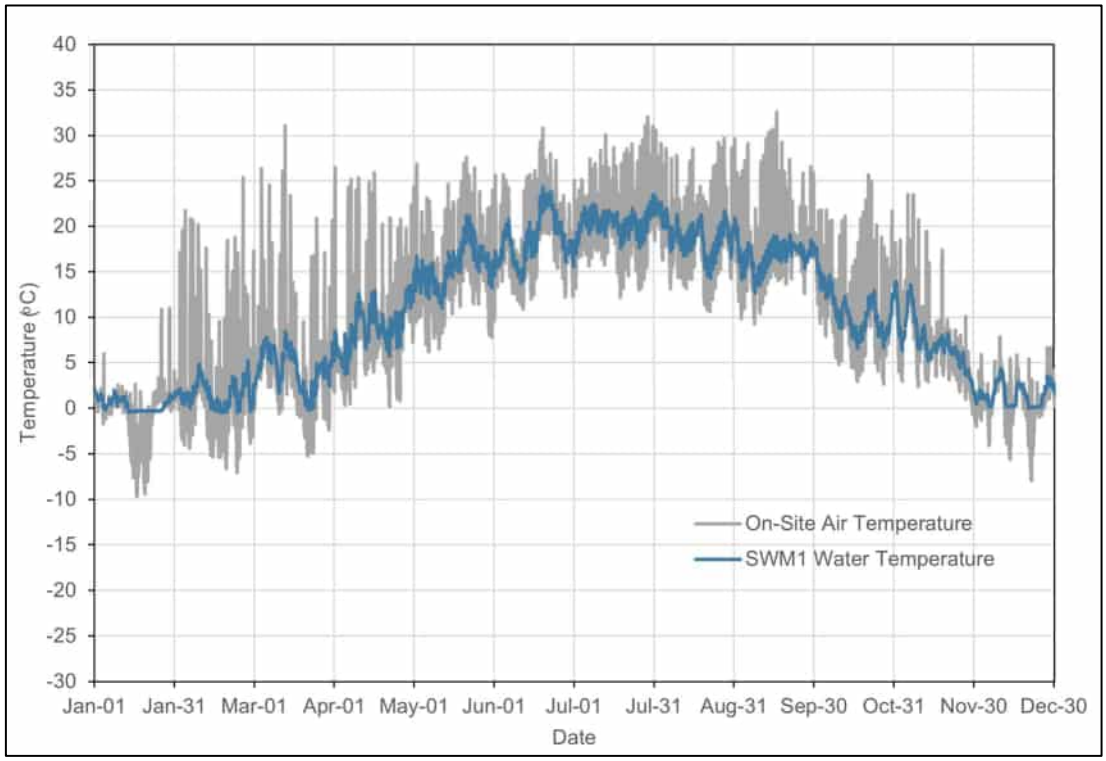

Figure 3-17: 2024 Air and Water Temperature at SWM1

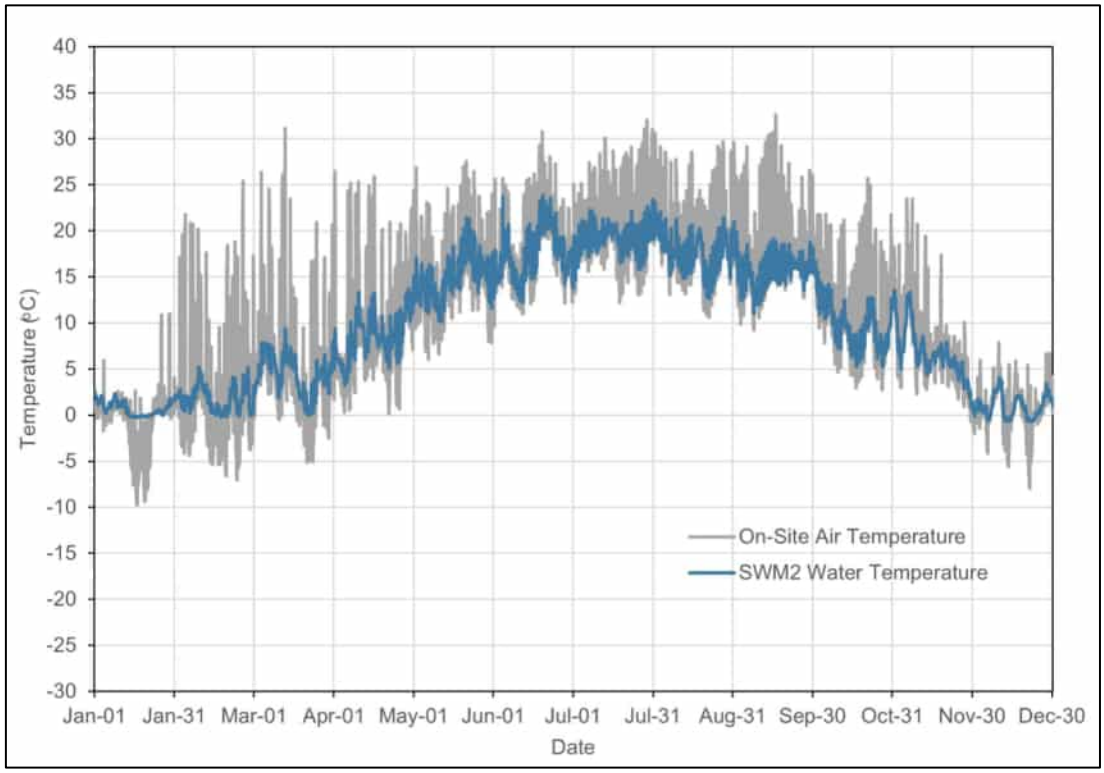

Figure 3-18: 2024 Air and Water Temperature at SWM2

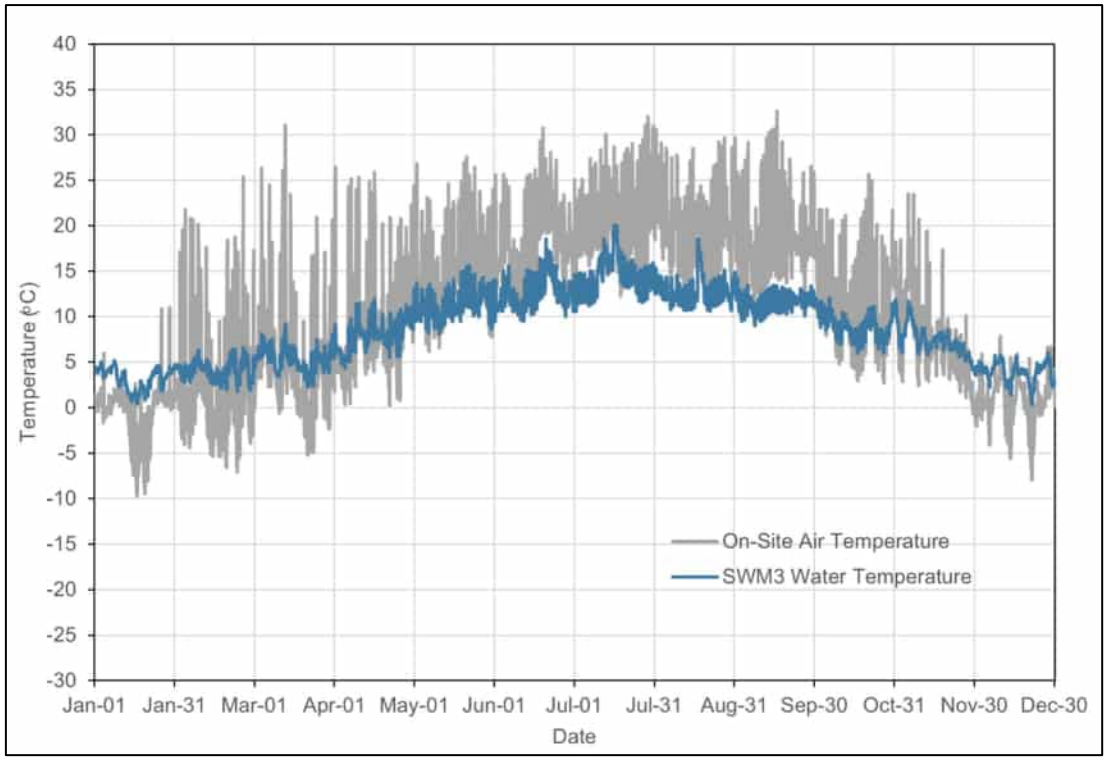

Figure 3-19: 2024 Air and Water Temperature at SWM3

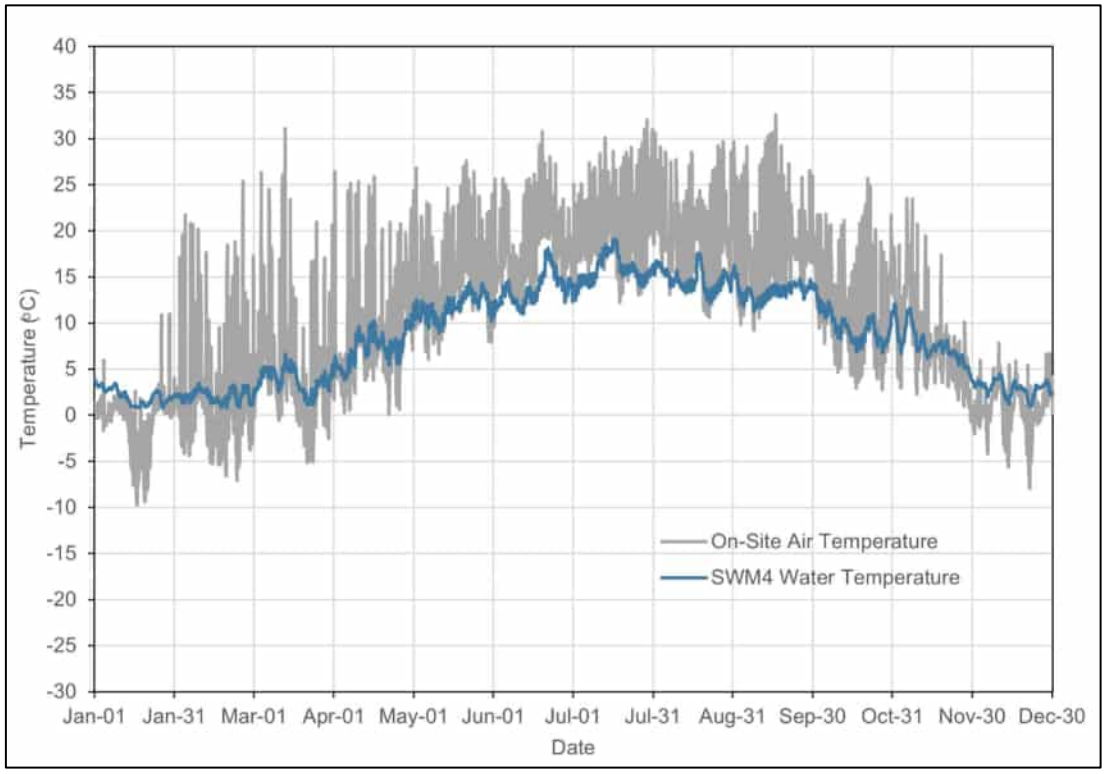

Figure 3-20: 2024 Air and Water Temperature at SWM4

The 2024 air temperature data recorded at Air Temperature Station 1 indicate that the maximum hourly temperature recorded in 2024 was 32.6°C on September 16. On September 16, the maximum air temperature recorded at the Shade's Mills Conservation Area climate station was 30°C. The maximum temperature recorded at Air Temperature Station 2 in 2024 was 33.3May 19. On May 19, the maximum air temperature recorded at the Shade's Mills Conservation Area climate station was 24°C. Consistent with past results, it is interpreted that higher air temperature values were recorded by the on-Site loggers on May 19 as a result of sunshine reaching the monitoring wells in which the barometric loggers are hung when there was a lack of tree foliage present. On September 16, the monitoring wells would have been shaded by foliage, which resulted in a similar maximum temperature being recorded at the on-Site loggers as at the local climate station.

The maximum temperature recorded at the Shade's Mills Conservation Area climate station in 2024 was 36°C, recorded on June 20 and July 4. The maximum air temperatures recorded at Air Temperature Station 1 on June 20 and July 4, 2024, were 27.4°C and 25.1°C, respectively.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings presented in this report, the following conclusions are provided.

- The 2024 monitoring program was completed in accordance with the surface water monitoring program required by the monitoring conditions.
- Based on the results of the 2024 and historical surface water monitoring program, there is no indication that aggregate extraction activities on the Dufferin Aggregates Mill Creek Pit Property, or the resulting ponds, have affected stream flow or water temperatures in Mill Creek.
- Considering the extensive history of surface water monitoring data demonstrating a lack of surface water flow impacts by the pit operations, consideration should be given to reducing the surface water monitoring program.

5.0 REFERENCES

Stantec Consulting Ltd., March 28, 2019. Technical Appendix A of the Mill Creek Coordinated Monitoring Report: 2018 Surface Water Monitoring Report. Final Report.

WSP Canada Inc., March 25, 2021. Appendix A of the 2020 Coordinated Monitoring Report: Mill Creek Aggregates Pit Surface Water. For Dufferin Aggregates, a CRH Company.

WSP Canada Inc., March 28, 2022. Appendix A of the 2021 Coordinated Monitoring Report: Mill Creek Aggregates Pit Surface Water. For Dufferin Aggregates, a Division of CRH Canada Inc.

WSP Canada Inc., March 29, 2023. Appendix A of the 2022 Coordinated Monitoring Report: Mill Creek Aggregates Pit Surface Water. For Dufferin Aggregates, a Division of CRH Canada Inc.

WSP Canada inc., March 27, 2024. Appendix A of the 2023 Coordinated Monitoring Report. Mill Creek Aggregates Pit Surface Water. For Dufferin Aggregates, A CRH Company.

Signature Page

WSP Canada Inc.

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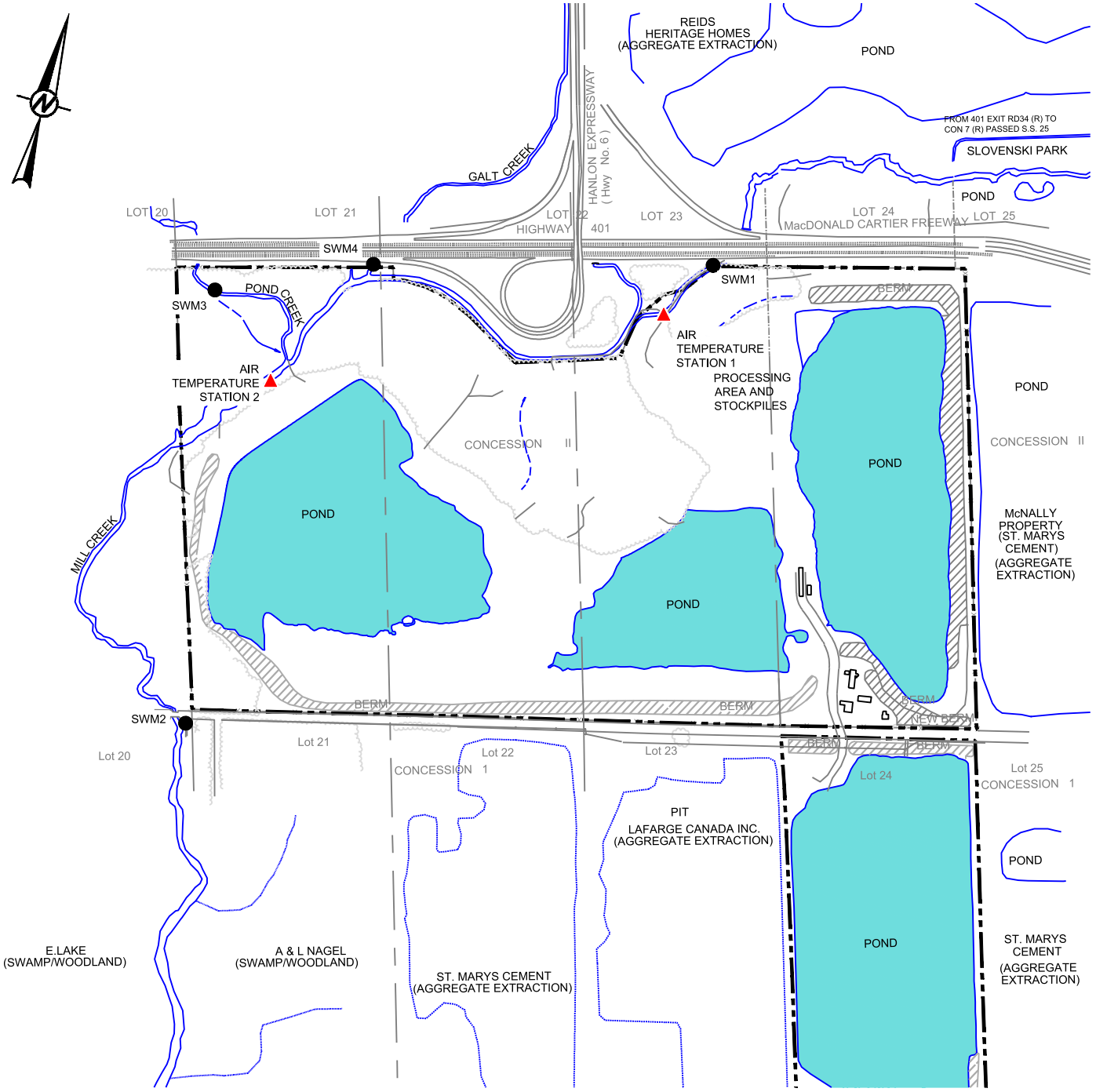
RW/GS/rc

https://wsponlinecan.sharepoint.com/sites/ca-ca0046173.5391/shared documents/05. technical/2024 sw amr/word/technical appendix a - 2024 surface water report _f.docx

Figures



LEGEND

- HYDRO/TELEPHONE LINE
- POST AND WIRE FENCE
- BUILDING
- AIR TEMPERATURE MONITORING LOCATION
- GATE
- WOODLANDS/FOREST (MIXED)
- SURFACE WATER MONITORING (SWM) STATION
- POND
- NATURAL DRAINAGE
- CREEK
- BOUNDARY OF LICENSED PROPERTY

0 250 500
1:12,500 METRES

CLIENT
DUFFERIN AGGREGATES

CONSULTANT
wsp

YYYY-MM-DD	2025-02-10
DESIGNED	-
PREPARED	SV
REVIEWED	RW
APPROVED	RW

PROJECT
2024 ANNUAL SURFACE WATER MONITORING REPORT
MILL CREEK AGGREGATES PIT
TOWNSHIP OF PUSLINCH

TITLE
SURFACE WATER MONITORING LOCATIONS

PROJECT NO.	CONTROL	REV.	FIGURE
CA0046173.5391	0001	A	1

APPENDIX A

Climate Data

(Technical Appendix A - 2024 Surface Water Report)

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
01-Jan-24	1	-2	-0.5	0	4	4
02-Jan-24	2	-4	-1	0	0	0
03-Jan-24	0	-3	-1.5	0.1	0	0.1
04-Jan-24	2	-6	-2	0	0.5	0.5
05-Jan-24	-3	-7	-5	0	0	0
06-Jan-24	-2	-4	-3	0	0	0
07-Jan-24	0	-4	-2	0	2	2
08-Jan-24	2	-4	-1	0	0	0
09-Jan-24	3	0	1.5	0	2.6	2.6
10-Jan-24	5	0	2.5	24.6	5	29.6
11-Jan-24	2	-1	0.5	0	1	1
12-Jan-24	3	-3	0	1	1.5	2.5
13-Jan-24	4	-2	1	17	8.5	25.5
14-Jan-24	0	-10	-5	0	3	3
15-Jan-24	-10	-16	-13	0	0	0
16-Jan-24	-10	-16	-13	0	1	1
17-Jan-24	-10	-17	-13.5	0	0	0
18-Jan-24	-8	-14	-11	0	0	0
19-Jan-24	-4	-10	-7	0	1	1
20-Jan-24	-10	-14	-12	0	0	0
21-Jan-24	-8	-14	-11	0	0	0
22-Jan-24	-3	-13	-8	0	0	0
23-Jan-24	0	-13	-6.5	0	1.4	1.4
24-Jan-24	1	-2	-0.5	1.4	8	9.4
25-Jan-24	3	-0.5	1.25	8.4	0	8.4
26-Jan-24	4	1	2.5	22	0	22
27-Jan-24	8	1	4.5	3.4	0	3.4
28-Jan-24	3	0	1.5	0.6	0	0.6
29-Jan-24	1	0	0.5	0	0	0
30-Jan-24	4	-1	1.5	0	0	0
31-Jan-24	2	0	1	0	0	0
01-Feb-24	4	-1	1.5	0	0	0
02-Feb-24	4	-1	1.5	0.2	0	0.2
03-Feb-24	3	-6	-1.5	0	0	0
04-Feb-24	5	-7	-1	0	0	0
05-Feb-24	8	-5	1.5	0	0	0
06-Feb-24	2	-7	-2.5	0	0	0
07-Feb-24	6	-6	0	0	0	0
08-Feb-24	9	-3	3	0	0	0
09-Feb-24	10	-1	4.5	0.8	0	0.8
10-Feb-24	16	6	11	0.4	0	0.4
11-Feb-24	8	0	4	0	0	0
12-Feb-24	2	-1	0.5	0	0	0
13-Feb-24	6	-6	0	0	0	0
14-Feb-24	3	-8	-2.5	0	0	0
15-Feb-24	2	-8	-3	0	0	0
16-Feb-24	3.5	-4	-0.25	0	3.5	3.5
17-Feb-24	-1	-9	-5	0	1	1
18-Feb-24	-5	-8	-6.5	0	0	0
19-Feb-24	0	-7	-3.5	0	0	0
20-Feb-24	0	-11	-5.5	0	0	0
21-Feb-24	6	-8	-1	0	0	0
22-Feb-24	13	-2	5.5	0.6	0	0.6
23-Feb-24	12	-3	4.5	0	0	0
24-Feb-24	10	-12	-1	0	0	0
25-Feb-24	-2	-12	-7	0	0	0
26-Feb-24	6	-4	1	0	0	0
27-Feb-24	10	-2	4	0	0	0
28-Feb-24	13	6	9.5	15.4	0	15.4

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
29-Feb-24	16	-12	2	1	4	5
01-Mar-24	1	-8	-3.5	0	0	0
02-Mar-24	10	0	5	0.6	0	0.6
03-Mar-24	9	3	6	0	0	0
04-Mar-24	12	2	7	0	0	0
05-Mar-24	22	4	13	0	0	0
06-Mar-24	20	7	13.5	1.8	0	1.8
07-Mar-24	10	2	6	0.6	0	0.6
08-Mar-24	12	1	6.5	0	0	0
09-Mar-24	12	4	8	16	0	16
10-Mar-24	11	0	5.5	9.2	0.5	9.7
11-Mar-24	2	-1	0.5	0.6	0	0.6
12-Mar-24	8	0	4	0.6	0	0.6
13-Mar-24	19	1	10	0	0	0
14-Mar-24	20	0	10	0	0	0
15-Mar-24	11	3	7	21.5	0	21.5
16-Mar-24	12	-1	5.5	0.6	0	0.6
17-Mar-24	11	-1	5	2.6	0	2.6
18-Mar-24	6	-3	1.5	0	0	0
19-Mar-24	2	-3	-0.5	0	0.5	0.5
20-Mar-24	2	-3	-0.5	1.5	1.5	3
21-Mar-24	0	-8	-4	0	0.5	0.5
22-Mar-24	-3	-11	-7	0	0	0
23-Mar-24	-2	-8	-5	0	2.8	2.8
24-Mar-24	2	-10	-4	0	0	0
25-Mar-24	4	-7	-1.5	0	0	0
26-Mar-24	12	-1	5.5	0	0	0
27-Mar-24	10	-5	2.5	8.2	0	8.2
28-Mar-24	8	-3	2.5	0	0	0
29-Mar-24	5	-6	-0.5	0	0	0
30-Mar-24	5	-6	-0.5	0	0	0
31-Mar-24	9	-2	3.5	1.8	0	1.8
01-Apr-24	11	0	5.5	0	0	0
02-Apr-24	11	1	6	0	0	0
03-Apr-24	7	3	5	7.5	0	7.5
04-Apr-24	9	1	5	11	0	11
05-Apr-24	6	-1	2.5	0.8	0.2	1
06-Apr-24	6	1	3.5	0	0	0
07-Apr-24	14	-1	6.5	0	0	0
08-Apr-24	15	-3	6	0.2	0	0.2
09-Apr-24	16	-2	7	0	0	0
10-Apr-24	25	3	14	0	0	0
11-Apr-24	19	8	13.5	12	0	12
12-Apr-24	15	6	10.5	21	0	21
13-Apr-24	9	3	6	3	0	3
14-Apr-24	12	4	8	4.8	0	4.8
15-Apr-24	22	4	13	0	0	0
16-Apr-24	17	5	11	0	0	0
17-Apr-24	20	5	12.5	3.9	0	3.9
18-Apr-24	10	4	7	13.6	0	13.6
19-Apr-24	12	7	9.5	1.5	0	1.5
20-Apr-24	15	3	9	2.8	0	2.8
21-Apr-24	7	3	5	0.4	0	0.4
22-Apr-24	10	2	6	0	0	0
23-Apr-24	16	3	9.5	0	0	0
24-Apr-24	16	7	11.5	0	0	0
25-Apr-24	10	-2	4	0	0	0
26-Apr-24	9	-2	3.5	0	0	0
27-Apr-24	15	5	10	3	0	3
28-Apr-24	22	8	15	4.8	0	4.8
29-Apr-24	23	10	16.5	2.3	0	2.3

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
30-Apr-24	15	9	12	23.6	0	23.6
01-May-24	23	6	14.5	2.2	0	2.2
02-May-24	20	9	14.5	0	0	0
03-May-24	24	10	17	0	0	0
04-May-24	18	11	14.5	6.1	0	6.1
05-May-24	23	11	17	1.8	0	1.8
06-May-24	22	6	14	0.2	0	0.2
07-May-24	20	4	12	0	0	0
08-May-24	22	10	16	10.4	0	10.4
09-May-24	21	6	13.5	0	0	0
10-May-24	18	8	13	0	0	0
11-May-24	18	4	11	5.4	0	5.4
12-May-24	12	8	10	6.4	0	6.4
13-May-24	20	9	14.5	0.8	0	0.8
14-May-24	25	13	19	0.4	0	0.4
15-May-24	23	11	17	0	0	0
16-May-24	23	10	16.5	0	0	0
17-May-24	25	13	19	0	0	0
18-May-24	19	14	16.5	3.8	0	3.8
19-May-24	24	10	17	0	0	0
20-May-24	31	15	23	0	0	0
21-May-24	32	17	24.5	0.6	0	0.6
22-May-24	30	17	23.5	0	0	0
23-May-24	30	14	22	0	0	0
24-May-24	25	12	18.5	0	0	0
25-May-24	28	12	20	0.8	0	0.8
26-May-24	22	9	15.5	12	0	12
27-May-24	24	15	19.5	24	0	24
28-May-24	25	14	19.5	14	0	14
29-May-24	21	12	16.5	10.8	0	10.8
30-May-24	17	5	11	0	0	0
31-May-24	21	5	13	0	0	0
01-Jun-24	25	6	15.5	0	0	0
02-Jun-24	27	13	20	3.6	0	3.6
03-Jun-24	19	15	17	6	0	6
04-Jun-24	25	14	19.5	0.2	0	0.2
05-Jun-24	31	23	27	0	0	0
06-Jun-24	24	18	21	8.4	0	8.4
07-Jun-24	26	14	20	1.8	0	1.8
08-Jun-24	20	12	16	2.4	0	2.4
09-Jun-24	22	12	17	7.2	0	7.2
10-Jun-24	22	10	16	0.6	0	0.6
11-Jun-24	18	10	14	0	0	0
12-Jun-24	20	10	15	0	0	0
13-Jun-24	27	16	21.5	0	0	0
14-Jun-24	31	15	23	0.8	0	0.8
15-Jun-24	26	10	18	0	0	0
16-Jun-24	25	12	18.5	0	0	0
17-Jun-24	27	14	20.5	0	0	0
18-Jun-24	32	21	26.5	8.8	0	8.8
19-Jun-24	34	22	28	0	0	0
20-Jun-24	36	25	30.5	5.6	0	5.6
21-Jun-24	32	20	26	9.4	0	9.4
22-Jun-24	32	20	26	0	0	0
23-Jun-24	33	20	26.5	1.3	0	1.3
24-Jun-24	27	16	21.5	1.6	0	1.6
25-Jun-24	29	14	21.5	0	0	0
26-Jun-24	28	18	23	0	0	0
27-Jun-24	30	14	22	9	0	9
28-Jun-24	24	9	16.5	0	0	0
29-Jun-24	23	16	19.5	11	0	11

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
30-Jun-24	29	16	22.5	4.1	0	4.1
01-Jul-24	20	10	15	0	0	0
02-Jul-24	26	11	18.5	0	0	0
03-Jul-24	26	18	22	0	0	0
04-Jul-24	36	22	29	0	0	0
05-Jul-24	31	22	26.5	0	0	0
06-Jul-24	31	23	27	8.4	0	8.4
07-Jul-24	29	16	22.5	0	0	0
08-Jul-24	31	17	24	0	0	0
09-Jul-24	33	17	25	0	0	0
10-Jul-24	30	18	24	29	0	29
11-Jul-24	23	18	20.5	29	0	29
12-Jul-24	28	17	22.5	0	0	0
13-Jul-24	30	16	23	0.4	0	0.4
14-Jul-24	32	18	25	0	0	0
15-Jul-24	31	21	26	3.4	0	3.4
16-Jul-24	28	20	24	15	0	15
17-Jul-24	30	18	24	56	0	56
18-Jul-24	28	15	21.5	0.2	0	0.2
19-Jul-24	24	12	18	0	0	0
20-Jul-24	26	14	20	0	0	0
21-Jul-24	26	16	21	0	0	0
22-Jul-24	30	15	22.5	0	0	0
23-Jul-24	29	17	23	3.3	0	3.3
24-Jul-24	30	22	26	0	0	0
25-Jul-24	28	15	21.5	0	0	0
26-Jul-24	26	14	20	0	0	0
27-Jul-24	29	13	21	0	0	0
28-Jul-24	30	14	22	0	0	0
29-Jul-24	32	16	24	0	0	0
30-Jul-24	33	20	26.5	5.8	0	5.8
31-Jul-24	30	21	25.5	2.8	0	2.8
01-Aug-24	32	20	26	0	0	0
02-Aug-24	34	22	28	7.8	0	7.8
03-Aug-24	29	18	23.5	0	0	0
04-Aug-24	32	18	25	0	0	0
05-Aug-24	30	19	24.5	0	0	0
06-Aug-24	32	18	25	2	0	2
07-Aug-24	21	13	17	2.6	0	2.6
08-Aug-24	26	15	20.5	0	0	0
09-Aug-24	27	19	23	3.4	0	3.4
10-Aug-24	29	14	21.5	0	0	0
11-Aug-24	24	14	19	0	0	0
12-Aug-24	23	13	18	0	0	0
13-Aug-24	25	14	19.5	0	0	0
14-Aug-24	28	14	21	0	0	0
15-Aug-24	30	14	22	0	0	0
16-Aug-24	30	25	27.5	0	0	0
17-Aug-24	26	20	23	7.4	0	7.4
18-Aug-24	29	20	24.5	48.7	0	48.7
19-Aug-24	29	15	22	6.2	0	6.2
20-Aug-24	21	9	15	0	0	0
21-Aug-24	22	10	16	0	0	0
22-Aug-24	22	10	16	0	0	0
23-Aug-24	26	11	18.5	0	0	0
24-Aug-24	26	12	19	0	0	0
25-Aug-24	28	15	21.5	0	0	0
26-Aug-24	31	16	23.5	0	0	0
27-Aug-24	31	22	26.5	0	0	0
28-Aug-24	33	21	27	1	0	1
29-Aug-24	29	17	23	12	0	12
30-Aug-24	23	14	18.5	0.4	0	0.4

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
31-Aug-24	31	17	24	12.8	0	12.8
01-Sep-24	29	16	22.5	0	0	0
02-Sep-24	25	11	18	0	0	0
03-Sep-24	21	8	14.5	0	0	0
04-Sep-24	23	5	14	0	0	0
05-Sep-24	27	11	19	0	0	0
06-Sep-24	30	14	22	0.6	0	0.6
07-Sep-24	23	11	17	1	0	1
08-Sep-24	17	7	12	0.6	0	0.6
09-Sep-24	22	19	20.5	0	0	0
10-Sep-24	21	6	13.5	0	0	0
11-Sep-24	26	10	18	0	0	0
12-Sep-24	26	9	17.5	0	0	0
13-Sep-24	30	8	19	0	0	0
14-Sep-24	30	13	21.5	0	0	0
15-Sep-24	29	15	22	0	0	0
16-Sep-24	30	13	21.5	0	0	0
17-Sep-24	30	12	21	0	0	0
18-Sep-24	28	13	20.5	0	0	0
19-Sep-24	28	8	18	0	0	0
20-Sep-24	29	12	20.5	0	0	0
21-Sep-24	28	15	21.5	1.6	0	1.6
22-Sep-24	31	13	22	2	0	2
23-Sep-24	24	16	20	15.4	0	15.4
24-Sep-24	22	17	19.5	0.2	0	0.2
25-Sep-24	22	18	20	6	0	6
26-Sep-24	26	15	20.5	1.2	0	1.2
27-Sep-24	25	9	17	0.2	0	0.2
28-Sep-24	22	14	18	0	0	0
29-Sep-24	22	16	19	0	0	0
30-Sep-24	27	15	21	0	0	0
01-Oct-24	24	15	19.5	0	0	0
02-Oct-24	23	9	16	2.2	0	2.2
03-Oct-24	20	7	13.5	0	0	0
04-Oct-24	21	8	14.5	0	0	0
05-Oct-24	22	5	13.5	1.2	0	1.2
06-Oct-24	21	5	13	0	0	0
07-Oct-24	25	11	18	0	0	0
08-Oct-24	17	7	12	1.6	0	1.6
09-Oct-24	16	4	10	2.2	0	2.2
10-Oct-24	16	2	9	0	0	0
11-Oct-24	16	2	9	0	0	0
12-Oct-24	18	6	12	0	0	0
13-Oct-24	18	7	12.5	0	0	0
14-Oct-24	15	4	9.5	2.4	0	2.4
15-Oct-24	11	3	7	0	0	0
16-Oct-24	11	3	7	0.2	0	0.2
17-Oct-24	12	-2	5	0	0	0
18-Oct-24	17	0	8.5	0	0	0
19-Oct-24	20	1	10.5	0	0	0
20-Oct-24	22	2	12	0	0	0
21-Oct-24	24	6	15	0	0	0
22-Oct-24	27	7	17	0	0	0
23-Oct-24	25	7	16	0	0	0
24-Oct-24	22	2	12	0	0	0
25-Oct-24	14	0	7	0	0	0
26-Oct-24	12	3	7.5	0	0	0
27-Oct-24	12	-2	5	0	0	0
28-Oct-24	13	1	7	0	0	0
29-Oct-24	13	5	9	1.4	0	1.4
30-Oct-24	21	8	14.5	24	0	24

Table A-1: 2024 Daily Climate Data from GRCA Shade's Mills Climate Station

Date	Maximum Temperature (°C)	Minimum Temperature (°C)	Mean Daily Temperature (°C)	Rain (mm)	Snow (cm)	Total Precipitation (mm)
31-Oct-24	23	15	19	0	0	0
01-Nov-24	23	9	16	1.6	0	1.6
02-Nov-24	10	-1	4.5	0	0	0
03-Nov-24	10	-2	4	0	0	0
04-Nov-24	11	-3	4	0	0	0
05-Nov-24	20	11	15.5	0.6	0	0.6
06-Nov-24	20	15	17.5	2.8	0	2.8
07-Nov-24	20	8	14	0	0	0
08-Nov-24	14	7	10.5	0	0	0
09-Nov-24	13	-3	5	0	0	0
10-Nov-24	10	0	5	0	0	0
11-Nov-24	15	6	10.5	10.6	0	10.6
12-Nov-24	12	1	6.5	1	0	1
13-Nov-24	9	-2	3.5	0	0	0
14-Nov-24	8	2	5	0	0	0
15-Nov-24	9	5	7	4	0	4
16-Nov-24	9	3	6	0.8	0	0.8
17-Nov-24	10	6	8	0	0	0
18-Nov-24	11	5	8	1.2	0	1.2
19-Nov-24	13	-1	6	0	0	0
20-Nov-24	10	6	8	1.4	0	1.4
21-Nov-24	10	-1	4.5	15.8	0	15.8
22-Nov-24	6	0	3	1	0	1
23-Nov-24	8	4	6	4	0	4
24-Nov-24	8	2	5	0.8	0	0.8
25-Nov-24	8	-2	3	0	0	0
26-Nov-24	8	2	5	5.2	0	5.2
27-Nov-24	7	-2	2.5	0.8	0	0.8
28-Nov-24	4	-1	1.5	0	0.5	0.5
29-Nov-24	5	-2	1.5	0	0	0
30-Nov-24	0	-4	-2	0	1	1
01-Dec-24	-1	-5	-3	0	0.5	0.5
02-Dec-24	-1	-5	-3	0	4.5	4.5
03-Dec-24	1	-5	-2	0	0	0
04-Dec-24	1	-4	-1.5	0	1	1
05-Dec-24	1	-3	-1	0	8	8
06-Dec-24	-1	-11	-6	0	0	0
07-Dec-24	-2	-8	-5	0	0	0
08-Dec-24	4	-3	0.5	0	0	0
09-Dec-24	6	2	4	7.4	0	7.4
10-Dec-24	6	1	3.5	7.1	0	7.1
11-Dec-24	9	2	5.5	2	0	2
12-Dec-24	3	-8	-2.5	1.4	0	1.4
13-Dec-24	-6	-9	-7.5	0	0	0
14-Dec-24	-4	-13	-8.5	0	0	0
15-Dec-24	-1	-10	-5.5	0	0	0
16-Dec-24	4	-3	0.5	2.4	0	2.4
17-Dec-24	10	3	6.5	14.2	0	14.2
18-Dec-24	5	2	3.5	0	0	0
19-Dec-24	3	-3	0	0	0	0
20-Dec-24	-3	-5	-4	0	3	3
21-Dec-24	-3	-10	-6.5	0	0	0
22-Dec-24	-8	-19	-13.5	0	0	0
23-Dec-24	-4	-19	-11.5	0	0	0
24-Dec-24	1	-5	-2	0	4	4
25-Dec-24	3	-5	-1	0	0	0
26-Dec-24	0	-4	-2	0	0	0
27-Dec-24	1	-3	-1	0	0	0
28-Dec-24	4	0	2	2.2	0	2.2
29-Dec-24	12	1	6.5	1.2	0	1.2
30-Dec-24	10	1	5.5	28	0	28
31-Dec-24	5	-1	2	0.6	0	0.6

Table A-2: Mean Monthly Air Temperature at GRCA Shade's Mills Climate Station (2000-2024)

Year	Mean Monthly Air Temperature (°C)												Annual Average (°C)
	January	February	March	April	May	June	July	August	September	October	November	December	
2000	-7	-4	4	6	14	18	19	18	14	10	2	-9	7
2001	-5	-4	-2	7	13	19	19	21	15	9	6	0	8
2002	-2	-3	0	6	10	18	22	20	18	7	2	-4	8
2003	-10	-9	-3	5	11	17	19	20	15	7	4	-2	6
2004	-10	-6	1	6	12	16	19	17	16	9	4	-5	6
2005	-8	-6	-4	6	10	21	21	20	16	10	4	-5	5
2006	-1	-5	0	7	13	18	21	18	14	7	4	0	8
2007	-5	-10	-1	5	13	19	19	19	16	12	1	-4	7
2008	-4	-7	-4	8	10	18	20	18	15	8	1	-4	8
2009	-11	-5	0	7	12	16	17	19	15	7	5	-4	7
2010	-6	-5	3	9	14	18	21	20	14	9	3	-5	8
2011	-10.2	-7.8	-3.6	5.5	12.6	16.6	21.4	19.0	15.0	8.9	4.8	-1.3	7.5
2012	-3.9	-2.5	5.5	5.0	14.8	18.3	21.7	18.5	13.8	8.6	1.6	-0.7	8.4
2013	-3.5	-6.9	-1.3	5.4	15.4	19.3	22.6	20.7	16.5	10.8	2.0	-4.1	8.1
2014	-9.5	-9.8	-5.9	6.2	14.3	20.7	20.4	20.0	16.5	10.3	1.0	-0.4	7.0
2015	-9	-14	-3	7	17	18	22	20	20	10	6	4	8
2016	-4.5	-3.0	2.4	4.7	14.9	19.7	23.4	23.8	19.1	11.8	6.3	-2.0	9.7
2017	-2.2	-0.3	-0.3	9.2	12.5	19.5	21.6	20.4	18.8	13.1	3.1	-4.9	9.2
2018	-6.9	-2.5	-0.3	3.0	17.9	19.7	23.4	23.3	19.4	9.5	1.6	0.4	9.0
2019	-6.7	-4.8	-1.5	5.9	12.8	18.8	23.7	21.3	17.8	10.6	0.9	-0.9	8.2
2020	-1.4	-3.6	2.4	5.8	12.7	20.5	25.0	22.2	16.1	9.3	6.4	-0.6	9.6
2021	-2.7	-6.1	3.4	8.9	14.1	22.1	21.3	23.8	17.5	13.9	3.6	0.9	10.1
2022	-8.4	-5.4	1.0	6.9	16.1	19.8	22.7	22.3	17.8	10.0	4.7	-0.9	8.9
2023	-2.3	-2.8	-0.6	7.8	12.2	17.4	19.5	17.8	16.2	10.2	2.2	1.8	8.3
2024	-3.2	0.5	3.3	8.5	16.5	21.0	22.9	21.9	19.0	11.6	6.5	-1.5	10.6
30-Year Normal *	-5.5	-4.9	-0.2	6.5	13.8	19.5	21.9	20.2	16.7	9.8	3.5	-1.9	8.3

Notes: 2023 air temperature data from GRCA Shade's Mill Climate Station is unavailable. Data shown is from Kitchener/Waterloo Climate Station.
* 30-year normal average temperature calculated from GRCA Shade's Mills climate station data between 1991-2020

Table A-3: Total Monthly Precipitation at GRCA Shade's Mills Climate Station (2000-2024)

Year	Total Monthly Precipitation (mm)												Annual Total (mm)
	January	February	March	April	May	June	July	August	September	October	November	December	
2000	39.9	48.5	45.0	75.2	145.3	150.0	98.0	53.0	95.5	21.1	70.3	91.1	933
2001	43.8	110.9	42.5	45.5	88.2	53.7	21.5	57.8	87.9	131.3	91.9	62.0	837
2002	64.3	66.5	64.4	110.1	105.9	95.8	69.0	10.7	80.7	55.7	57.0	16.0	796
2003	31.1	52.0	57.0	62.0	97.6	39.1	65.3	123.5	105.5	70.6	146.9	79.4	930
2004	37.5	22.0	84.5	63.5	116.5	60.5	86.0	45.0	27.0	70.5	66.0	77.5	757
2005	59.5	59.5	17.0	52.0	27.0	36.0	190.5	109.0	80.5	36.0	103.0	33.0	803
2006	93.8	85.0	62.8	69.5	93.5	18.0	182.5	38.0	141.0	45.0	105.4	85.6	1020
2007	73.3	65.0	53.4	103.8	103.0	25.5	66.5	56.5	45.6	61.6	83.3	89.0	827
2008	98.5	57.4	85.5	64.6	86.1	81.6	131.3	120.7	119.3	68.4	103.1	100.4	1117
2009	30.5	68.0	59.0	113.5	79.0	84.0	114.5	108.0	32.0	72.5	33.0	58.5	853
2010	20.5	14.5	47.0	57.7	67.1	130.7	129.3	27.7	112.6	76.2	33.2	14.2	731
2011	47.6	58.2	86.1	100.7	113.3	87.0	31.9	158.6	76.1	128.9	90.5	85.5	1064
2012	46.8	32.0	31.0	30.0	28.2	64.6	30.4	62.6	106.2	127.3	40.2	79.9	679
2013	80.5	71.2	40.6	123.8	102.0	122.3	130.9	69.5	142.9	142.9	33.7	52.2	1113
2014	90.7	70.5	45.0	87.2	79.1	51.6	127.9	25.2	144.2	71.8	78.2	27.3	899
2015	35.0	56.3	14.0	98.9	69.4	160.3	69.7	85.0	72.6	84.0	54.4	59.2	859
2016	44.8	52.4	99.5	90.8	31.8	42.2	93.0	183.3	68.8	45.8	67.6	113.5	934
2017	110.2	77.1	93.4	120.3	137.1	78.9	92.6	138.0	25.5	76.6	88.7	53.4	1092
2018	87.4	81.5	32.5	139.7	57.3	86.5	71.1	165.5	51.1	92.9	121.4	55.3	1042
2019	74.7	66.4	73.4	99.3	123.3	79.8	143.0	64.6	79.5	141.1	62.4	55.6	1063
2020	130.9	38.6	83.4	43.3	52.7	61.7	58.9	72.6	46.4	91.4	57.7	110.0	848
2021	32.6	54.2	53.4	64.9	33.0	132.2	95.3	83.5	222.7	129.7	46.1	72.4	1020
2022	36.6	109.7	64.4	36.6	55.1	57.2	33.0	87.2	28.2	52.5	39.7	82.1	682
2023	71.2	45.2	121.3	87.2	55.6	81.1	203.2	116.5	22.1	61.0	42.7	75.9	983
2024	118.0	26.9	71.4	116.4	99.7	81.8	153.3	104.3	28.8	35.2	53.1	87.5	976
*30-Year Normal	77.2	58.2	63.6	84.2	82.2	84.7	95.4	76.9	82.5	81.6	76.6	71.4	935

Notes: * 30-year normal average precipitation calculated from GRCA Shade's Mills climate station data between 1991-2020

Figure A-1: 2024 Air Temperature at On-Site Monitoring Locations

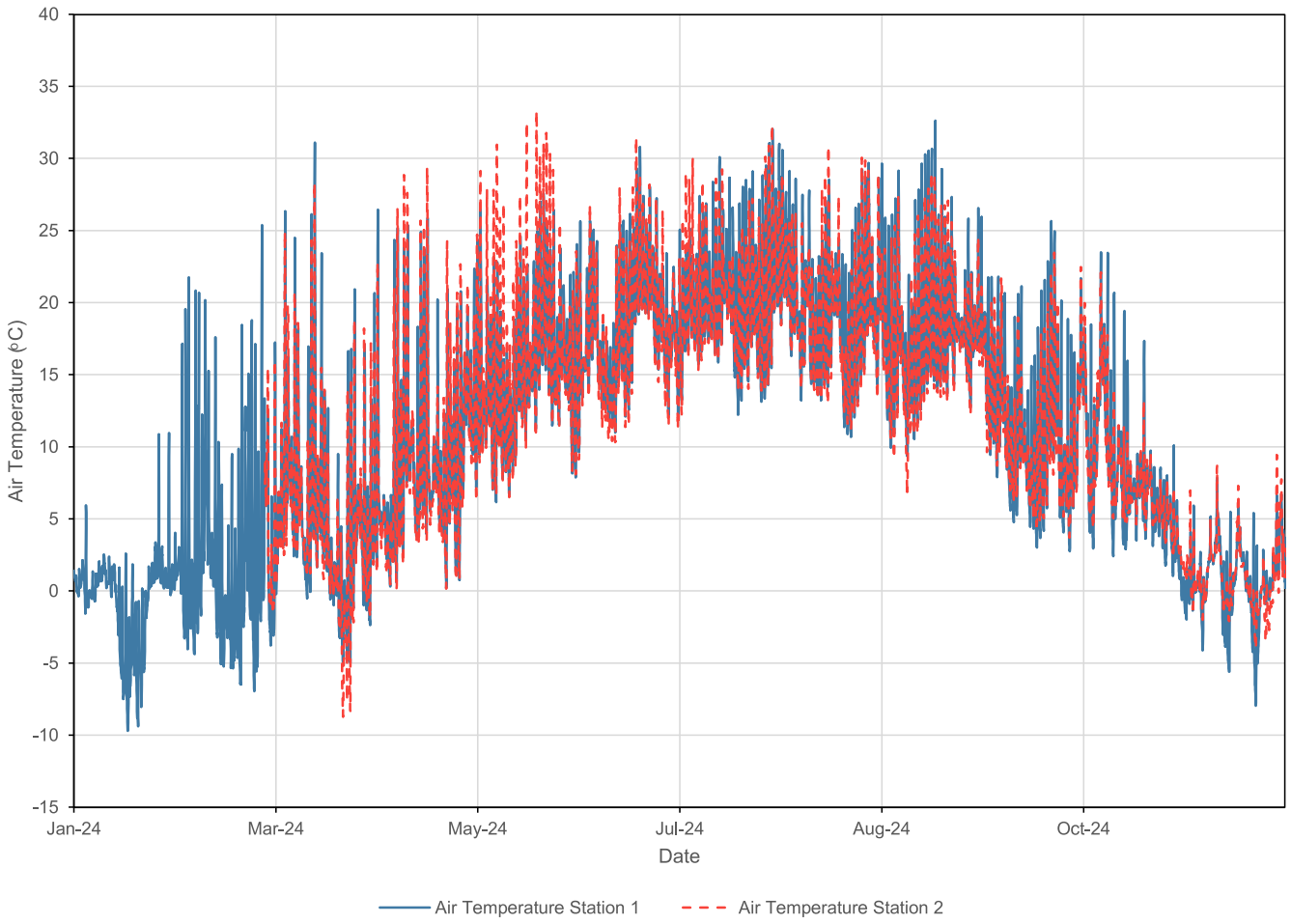


Figure A-2: 2024 Air Temperature at Two On-Site Monitoring Locations
January to March 2024

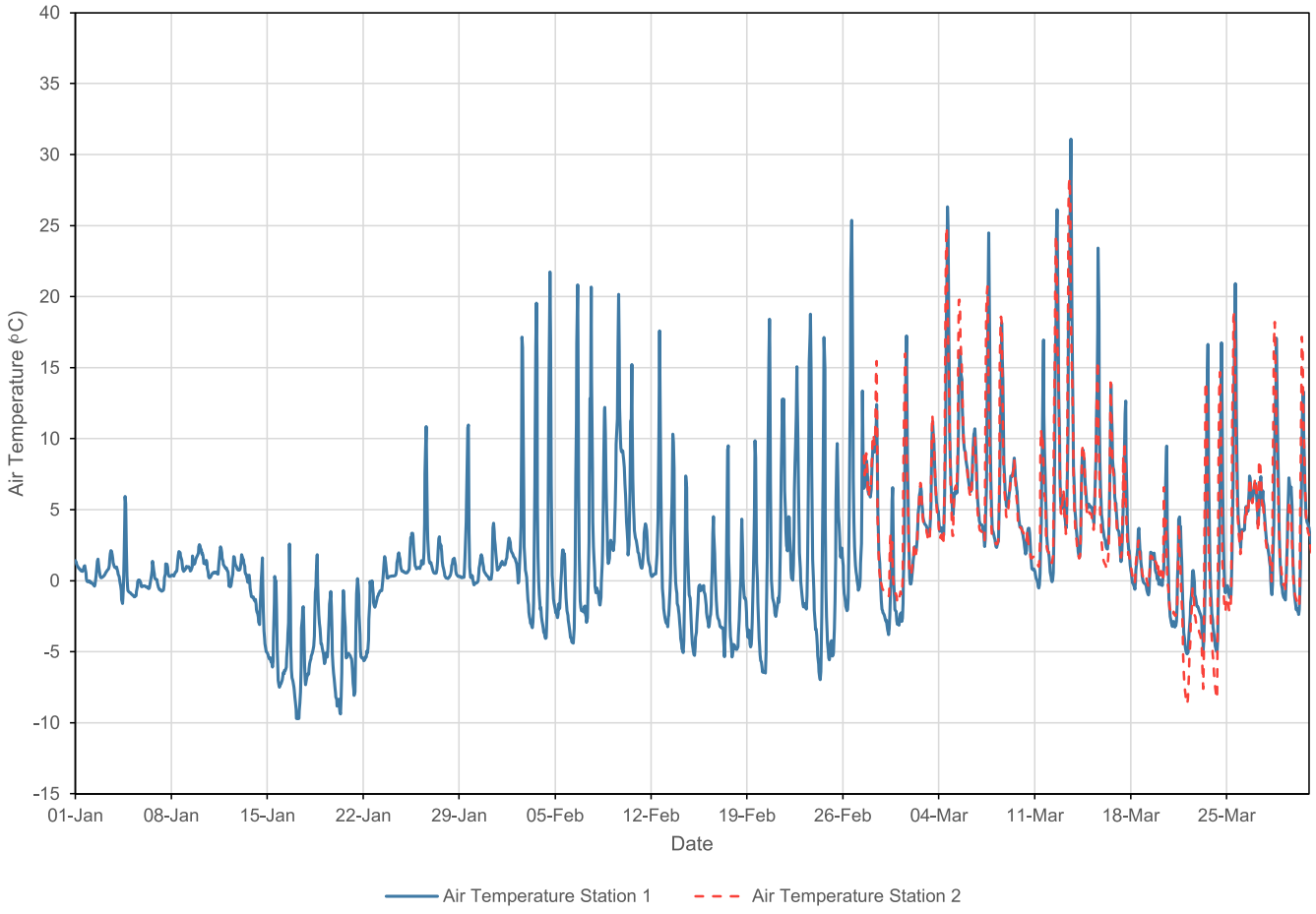


Figure A-3: 2024 Air Temperature at Two On-Site Monitoring Locations
April to June 2024

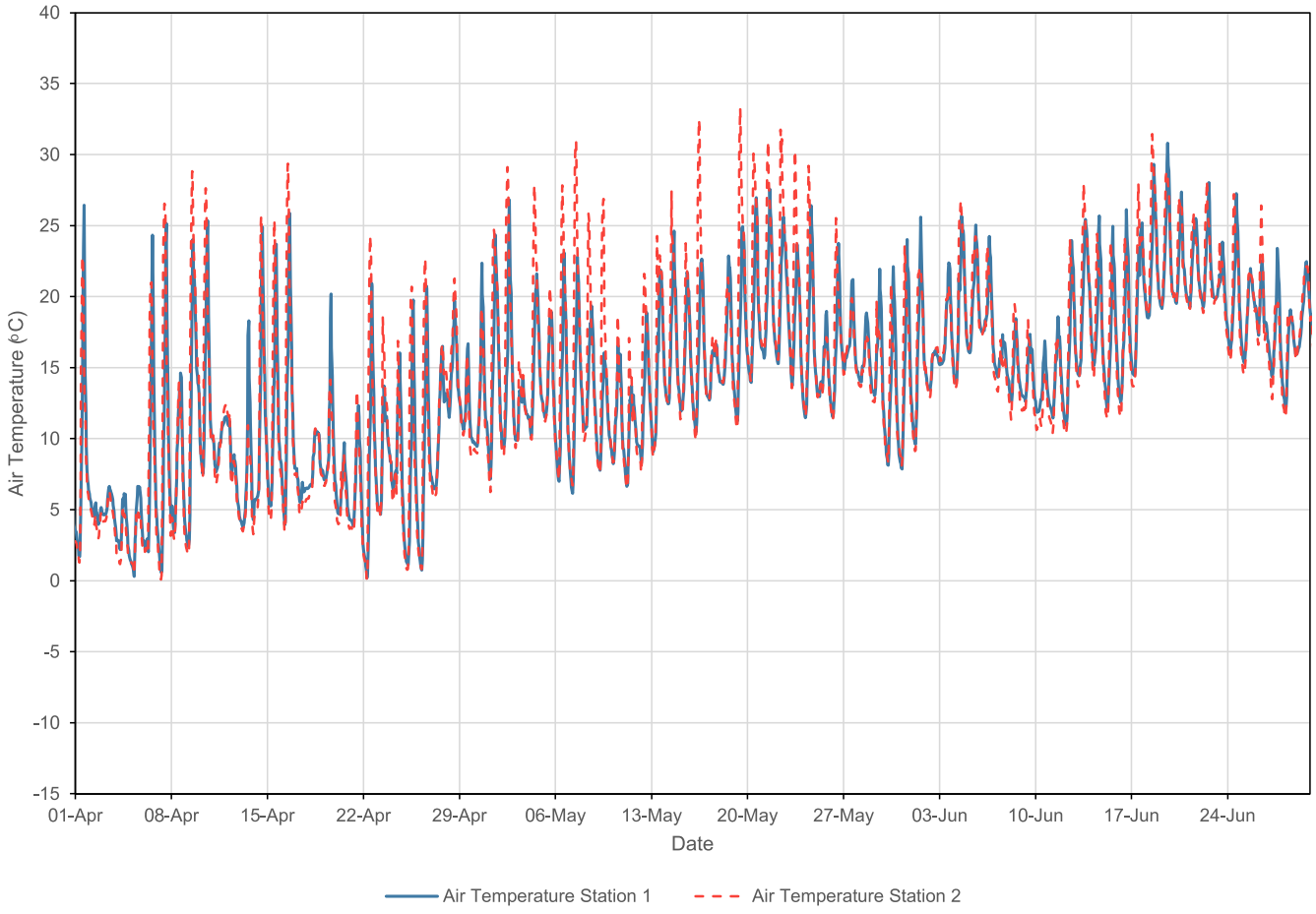


Figure A-4: 2024 Air Temperature at Two On-Site Monitoring Locations
July to September 2024

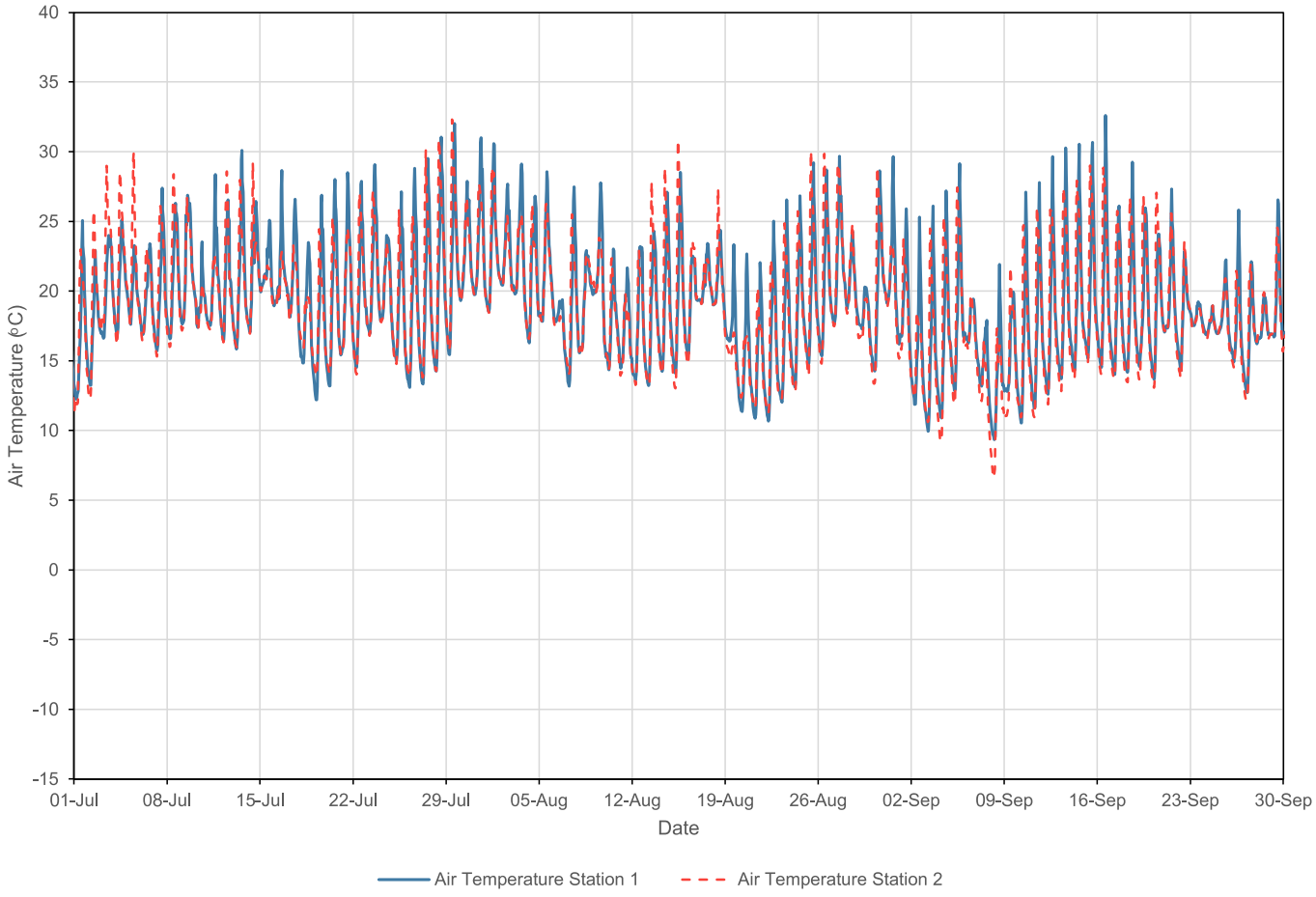


Figure A-5: 2024 Air Temperature at Two On-Site Monitoring Locations
October to December 2024

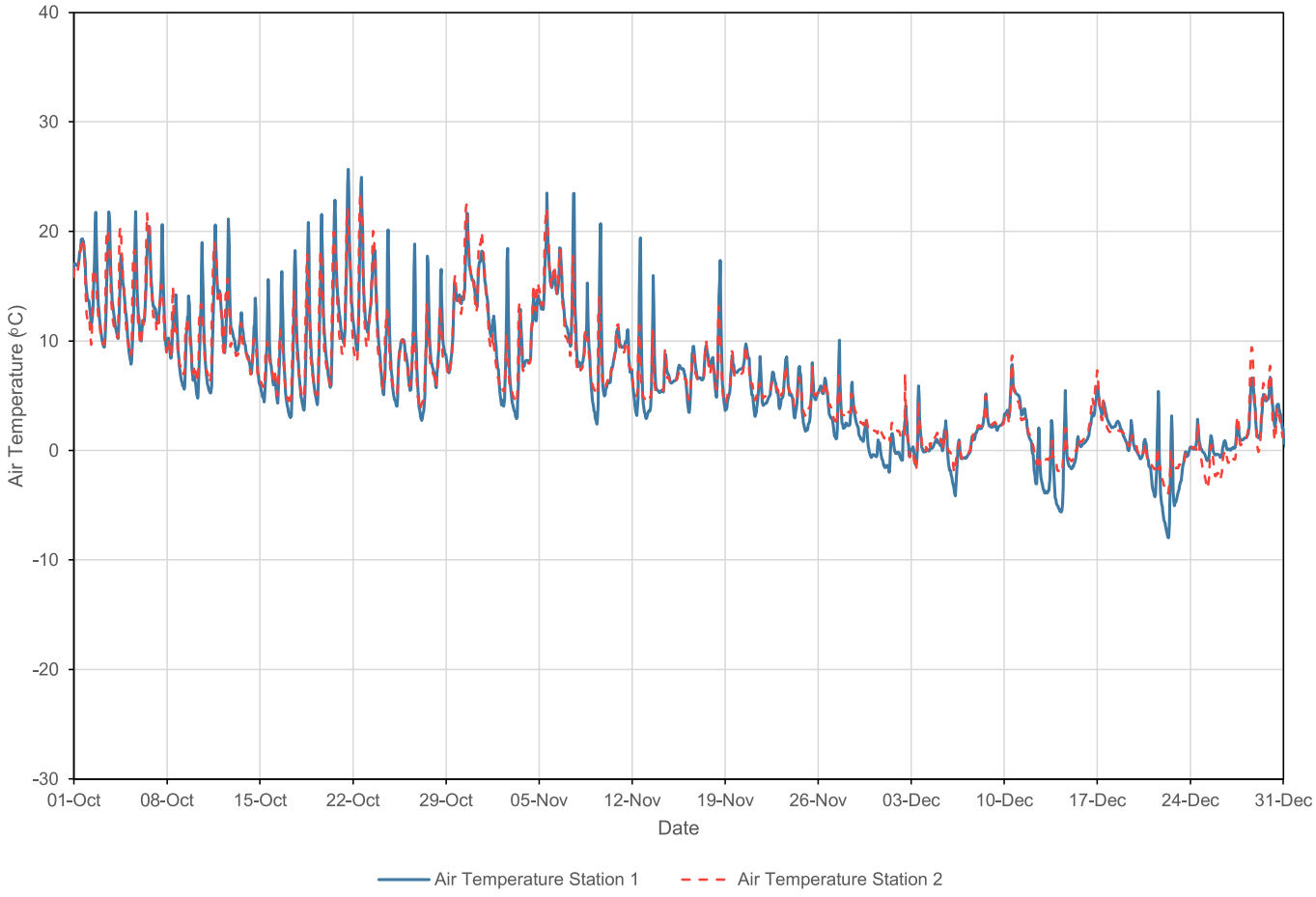


Figure A-6: 2024 Daily Precipitation at GRCA Shade's Mills Climate Station

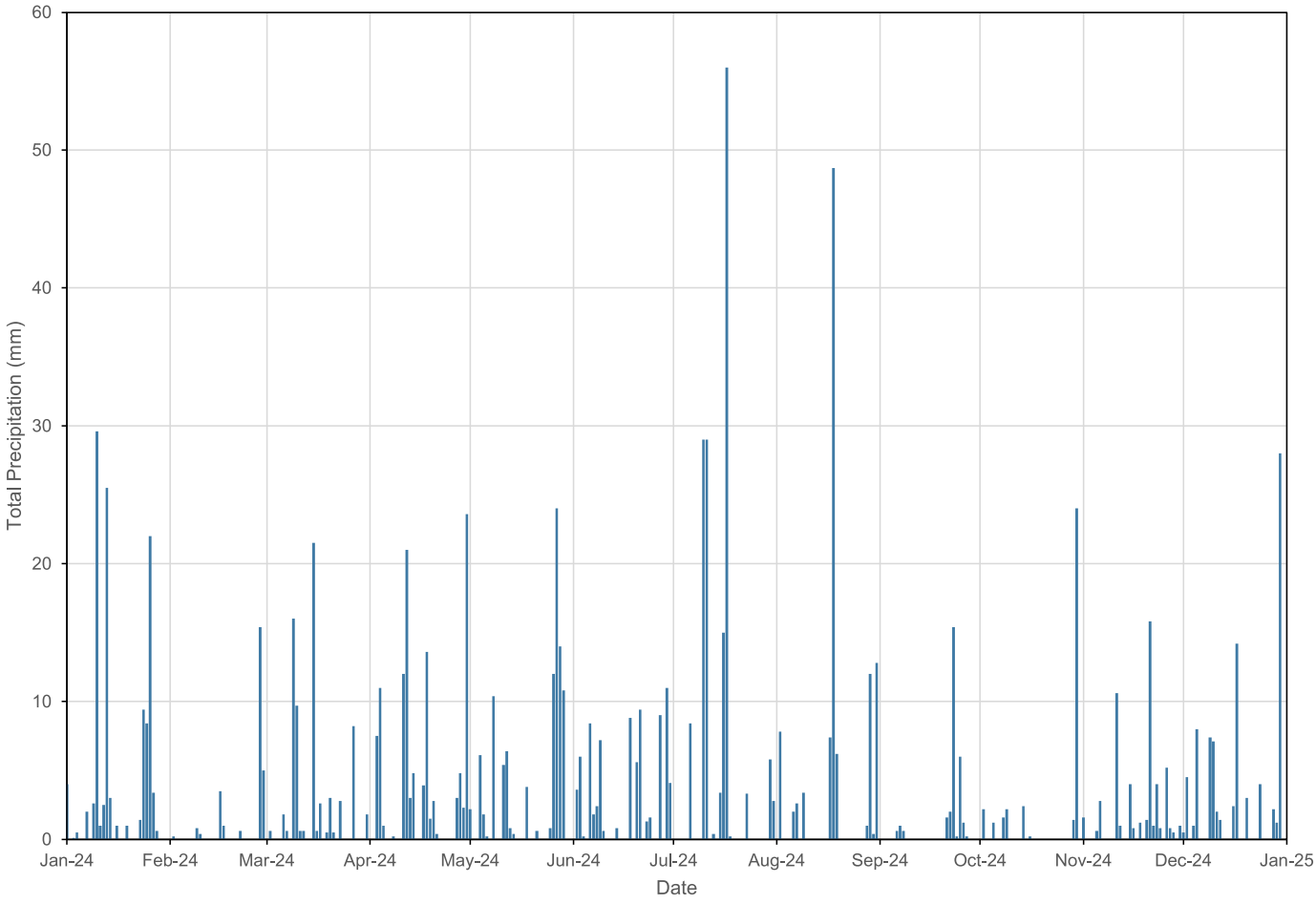


Figure A-7: 2024 Daily Precipitation at GRCA Shade's Mills Climate Station
January to March 2024

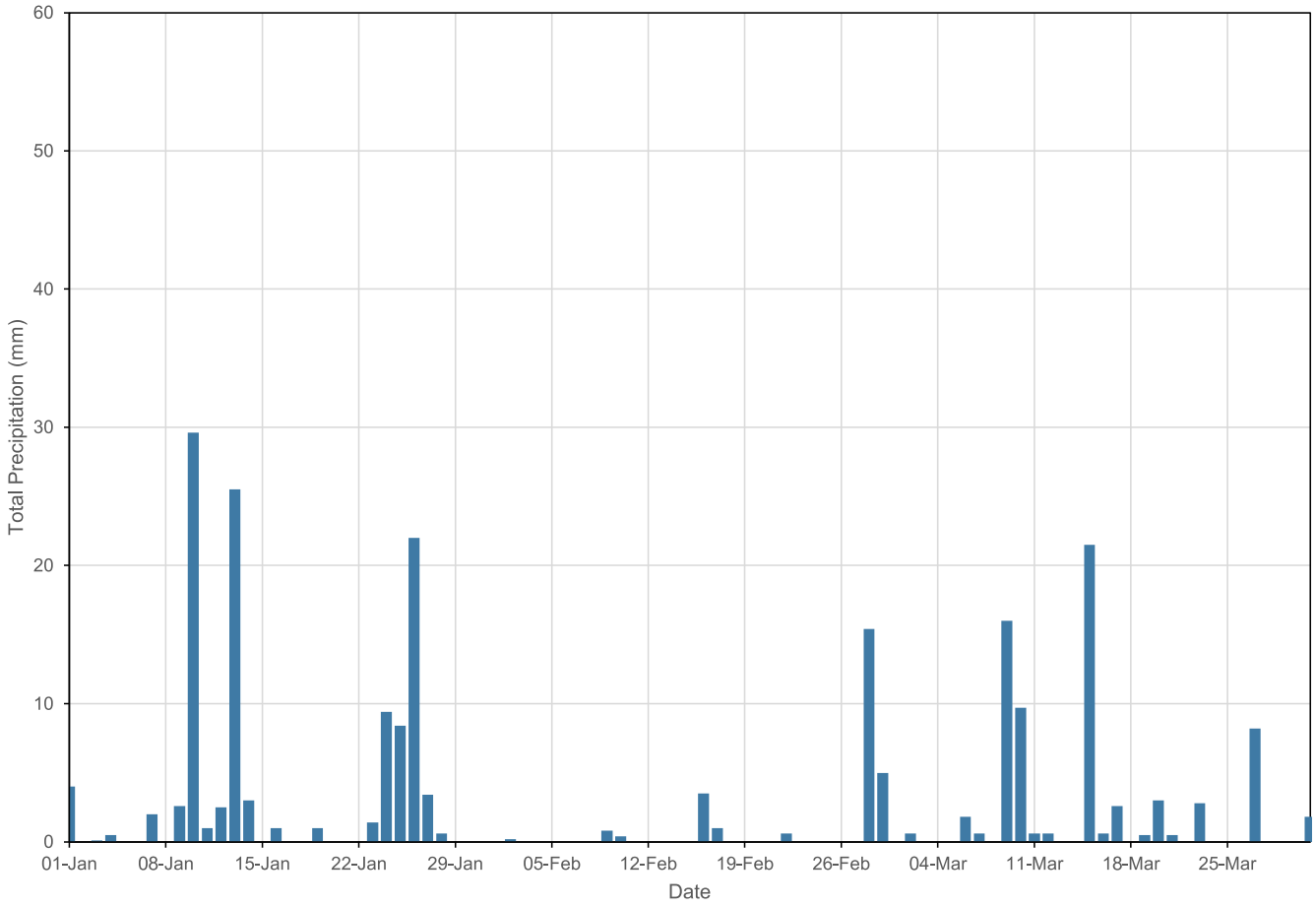


Figure A-8: 2024 Daily Precipitation at GRCA Shade's Mills Climate Station
April to June 2024

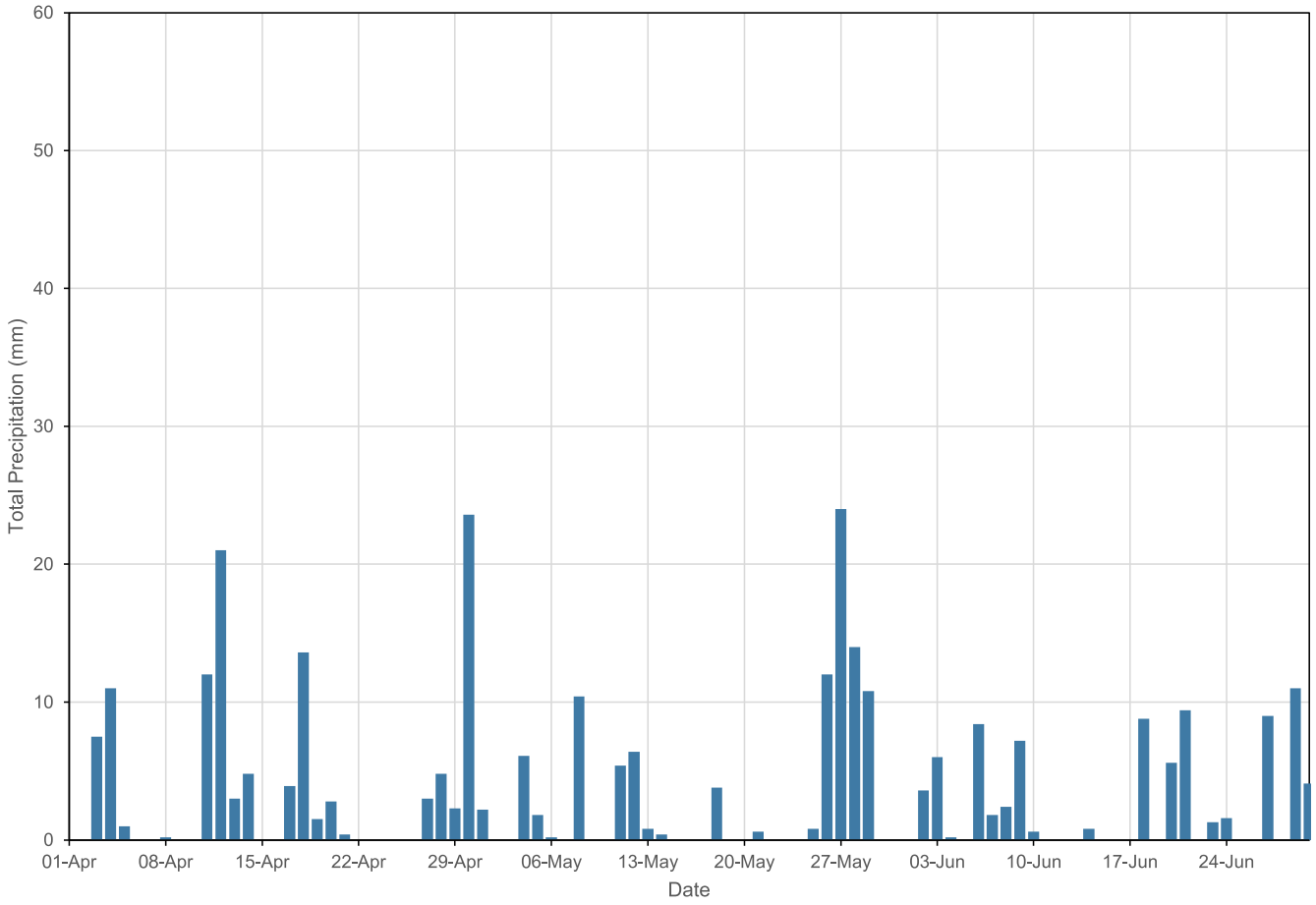


Figure A-9: 2024 Daily Precipitation at GRCA Shade's Mills Climate Station
July to September 2024

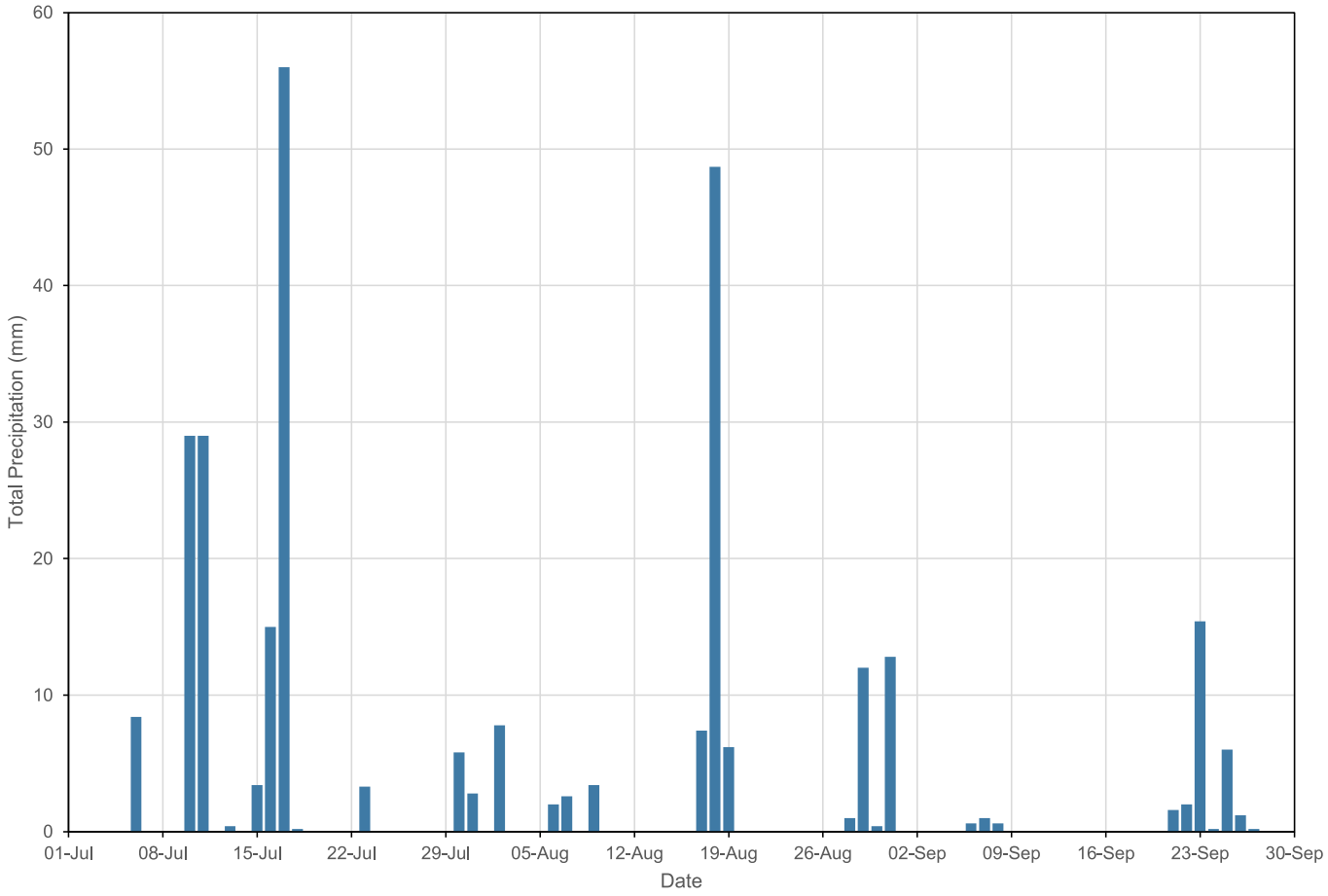


Figure A-10: 2024 Daily Precipitation at GRCA Shade's Mills Climate Station
October to December 2024

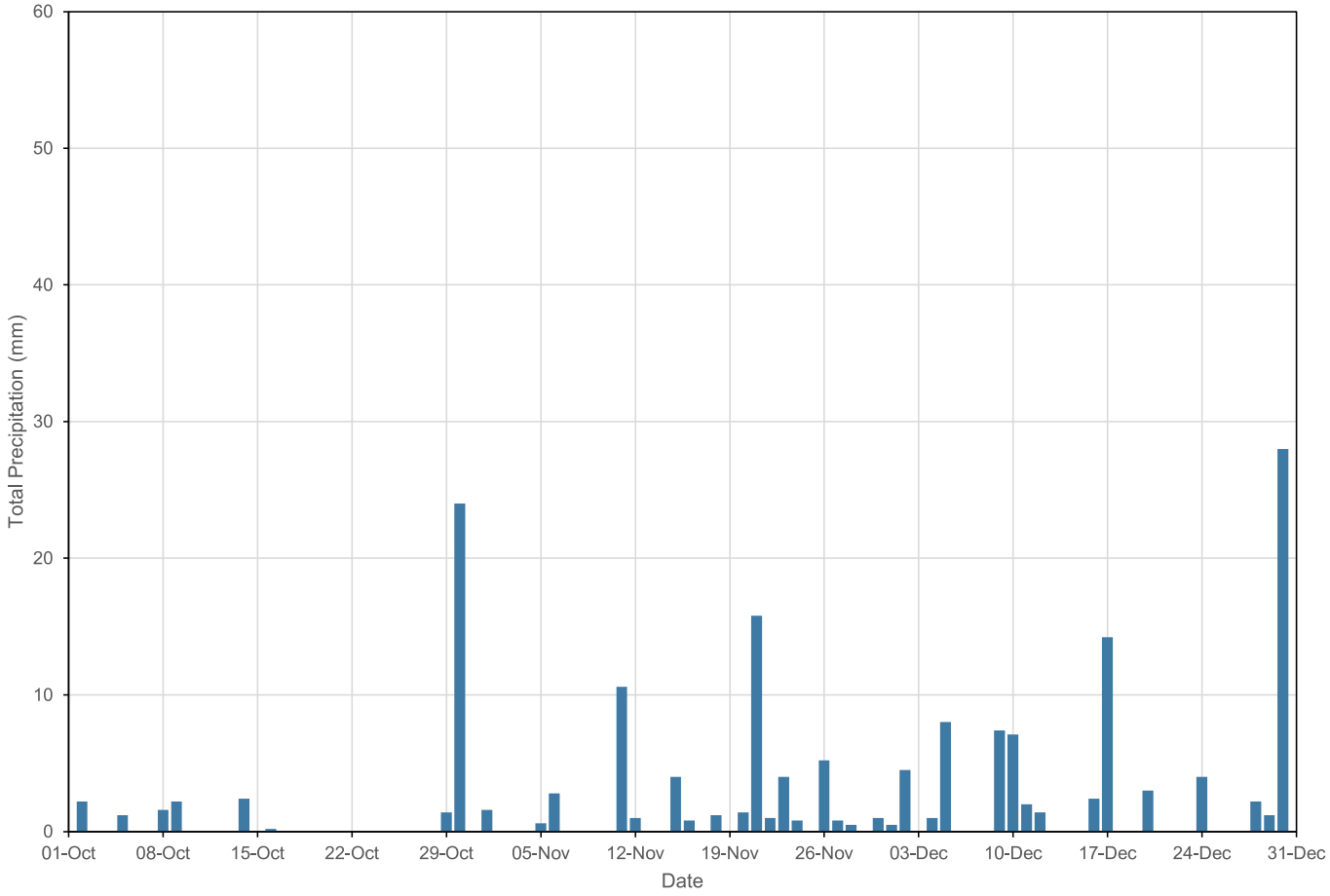


Figure A-11: 2024 Air Temperature at GRCA Shade's Mills Climate Station

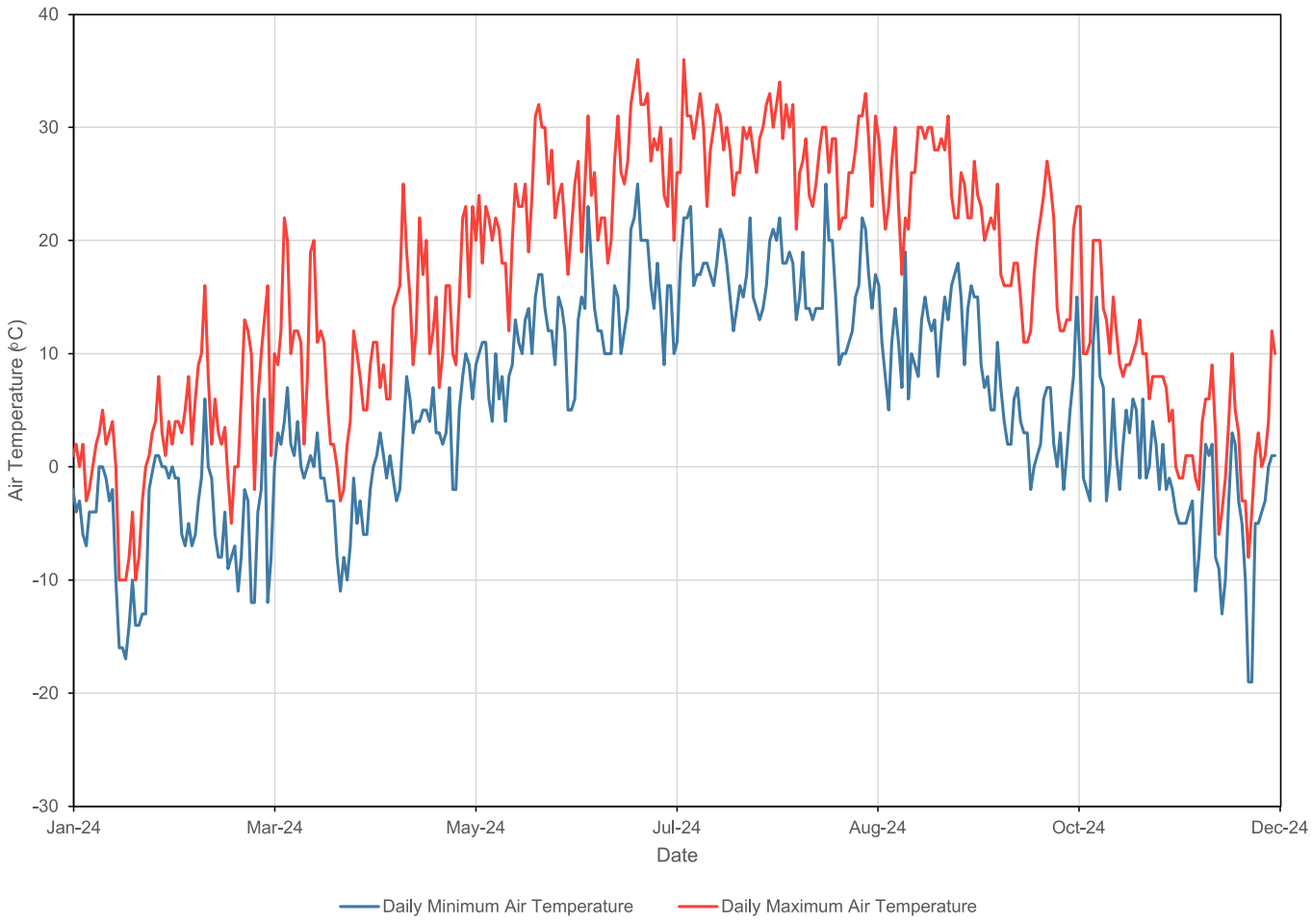


Figure A-12: 2024 Air Temperature at GRCA Shade's Mills Climate Station
January to March 2024

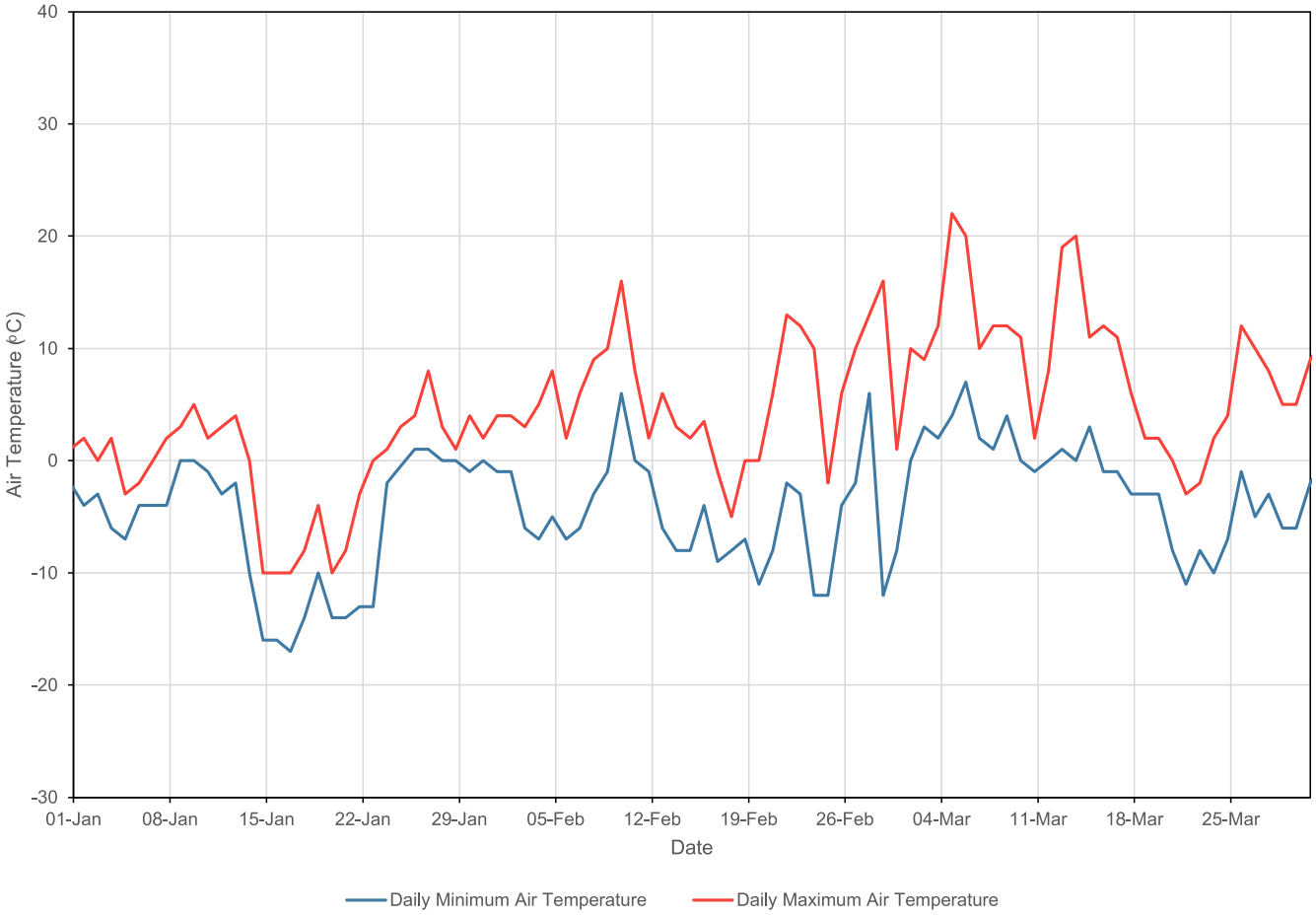


Figure A-13: 2024 Air Temperature at GRCA Shade's Mills Climate Station
April to June 2024

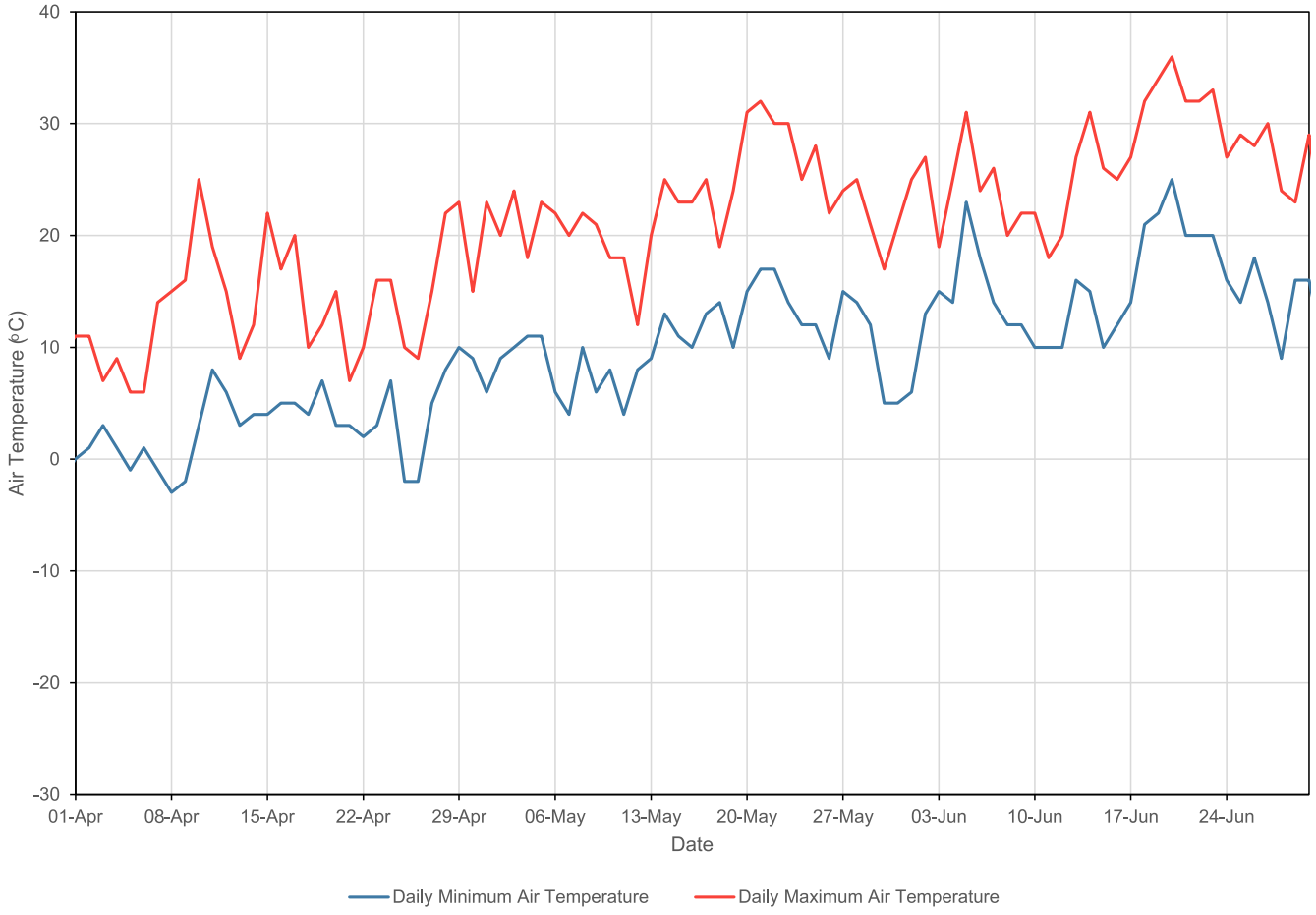


Figure A-14: 2024 Air Temperature at GRCA Shade's Mills Climate Station
July to September 2024

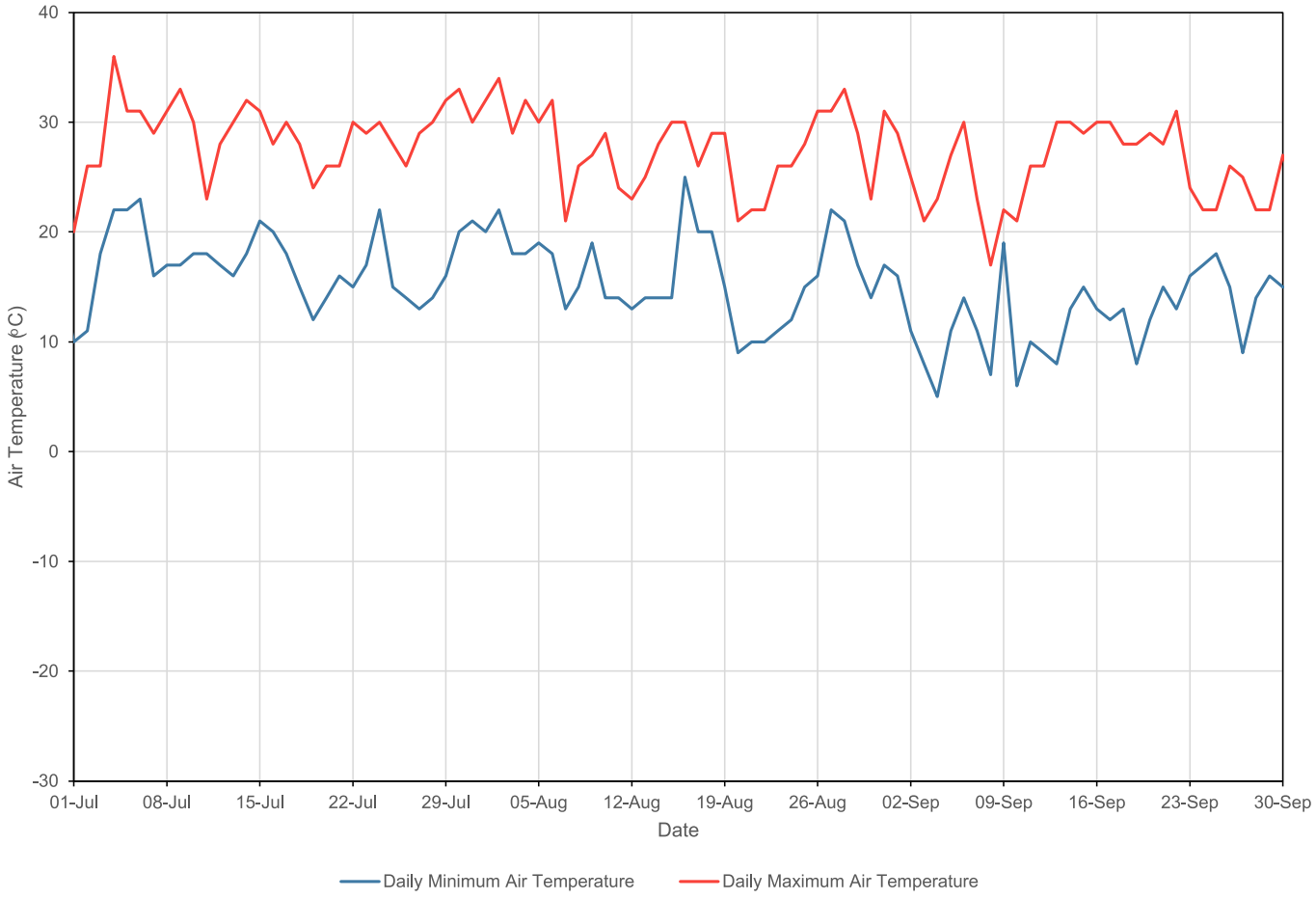
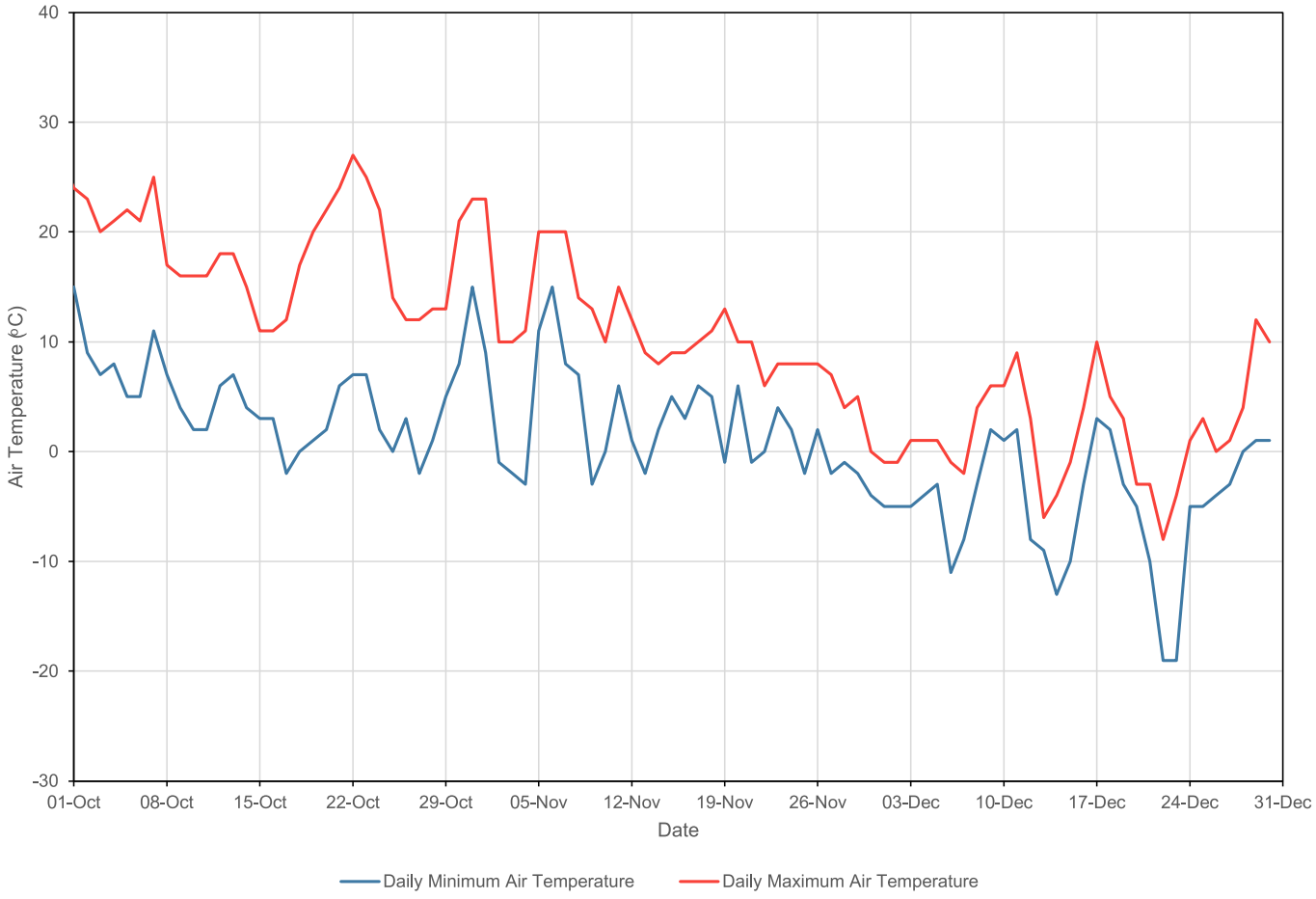


Figure A-15: 2024 Air Temperature at GRCA Shade's Mills Climate Station
October to December 2024



APPENDIX B

SWM1 and SWM2 Rating Curve Data

(Technical Appendix A - 2024 Surface Water Report)

Table B-1: SWM1 and SWM2 Rating Curve Data (2010-2024)

DATE	SWM1		SWM2	
	Water Level (m above logger)	Discharge (m^3/s)	Water Level (m above logger)	Discharge (m^3/s)
2010-Apr-01	0.3791	0.5578		
2010-Aug-30	0.1991	0.1440		
2010-Aug-04	0.2320	0.1810		
2010-Jun-11	0.3474	0.4786		
2010-Mar-05	0.2530	0.2244		
2010-Oct-13	0.2860	0.1970		
2011-Jun-02	0.3715	0.6025		
2011-Jul-12	0.2112	0.1950		
2011-Aug-22	0.1970	0.1380		
2011-Oct-12	0.2410	0.1730		
2011-Nov-08	0.2940	0.2520		
2012-Jan-11	0.3220	0.4106		
2012-Feb-01	0.4283	0.7185		
2012-Mar-05	0.4157	0.6063		
2012-Apr-11	0.2638	0.2173		
2012-May-02	0.2972	0.3090		
2012-Jun-06	0.2374	0.2035		
2012-Jul-10	0.1731	0.0873		
2012-Aug-03	0.1673	0.0720		
2012-Sep-06	0.2069	0.1291		
2012-Oct-02	0.2205	0.1621		
2012-Oct-25	0.3568	0.3969		
2012-Nov-26	0.2977	0.2689		
2012-Dec-14	0.3130	0.2868		
2013-Jan-08	0.2980	0.2557		
2013-Feb-07	0.3240	0.3409		
2013-Mar-20	0.3780	0.5361		
2013-Apr-17	0.4656	0.9823		
2013-May-09	0.2652	0.2998		
2013-Jun-13	0.3196	0.4461		
2013-Jul-22	0.2374	0.2822		
2013-Aug-26	0.2143	0.1867		
2013-Sep-16	0.2275	0.2069		
2013-Nov-19	0.3486	0.4941		
2013-Dec-16	0.2802	0.2977		
2014-Jan-20	0.4403	0.4256	BD	BD
2014-Mar-18	0.4394	0.3991	BD	BD
2014-May-07	0.3890	0.6505	0.5672	0.9354
2014-Jun-11	0.2685	0.2634	0.3764	0.4403
2014-Jul-15	0.2179	0.2112	0.3114	0.3092
2014-Aug-13	0.2688	0.2951	0.4125	0.5586
2014-Sep-30	0.2717	0.2431	0.3813	0.3921
2014-Oct-16	0.4248	0.3809	0.4486	0.5746
2014-Nov-17	0.4302	0.2647	0.3974	0.4467
2014-Dec-10	0.3861	0.3102	0.4207	0.4331
2015-Jan-20	0.3362	0.2373	0.3344	0.3616
2015-Mar-18	0.4530	0.4224	0.5280	0.8527
2015-Mar-26	0.3970	0.3646	0.3500	0.6412
2015-Apr-09	0.5810	1.1258	0.6145	1.6619
2015-May-19	0.2206	0.1786	0.2546	0.3285
2015-Jun-19	0.2616	0.2838	0.3453	0.4763
2015-Jul-20	0.2730	0.2424	0.2532	0.4641

Notes: BD - Beaver Dam located downstream; therefore, water level and discharge data not used
N/A - Water level/discharge measurement not available due to frozen/inaccessible conditions

Table B-1: SWM1 and SWM2 Rating Curve Data (2010-2024)

DATE	SWM1		SWM2	
	Water Level (m above logger)	Discharge (m^3/s)	Water Level (m above logger)	Discharge (m^3/s)
2015-Sep-15	0.2123	0.1071	0.3684	0.2821
2015-Oct-14	0.2594	0.1453	0.2057	0.2608
2015-Nov-16	0.4542	0.3319	0.4484	0.4401
2016-Feb-03	0.4175	0.6335	0.5123	0.9543
2016-Mar-04	0.4403	0.3401	0.3638	0.5504
2016-Apr-07	0.5685	1.1611	0.6255	1.6094
2016-May-04	0.3179	0.3561	0.3927	0.5631
2016-Jun-13	0.2267	0.1441	0.2983	0.2908
2016-Jul-05	0.2311	0.0991	0.2667	0.1903
2016-Aug-10	0.2225	0.0816	0.2841	0.1756
2016-Sep-27	0.2641	0.1452	0.3206	0.2525
2016-Oct-21	0.4087	0.2177	0.3499	0.3823
2016-Nov-18	0.4011	0.1612	0.3177	0.2624
2017-Jan-31	0.2605	0.3052	0.3385	0.5113
2017-Feb-16	0.1968	0.2204	0.2874	0.2869
2017-Mar-17	0.2212	0.2830	0.2716	0.4186
2017-Apr-12	0.4574	0.8291	0.5273	1.1843
2017-May-09	0.4664	0.9847	0.5489	1.2875
2017-Jun-12	0.2790	0.2830	0.3078	0.4290
2017-Jul-24	0.2879	0.1967	0.3518	0.4196
2017-Sep-21	0.2685	0.1475	0.3394	0.2692
2017-Oct-16	0.3208	0.2664	0.3745	0.4327
2017-Dec-08	0.2714	0.3052	0.3183	0.4778
2018-Jan-12	0.4859	0.9995	0.5923	1.4876
2018-Feb-09	N/A	N/A	0.2728	0.4086
2018-Mar-01	0.3637	0.7010	0.4446	0.9534
2018-Apr-04	0.4602	1.1219	0.5677	1.6301
2018-May-10	0.3368	0.4921	0.3793	0.6719
2018-Jun-18	0.2483	0.1872	0.2781	0.2478
2018-Jul-06	0.2542	0.1726	0.2856	0.2101
2018-Aug-09	0.3039	0.3207	0.3224	0.3643
2018-Sep-13	0.2940	0.1686	0.3006	0.1727
2018-Oct-30	BD	BD	0.2915	0.2919
2018-Nov-21	BD	BD	0.2971	0.3381
2019-Jan-03	BD	BD	0.4517	0.5925
2019-Feb-28	N/A	N/A	N/A	N/A
2019-Mar-20	0.6022	0.3100	N/A	N/A
2019-Apr-23	0.6312	0.4612	N/A	N/A
2019-May-23	0.4792	0.2310	0.3057	0.2708
2019-Jun-20	0.3611	0.1657	0.2712	0.2060
2019-Jul-18	0.3939	0.2256	0.3143	0.3089
2019-Aug-23	0.2833	0.0781	0.2352	0.0913
2019-Sep-25	0.3137	0.0661	0.3859	0.1123
2019-Oct-29	0.5038	0.2988	0.5950	0.2795
2019-Nov-27	0.3932	0.1666	0.5852	0.2220
2019-Dec-18	0.2952	0.1460	0.4663	0.2144
2020-Jan-07	0.3094	0.1479	0.4959	0.2434
2020-Feb-28	0.2522	0.1763	0.4512	0.2370
2020-Mar-12	0.5379	0.5878	0.6165	0.6633
2020-Apr-16	0.2584	0.2285	0.3816	0.2722

Notes:

BD - Beaver Dam located downstream; therefore, water level and discharge data not used

N/A - Water level/discharge measurement not available due to frozen/inaccessible conditions

Grey shading indicates measurements may be impacted by beaver dam activity downstream of monitoring locations

Table B-1: SWM1 and SWM2 Rating Curve Data (2010-2024)

DATE	SWM1		SWM2	
	Water Level (m above logger)	Discharge (m^3/s)	Water Level (m above logger)	Discharge (m^3/s)
2020-May-28	0.2889	0.1124	0.2987	0.1819
2020-Jun-25	0.2623	0.0816	0.2843	0.2364
2020-Jul-22	0.2545	0.0760	0.2867	0.1223
2020-Aug-25	0.2264	0.0891	0.3169	0.1318
2020-Sep-21	0.2445	0.0608	0.2843	0.0843
2020-Oct-30	0.3029	0.1116	0.3305	0.1435
2020-Nov-26	0.3874	0.2289	0.4319	0.3762
2020-Dec-18	0.2548	0.0594	0.3498	0.1399
2021-Jan-13	0.2920	0.1147	0.2840	0.1698
2021-Feb-26	0.2542	0.1239	0.2614	0.1618
2021-Mar-29	0.3938	0.2587	0.4433	0.4380
2021-Apr-29	0.2643	0.1587	0.2606	0.1563
2021-May-27	0.2285	0.0560	0.2314	0.0962
2021-Jun-22	0.2325	0.0531	0.2325	0.1045
2021-Jul-30	0.2650	0.0865	0.2682	0.1063
2021-Aug-13	0.2466	0.0422	0.2552	0.0880
2021-Sep-30	0.2810	0.0874	0.2813	0.1436
2021-Oct-25	0.3422	0.1572	0.3114	0.2854
2021-Nov-18	0.3177	0.1382	0.2990	0.2154
2021-Dec-15	0.3566	0.1645	0.3236	0.2829
2022-Jan-07	0.2627	0.0754	0.2416	0.1679
2022-Feb-22	0.3623	0.2631	0.3321	0.3126
2022-Mar-25	0.6290	0.8359	0.5760	0.8530
2022-Apr-22	0.4278	0.2887	0.3452	0.3789
2022-May-25	0.2996	0.1002	0.2286	0.1654
2022-Jun-16	0.3074	0.0957	0.2619	0.1256
2022-Jul-15	0.2786	0.0338	0.2414	0.0768
2022-Aug-26	0.2915	0.0308	0.2496	0.0840
2022-Sep-09	0.2682	0.0376	0.2454	0.0837
2022-Oct-14	0.3379	0.0731	0.2796	0.1121
2022-Nov-25	0.3031	0.0650	0.2615	0.1123
2022-Dec-20	0.3094	0.0479	0.2153	0.0800
2023-Jan-13	0.3410	0.1193	0.2803	0.1564
2023-Feb-15	0.3443	0.1399	0.2866	0.2009
2023-Mar-15	0.2824	0.0826	0.2548	0.1707
2023-Apr-28	0.3556	0.1412	0.2556	0.2213
2023-May-26	0.3132	0.0925	0.2457	0.1657
2023-Jun-15	0.3313	0.1346	0.2591	0.1761
2023-Jul-25	0.9214	1.7009	0.7432	1.9224
2023-Aug-09	0.3146	0.1533	0.2885	0.1915
2023-Sep-08	0.3171	0.1346	0.2595	0.0935
2023-Oct-27	0.3385	0.0779	0.2851	0.1378
2023-Nov-16	0.3144	0.0932	0.2820	0.1412
2023-Dec-19	0.3370	0.1268	0.2928	0.1886
2024-Jan-15	0.4482	0.2544	0.4757	0.3516
2024-Feb-27	0.3104	0.1181	0.2617	0.1741
2024-Mar-13	0.3670	0.2556	0.3177	0.1906
2024-Apr-05	0.3858	0.2454	0.3588	0.3415
2024-May-13	0.3311	0.0942	0.2152	0.2193
2024-Jun-04	0.3280	0.1196	0.2222	0.1909
2024-Jul-09	0.2652	0.0762	0.2023	0.1664

Notes:

BD - Beaver Dam located downstream; therefore, water level and discharge data not used

N/A - Water level/discharge measurement not available due to frozen/inaccessible conditions

Grey shading indicates measurements may be impacted by beaver dam activity downstream of monitoring locations

Table B-1: SWM1 and SWM2 Rating Curve Data (2010-2024)

DATE	SWM1		SWM2	
	Water Level (m above logger)	Discharge (m^3/s)	Water Level (m above logger)	Discharge (m^3/s)
2024-Aug-13	0.2992	0.1002	0.2464	0.1435
2024-Sep-10	0.2905	0.0790	0.2376	0.1194
2024-Oct-02	0.3054	0.0791	0.2563	0.1562
2024-Nov-04	0.3141	0.0737	0.2588	0.1155
2024-Dec-02	0.3082	0.0794	0.2564	0.1404

Notes:

BD - Beaver Dam located downstream; therefore, water level and discharge data not used

N/A - Water level/discharge measurement not available due to frozen/inaccessible conditions

Grey shading indicates measurements may be impacted by beaver dam activity downstream of monitoring locations

APPENDIX C

Monthly Hydrographs

(Technical Appendix A - 2024 Surface Water Report)

Figure C-1: 2024 Calculated Stream Flow at SWM1
January 2024

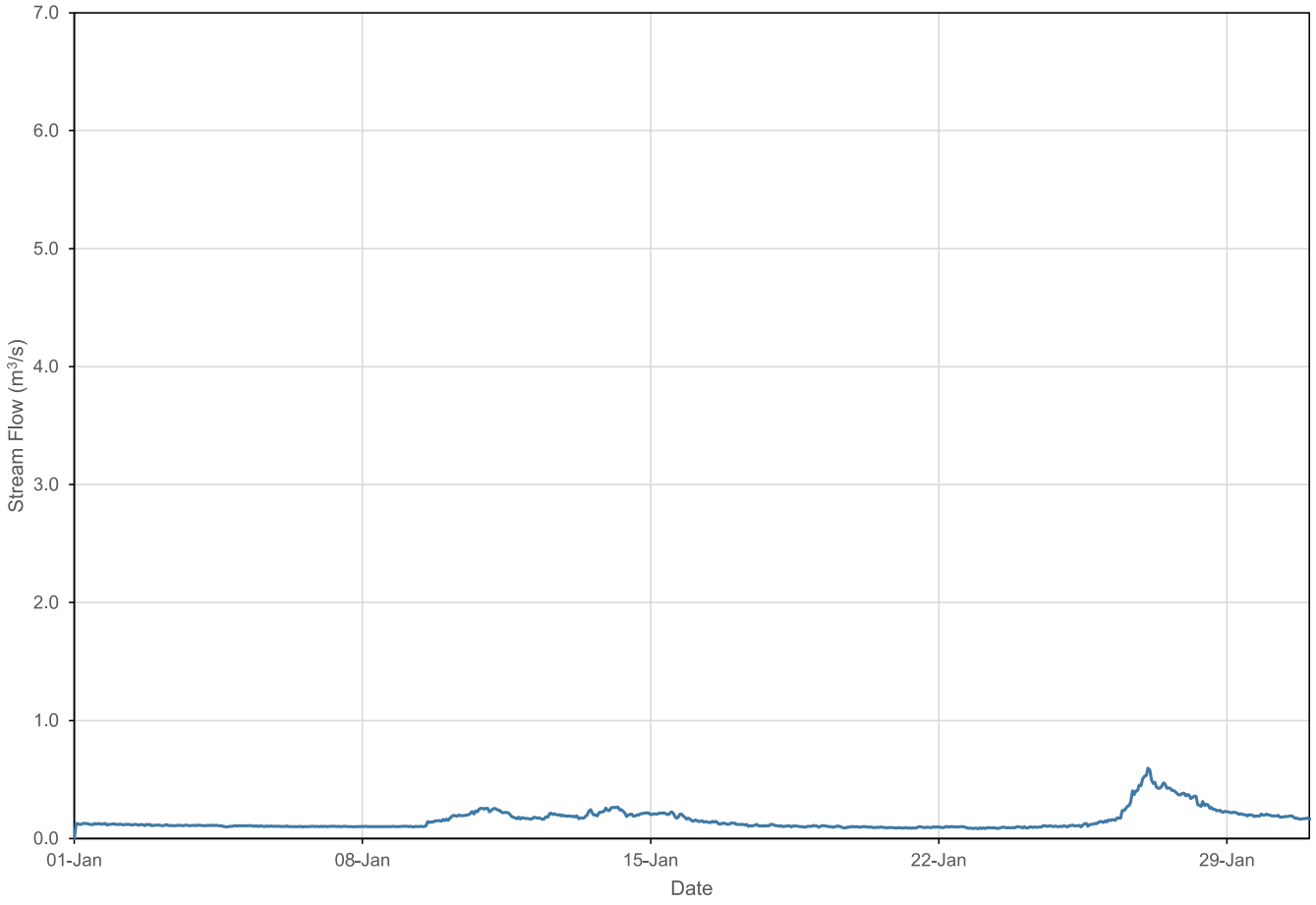


Figure C-2: 2024 Calculated Stream Flow at SWM1
February 2024

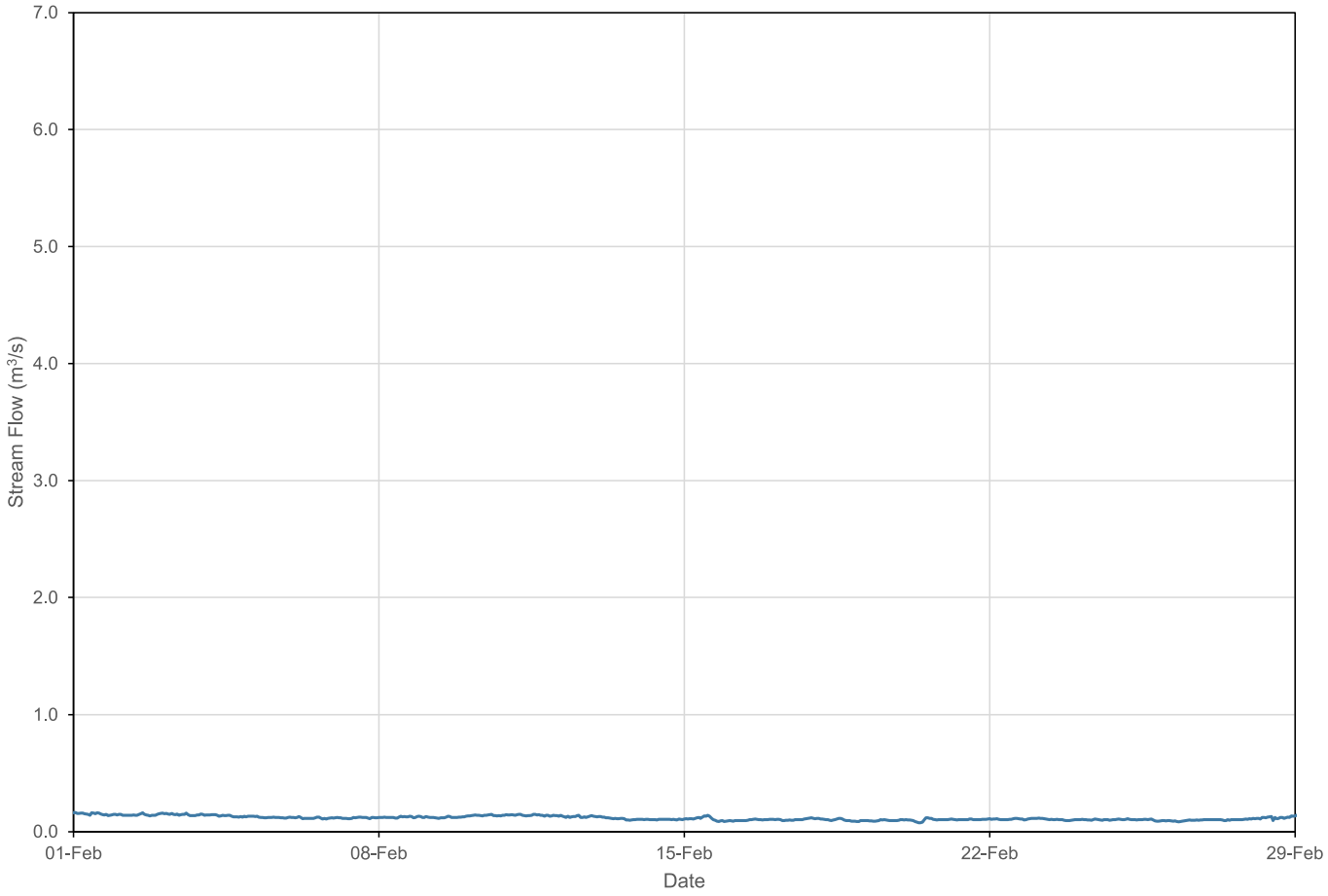


Figure C-3: 2024 Calculated Stream Flow at SWM1
March 2024

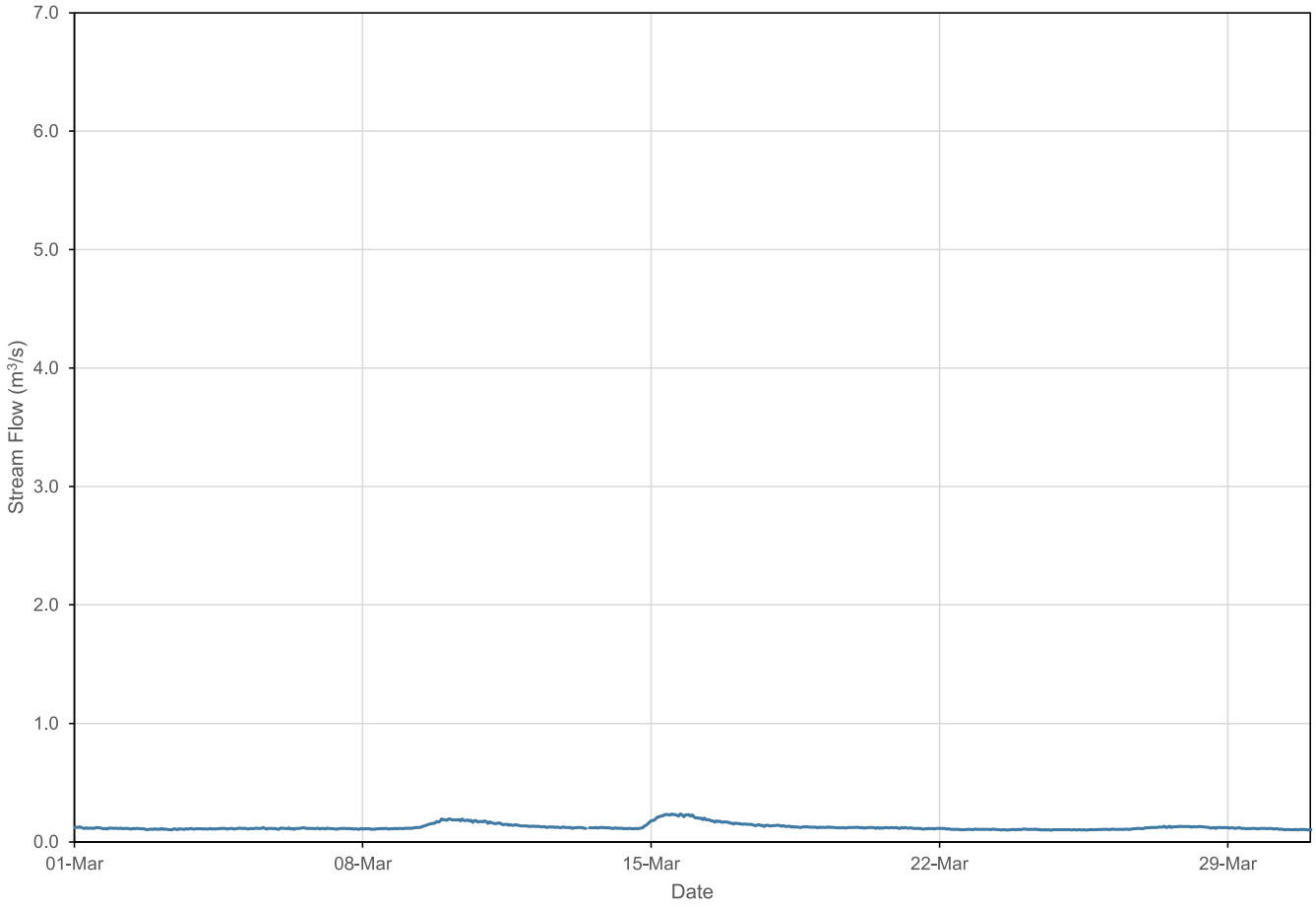


Figure C-4: 2024 Calculated Stream Flow at SWM1
April 2024

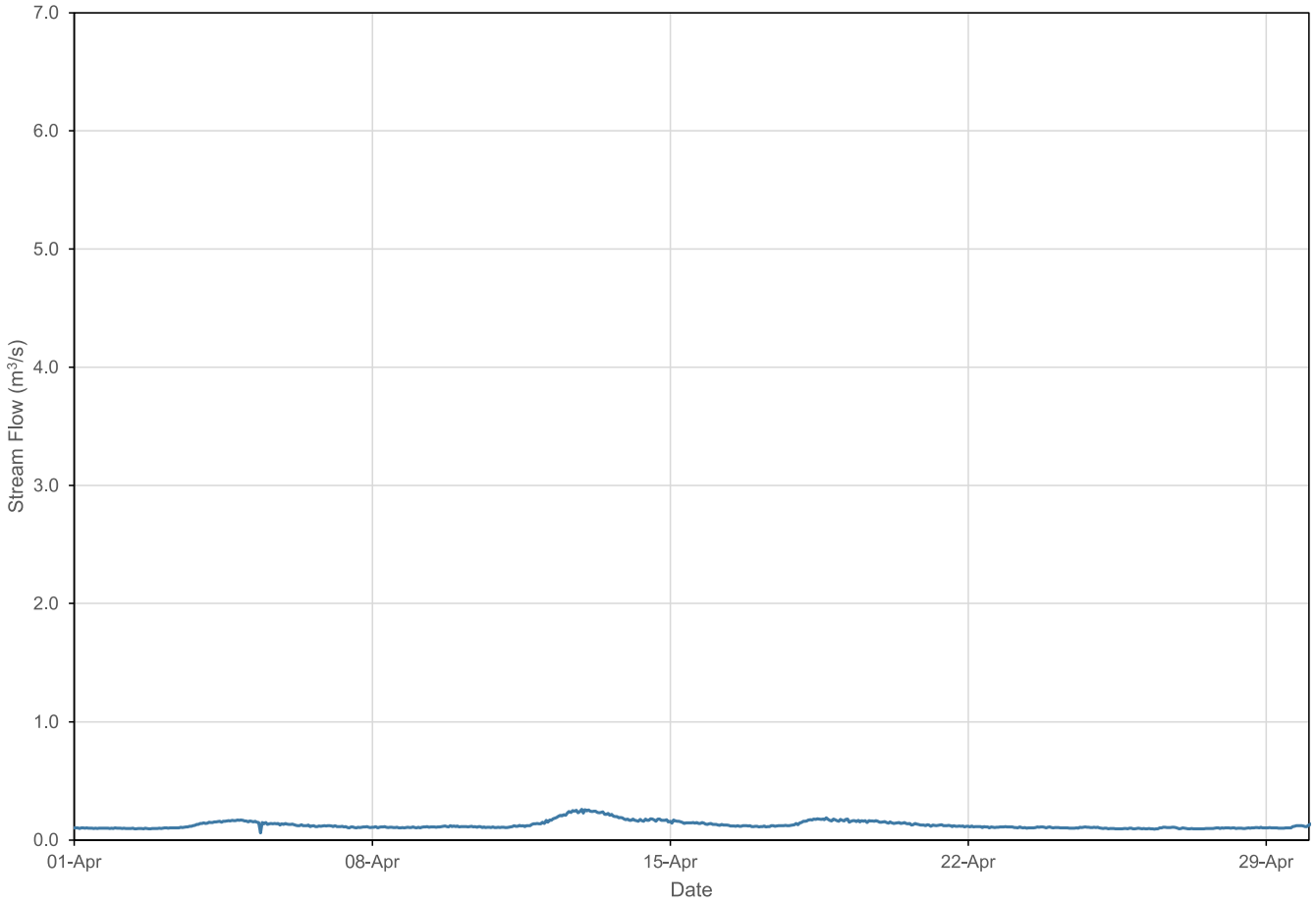


Figure C-5: 2024 Calculated Stream Flow at SWM1
May 2024

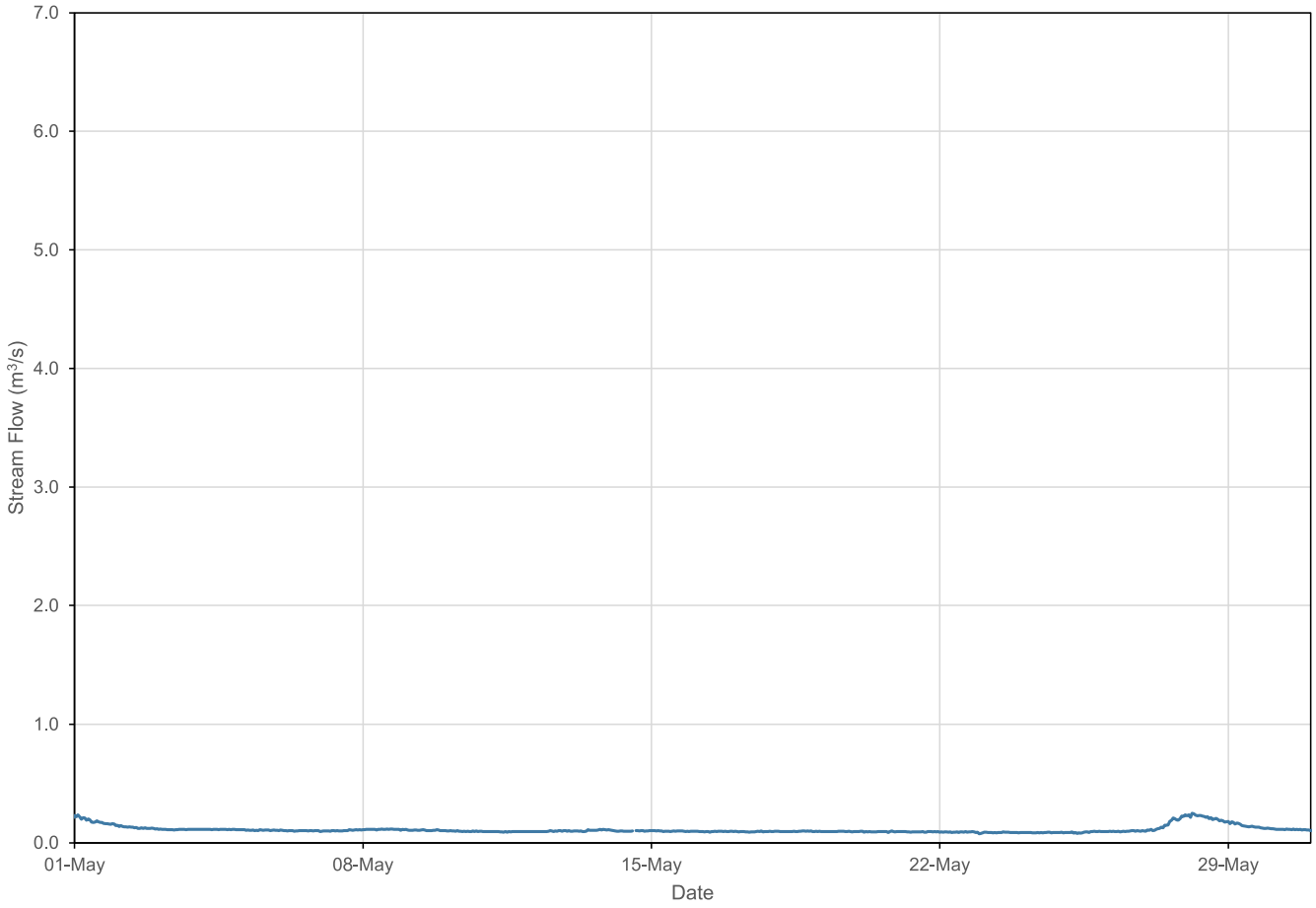


Figure C-6: 2024 Calculated Stream Flow at SWM1
June 2024

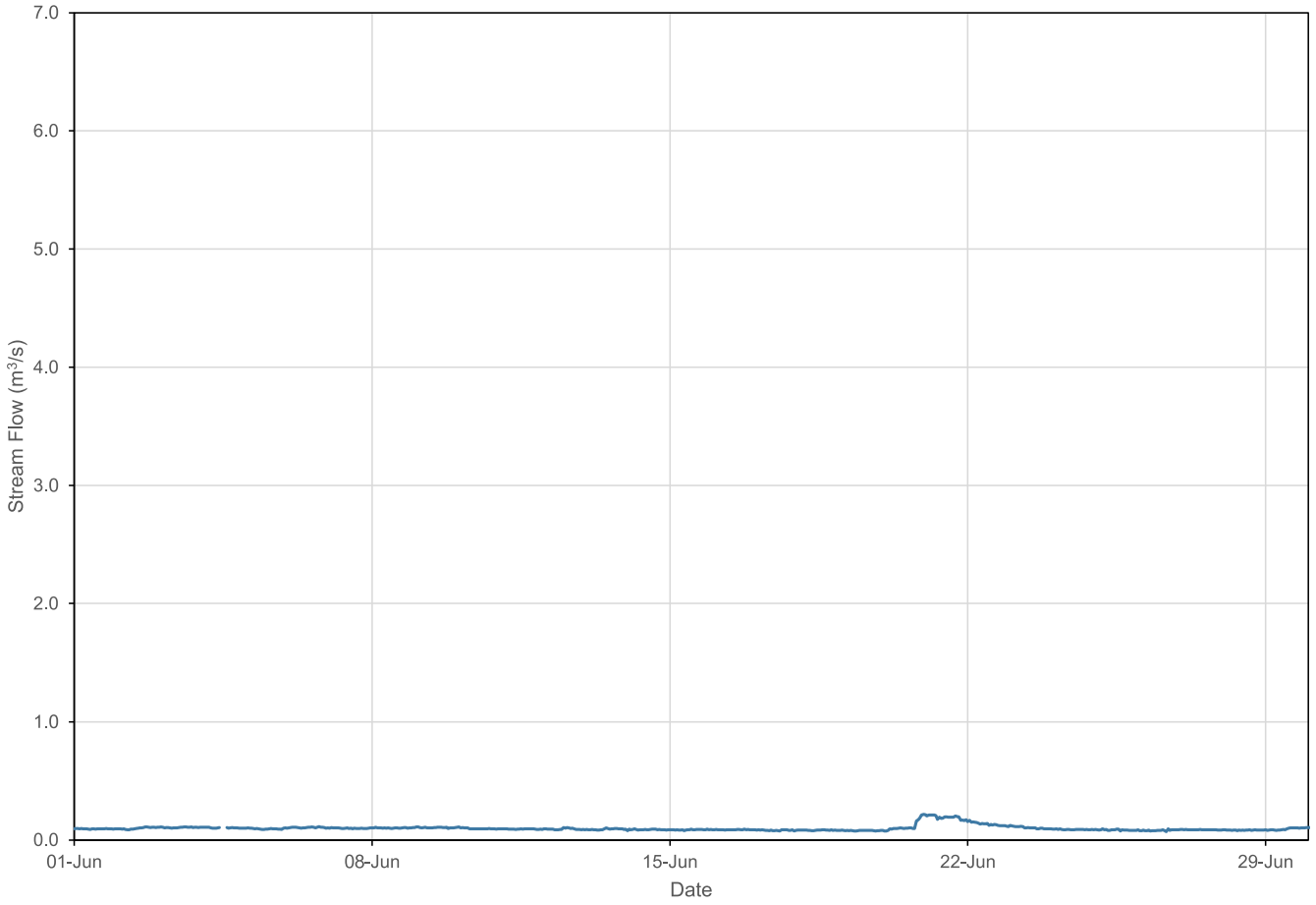


Figure C-7: 2024 Calculated Stream Flow at SWM1
July 2024

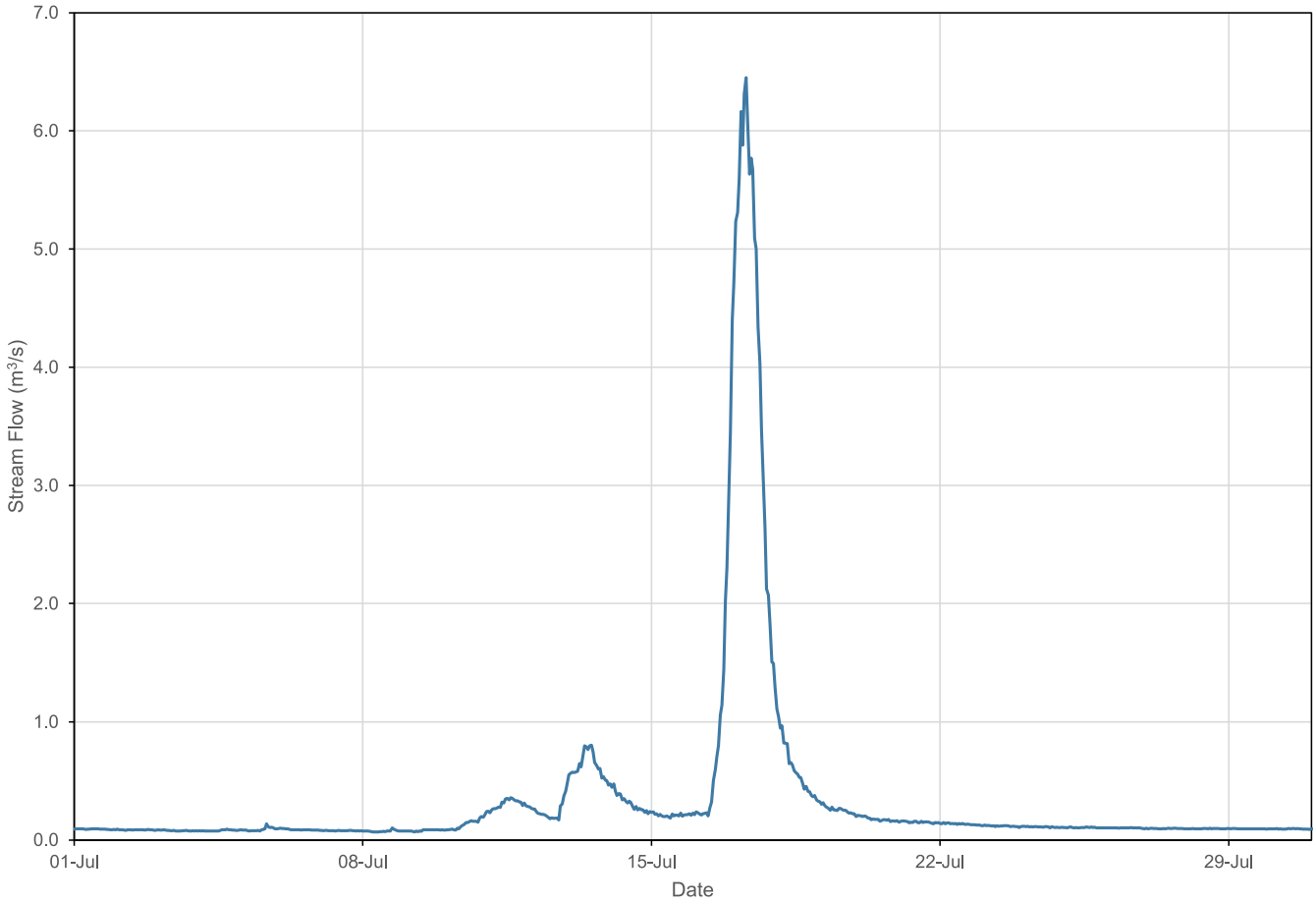


Figure C-8: 2024 Calculated Stream Flow at SWM1
August 2024

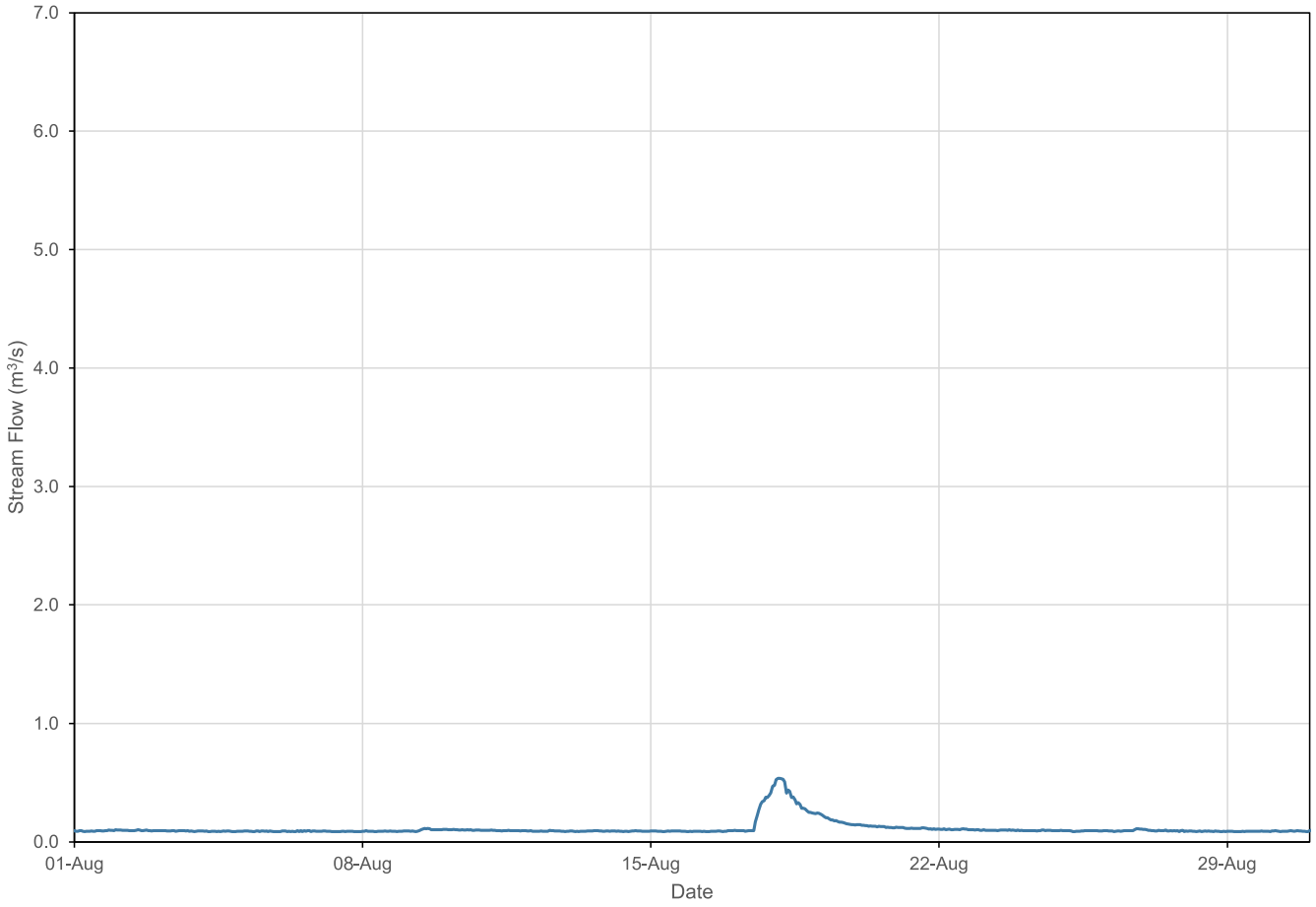


Figure C-9: 2024 Calculated Stream Flow at SWM1
September 2024

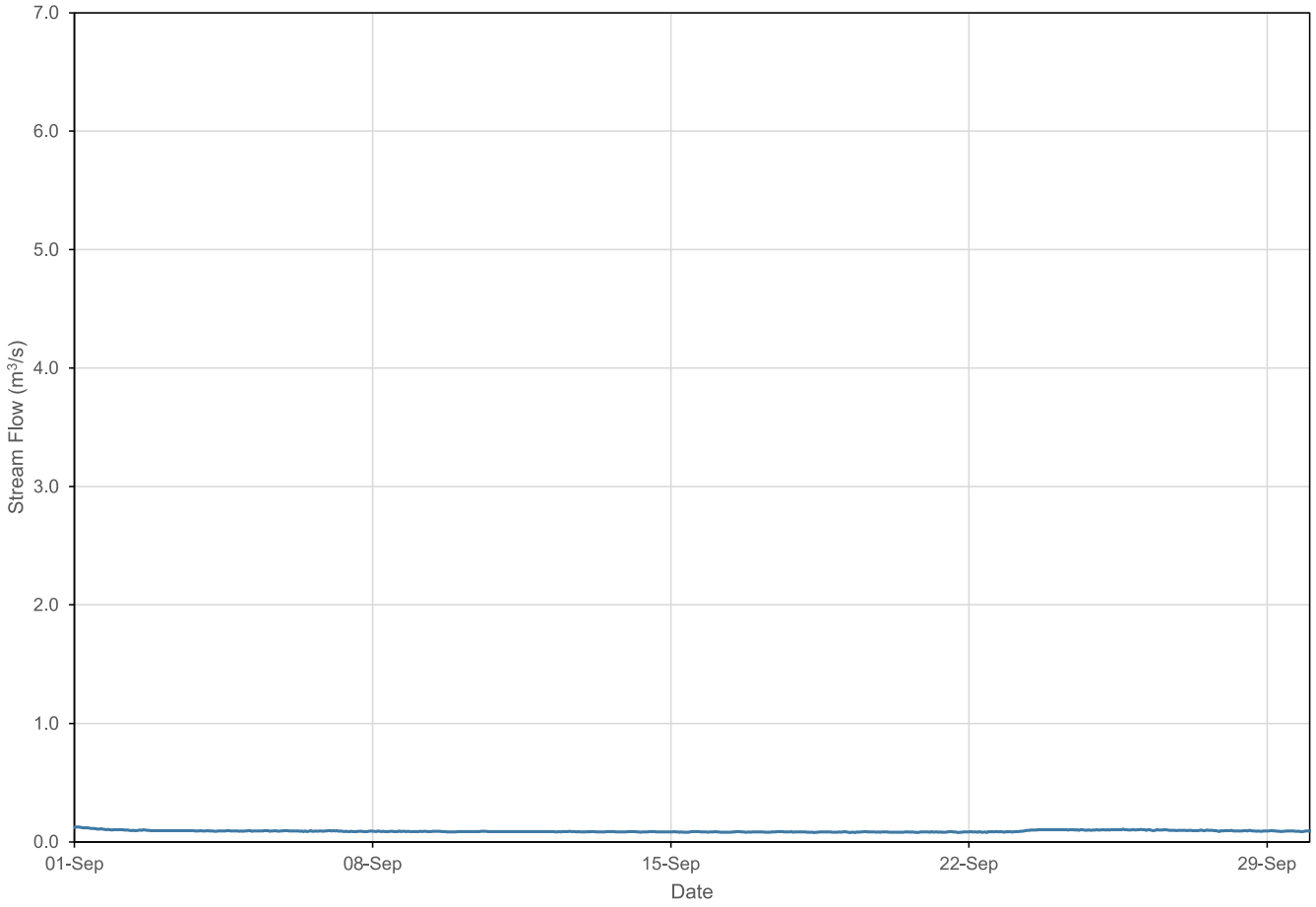


Figure C-10: 2024 Calculated Stream Flow at SWM1
October 2024

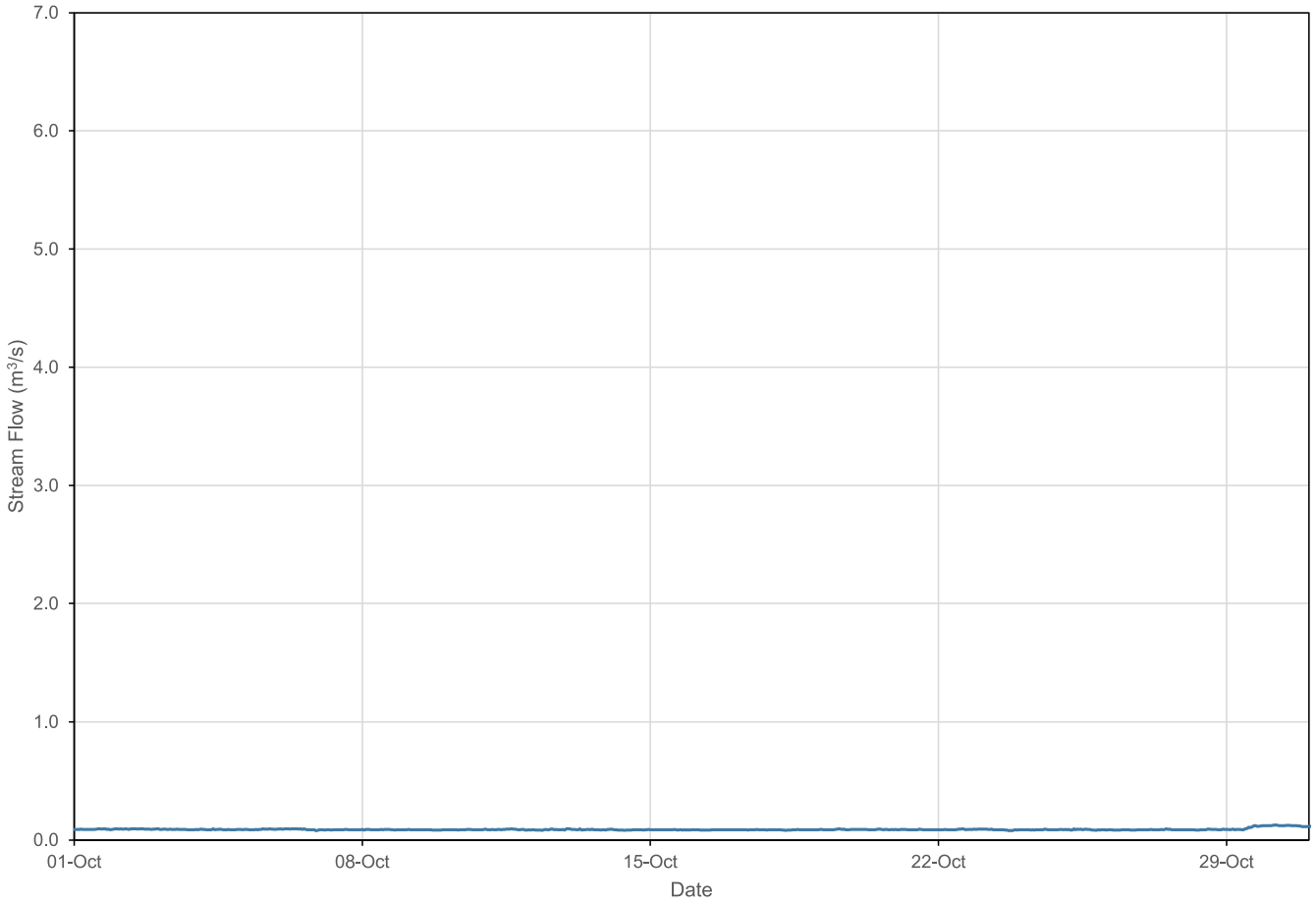


Figure C-11: 2024 Calculated Stream Flow at SWM1
November 2024

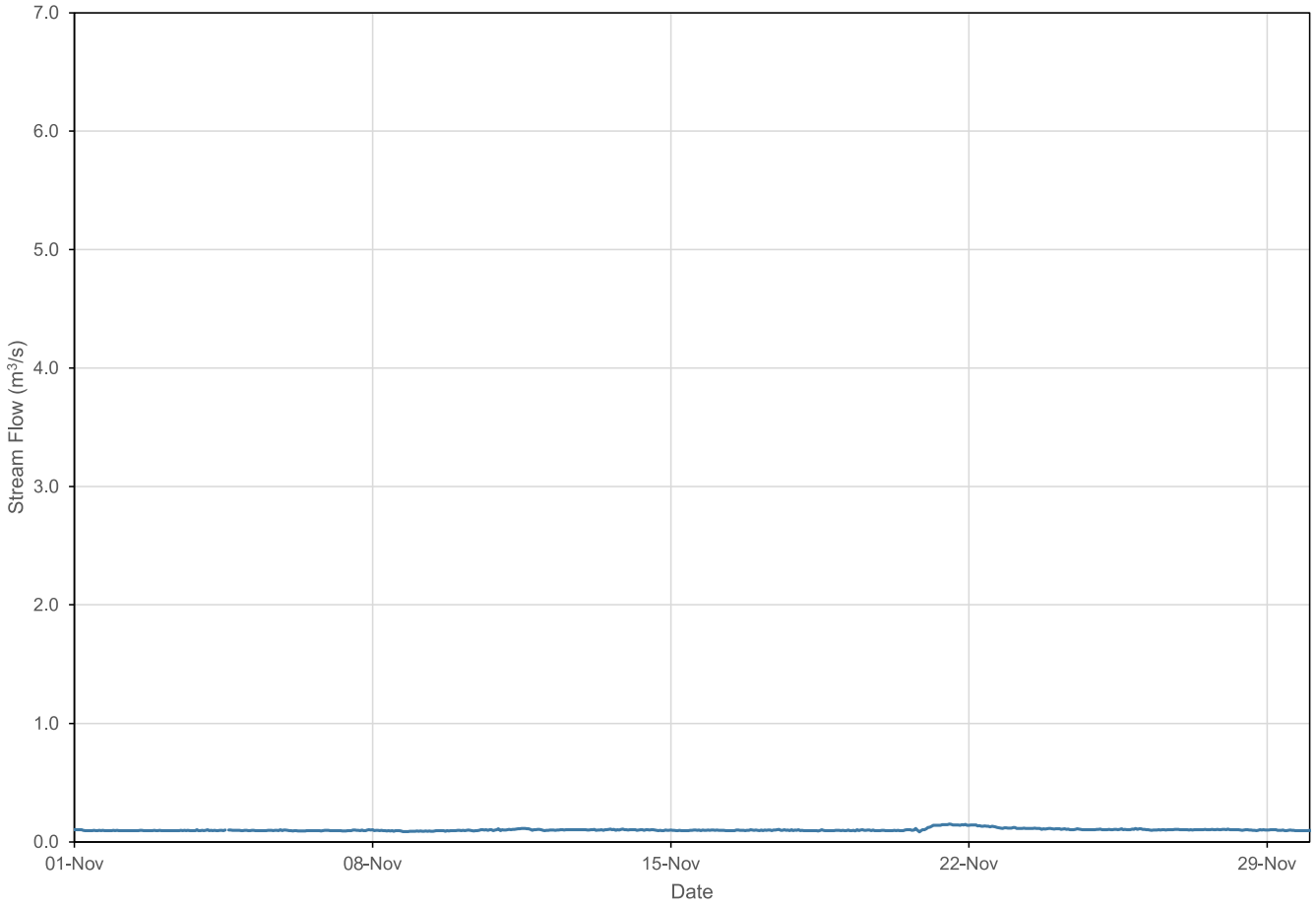


Figure C-12: 2024 Calculated Stream Flow at SWM1
December 2024

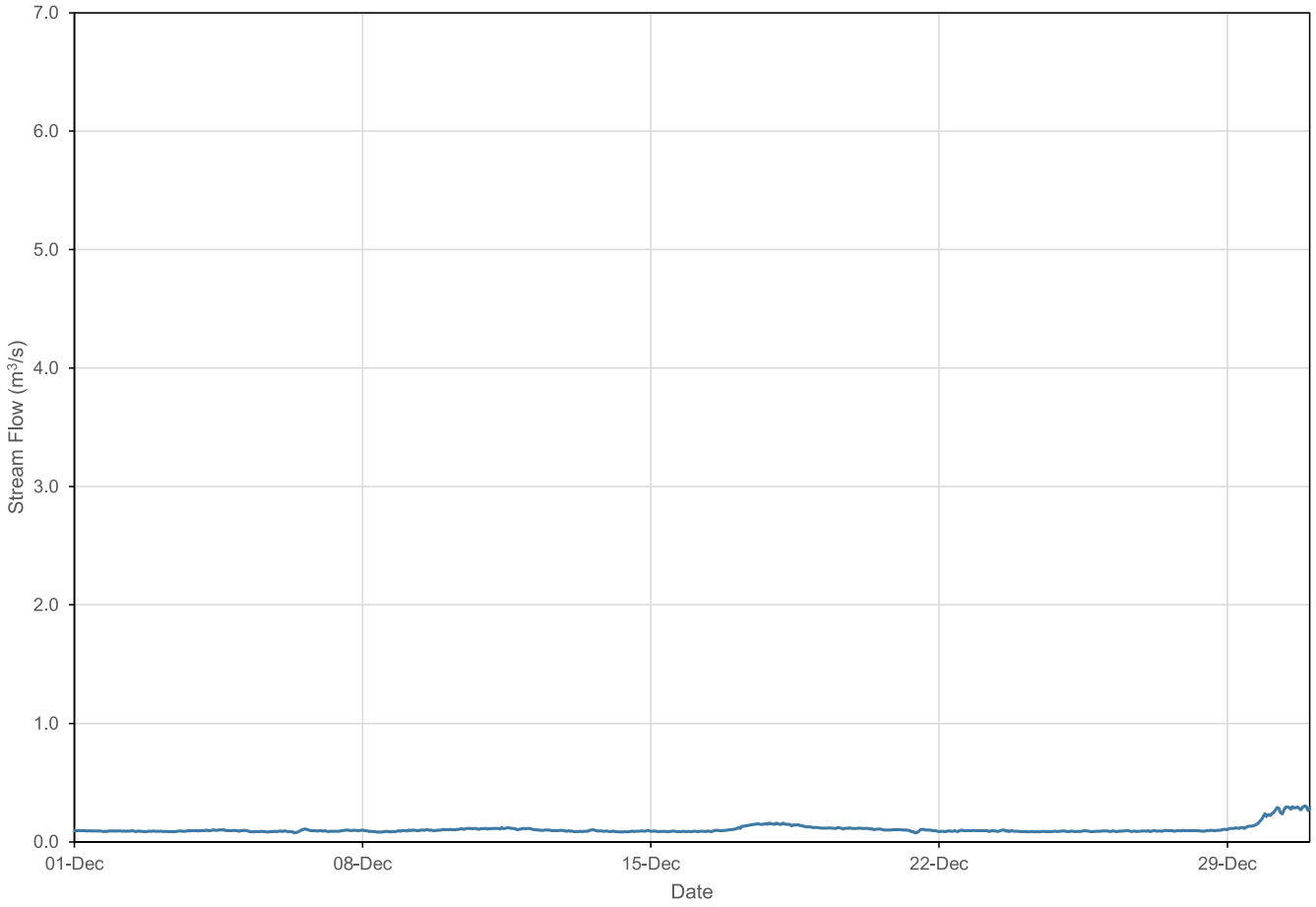


Figure C-13: 2024 Calculated Stream Flow at SWM2
January 2024

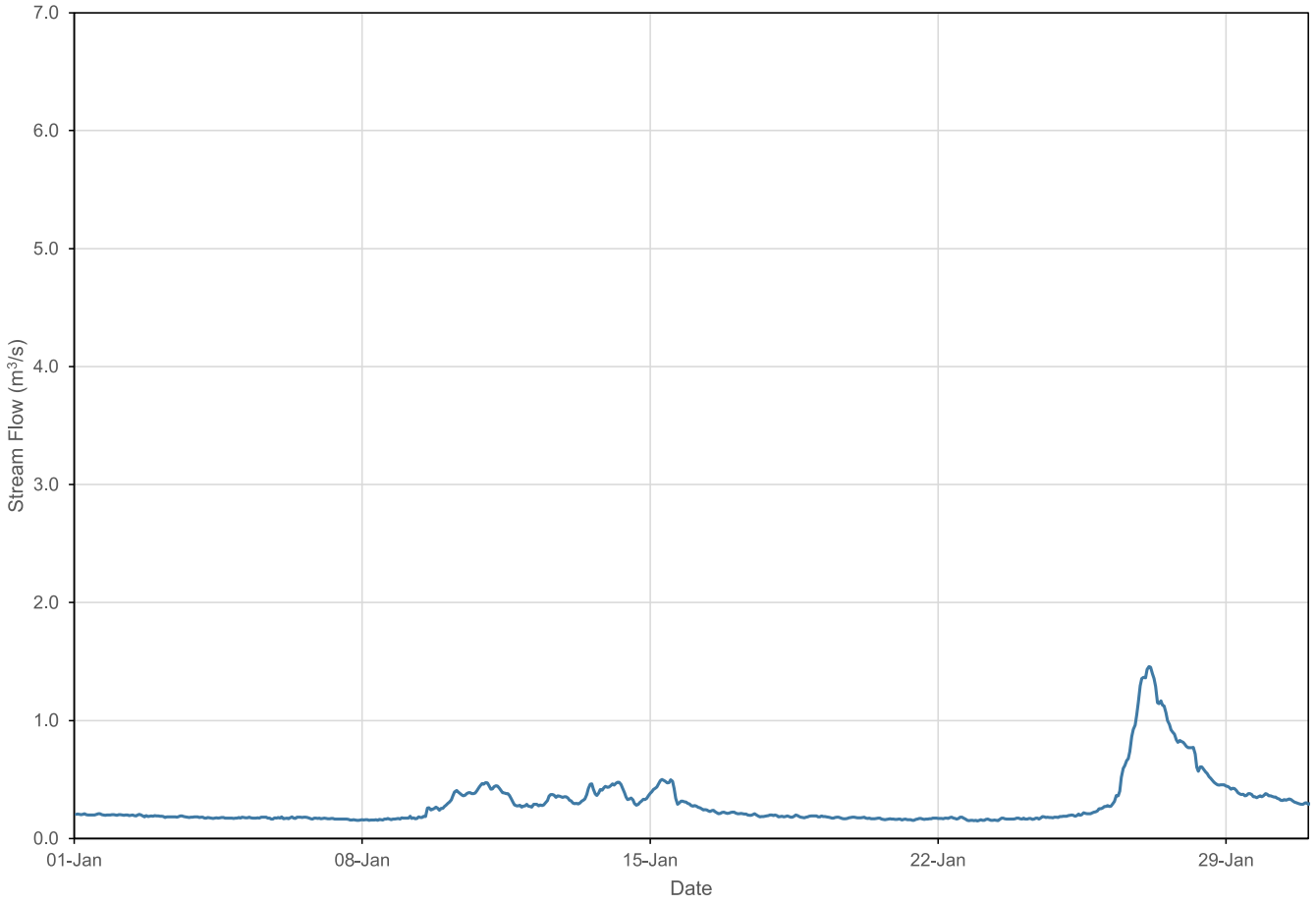


Figure C-14: 2024 Calculated Stream Flow at SWM2
February 2024

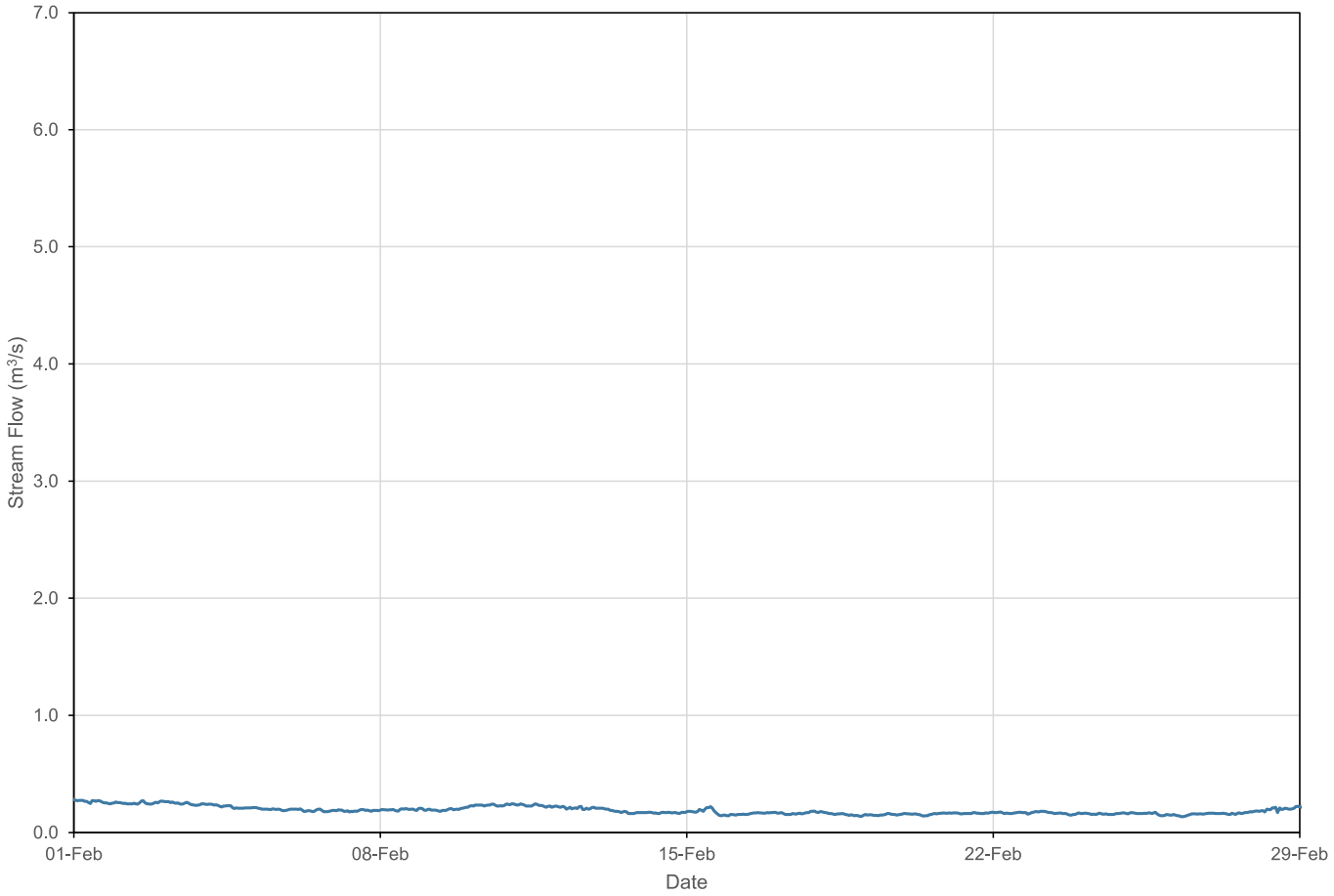


Figure C-15: 2024 Calculated Stream Flow at SWM2
March 2024

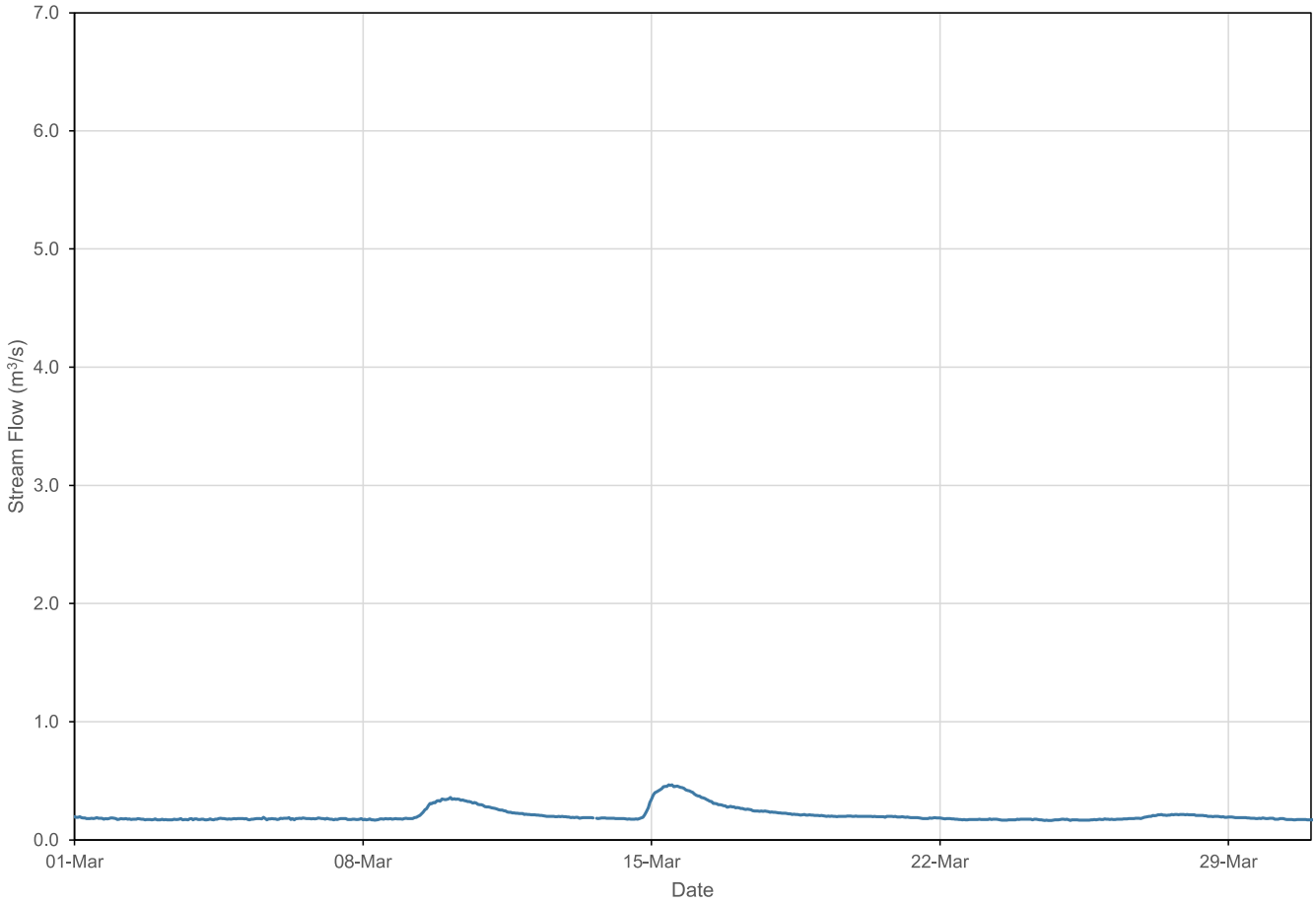


Figure C-16: 2024 Calculated Stream Flow at SWM2
April 2024

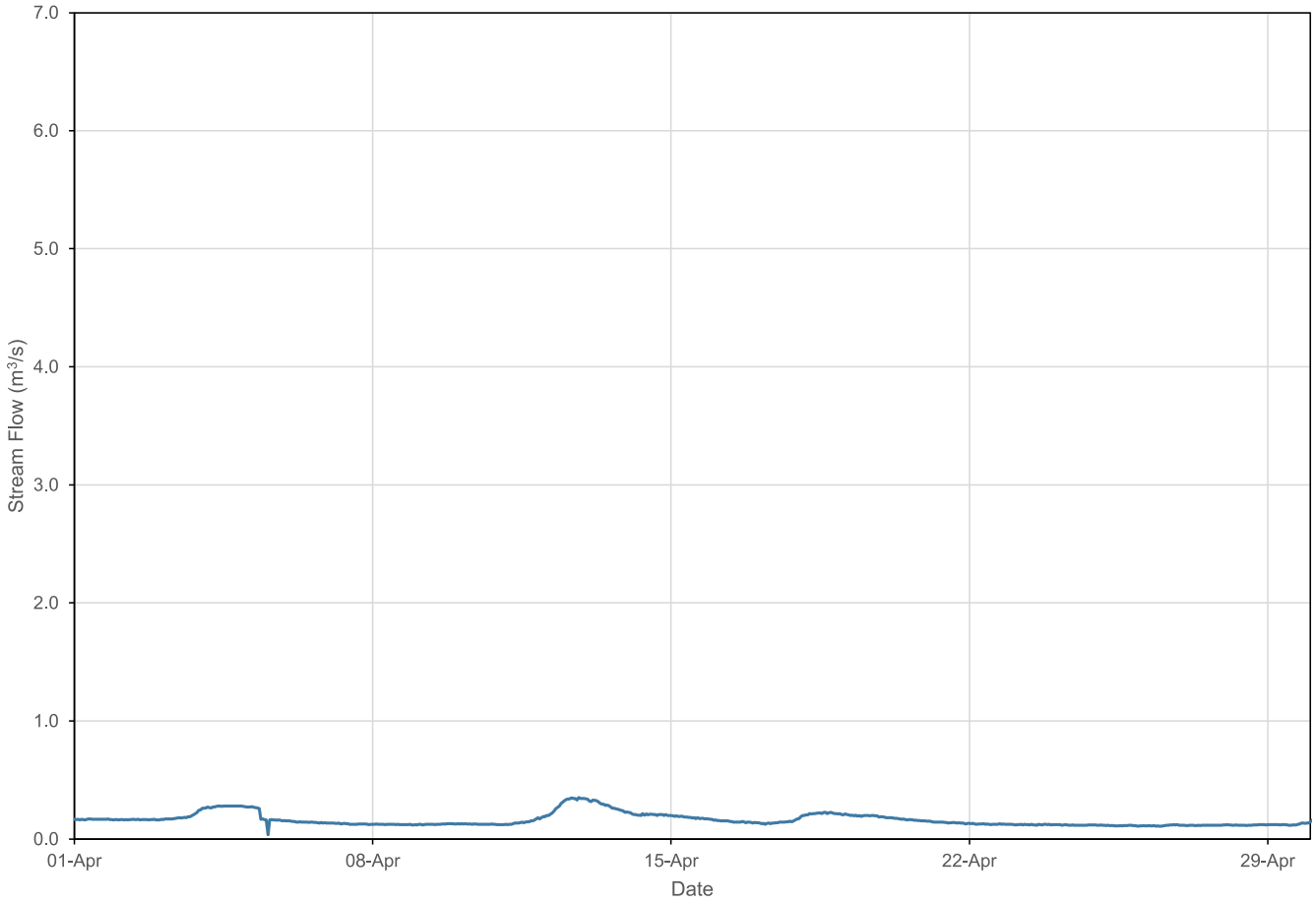


Figure C-17: 2024 Calculated Stream Flow at SWM2
May 2024

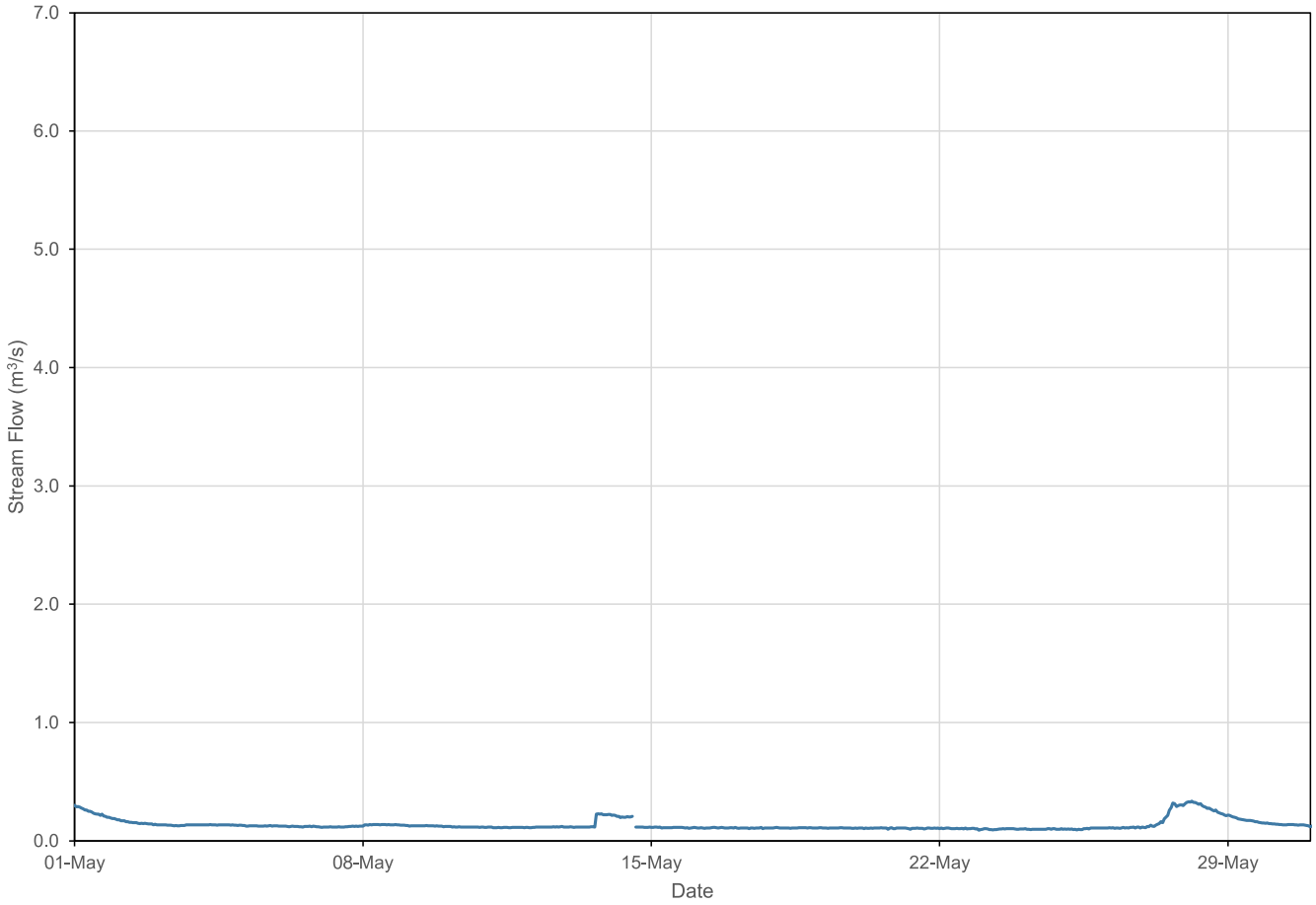


Figure C-18: 2024 Calculated Stream Flow at SWM2
June 2024

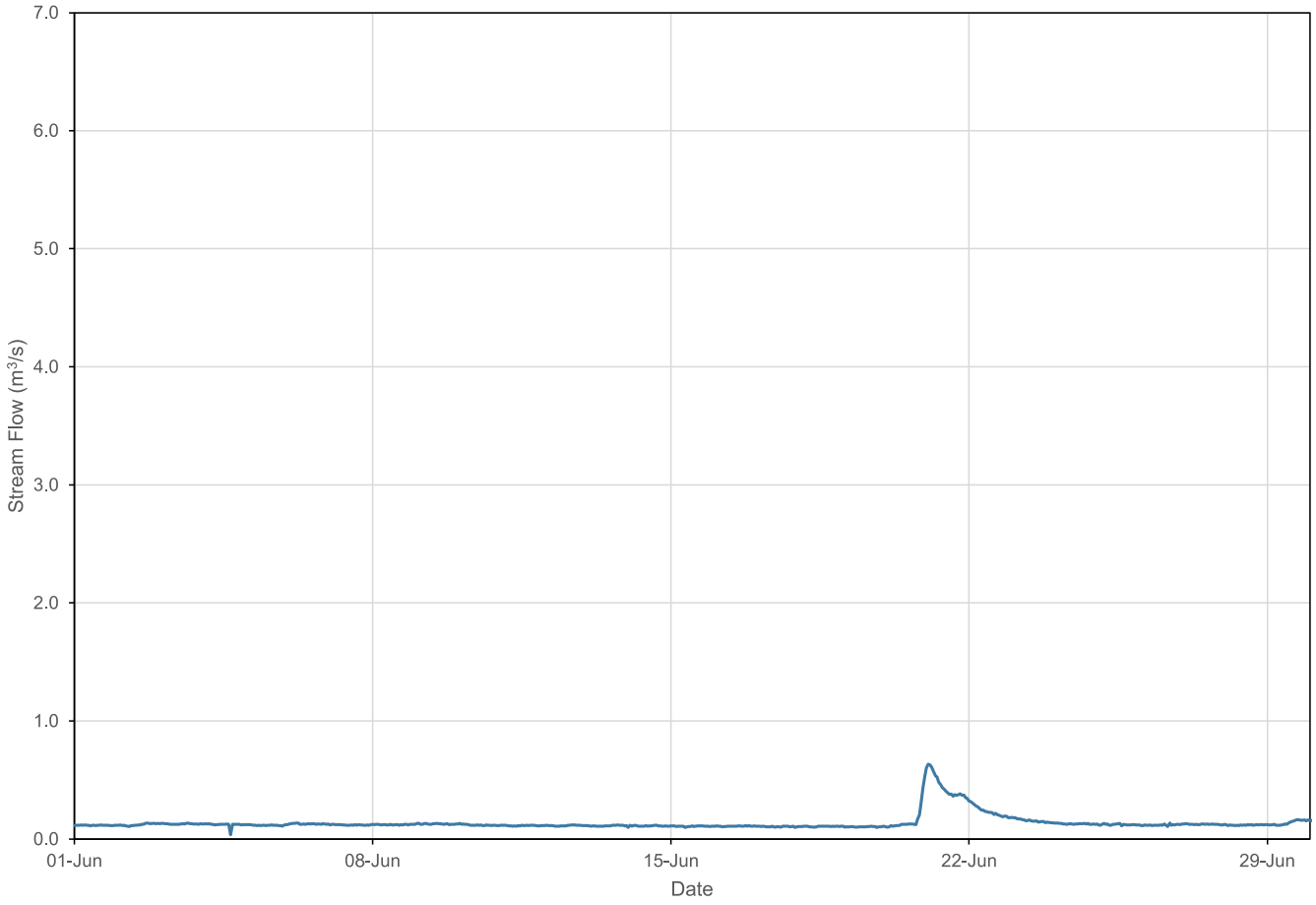


Figure C-19: 2024 Calculated Stream Flow at SWM2
July 2024

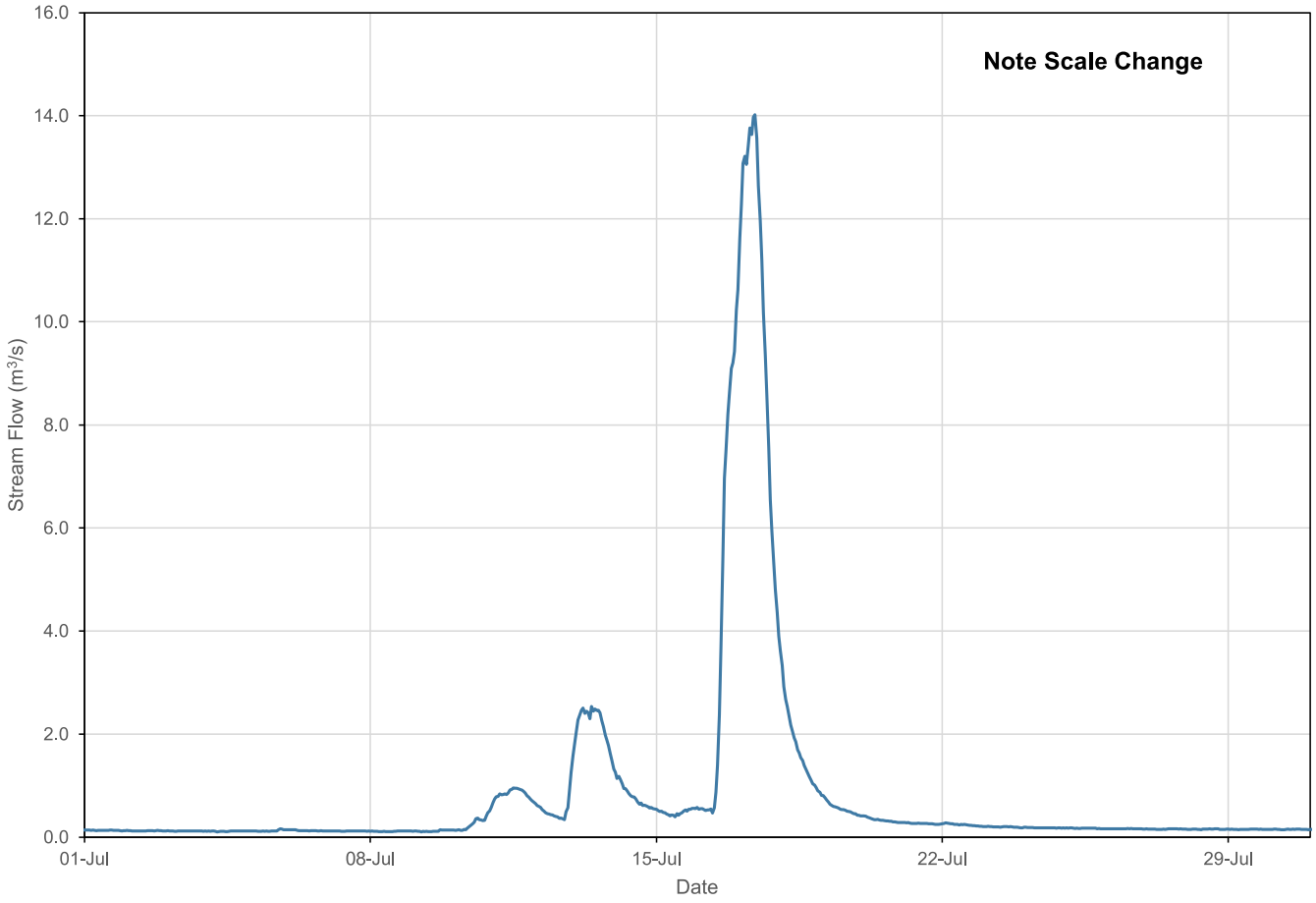


Figure C-20: 2024 Calculated Stream Flow at SWM2
August 2024

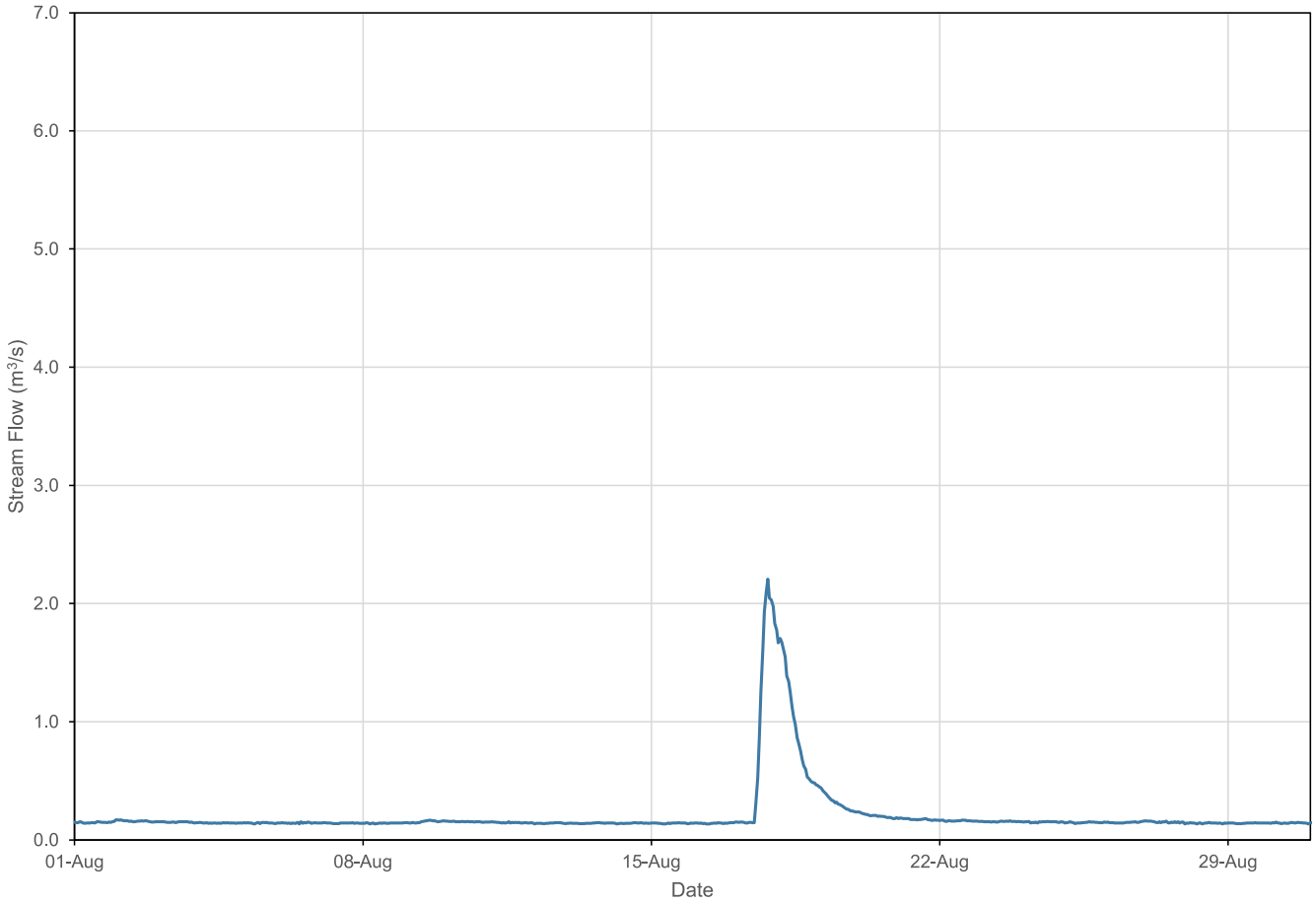


Figure C-21: 2024 Calculated Stream Flow at SWM2
September 2024

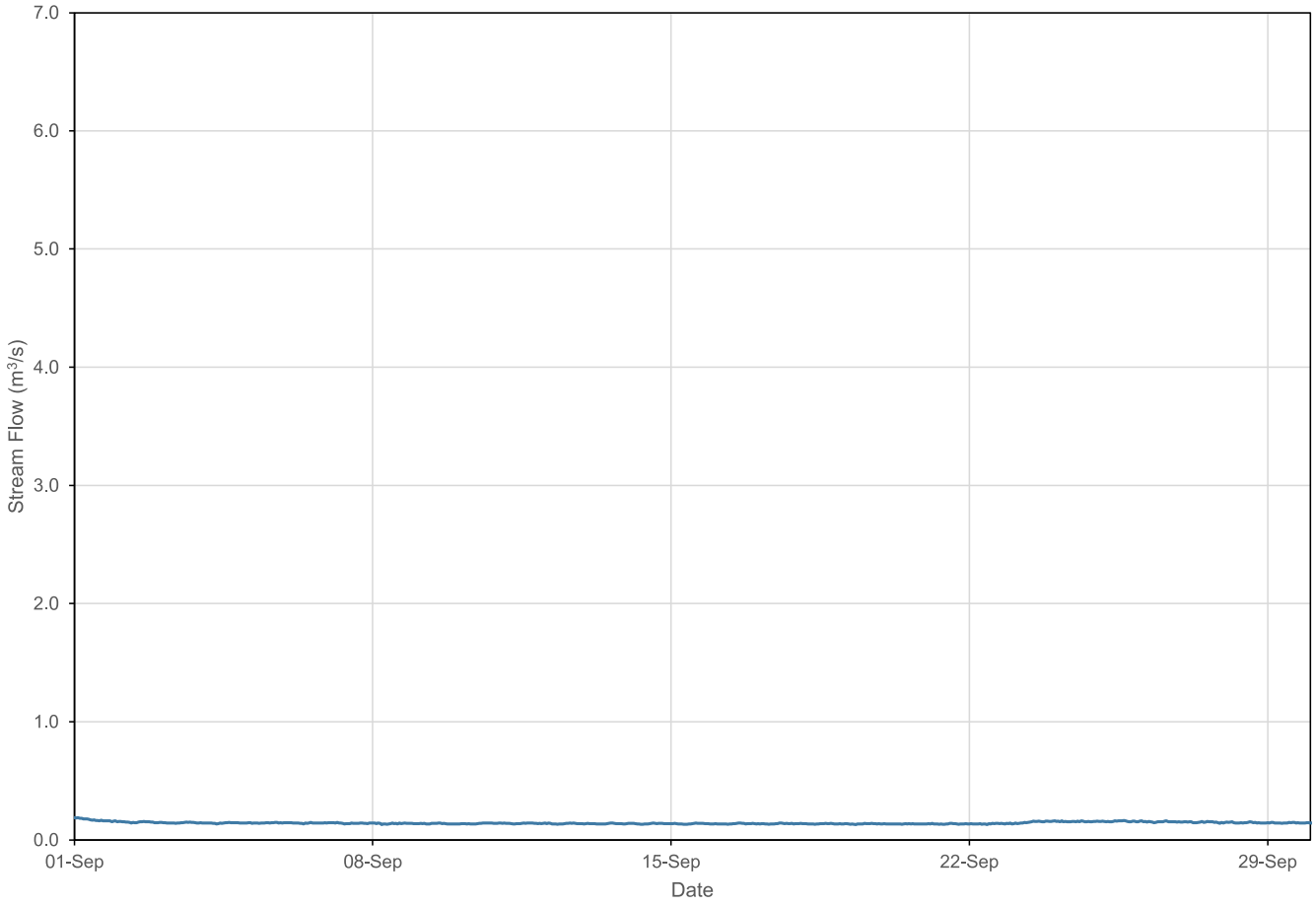


Figure C-22: 2024 Calculated Stream Flow at SWM2
October 2024

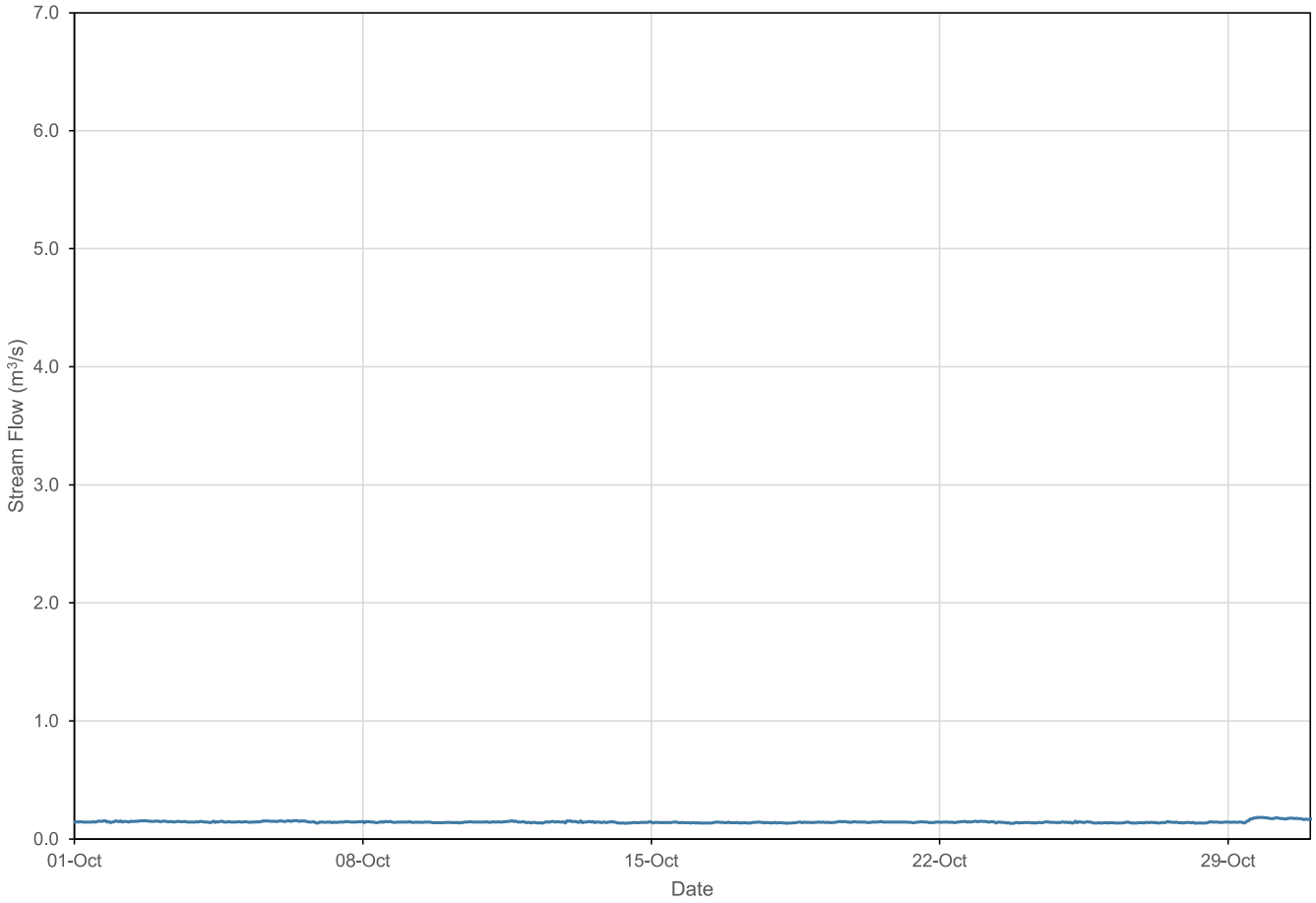


Figure C-24: 2024 Calculated Stream Flow at SWM2
November 2024

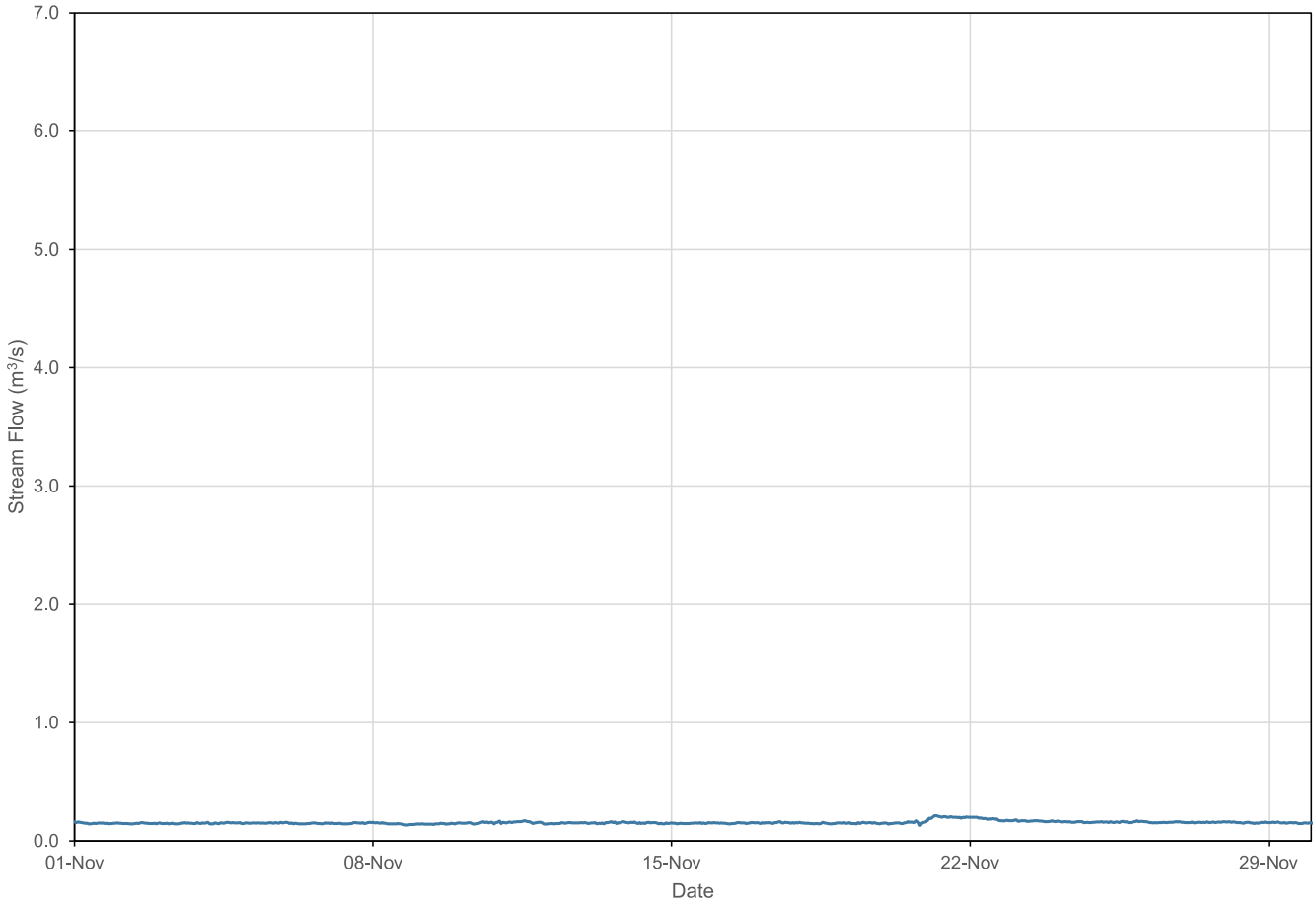
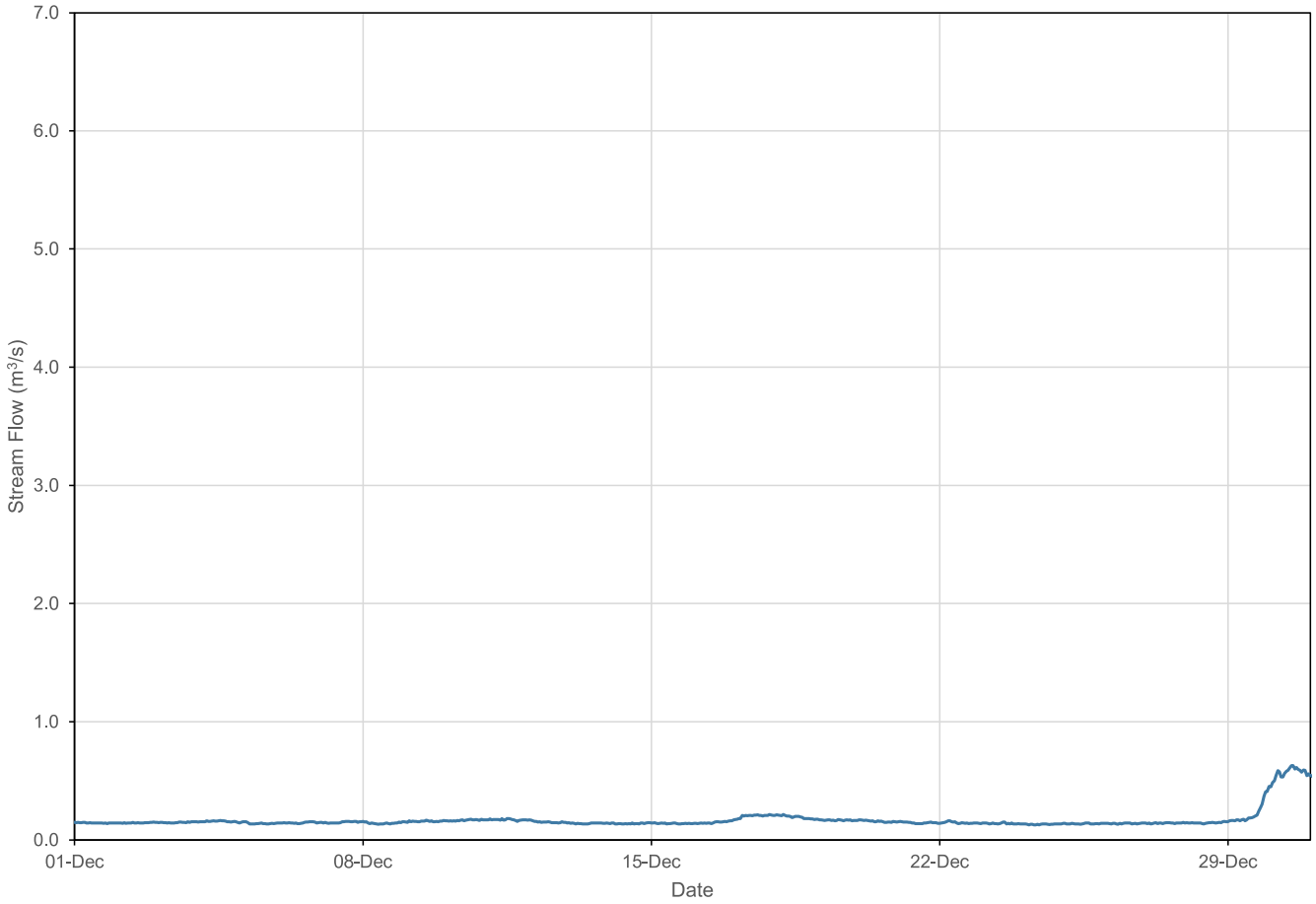


Figure C-24: 2024 Calculated Stream Flow at SWM2
December 2024



APPENDIX D

Regression Plots for Air Temperature and Precipitation vs. Flow

(Technical Appendix A - 2024 Surface Water Report)

Figure D-1: Regression Analysis Summary Output
Total Summer Precipitation versus Summer 7-day Low Flow (2000-2024)

Y - Total Summer Precipitation (mm)
X - Summer 7-day Low Flow

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.400604178
R Square	0.160483707
Adjusted R Square	0.123982999
Standard Error	78.24405966
Observations	25

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	26917.35653	26917.35653	4.396728572	0.047202516
Residual	23	140809.0561	6122.132873		
Total	24	167726.4126			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	166.9380599	47.65017884	3.503408884	0.001912106	68.36615478	265.509965	68.36615478	265.509965
X Variable 1	461.1386164	219.9209811	2.096837755	0.047202516	6.19740513	916.0798276	6.19740513	916.0798276

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*
1	263.3160307	37.6839693
2	230.5751889	-98.77518894
3	235.6477137	-60.14771372
4	243.4870702	-15.5870702
5	250.8652881	-59.36528806
6	265.6217238	69.87827621
7	238.875684	-0.375684037
8	215.8187532	-141.3187532
9	286.8341001	81.16589986
10	303.8962289	2.603771057
11	293.2900408	-5.590040767
12	262.8548921	-81.95489209
13	253.6321198	-95.63211976
14	309.891031	-18.89103096
15	277.1501892	-72.45018919
16	293.2900408	2.709959233
17	288.217516	19.88248401
18	341.7095955	-28.20959548
19	290.0620705	46.83792955
20	267.9274169	48.07258313
21	225.6410057	21.53399425
22	222.2746938	170.2253062
23	219.0467235	-57.44672353
24	230.5751889	157.6248111
25	222.2746938	77.52530615

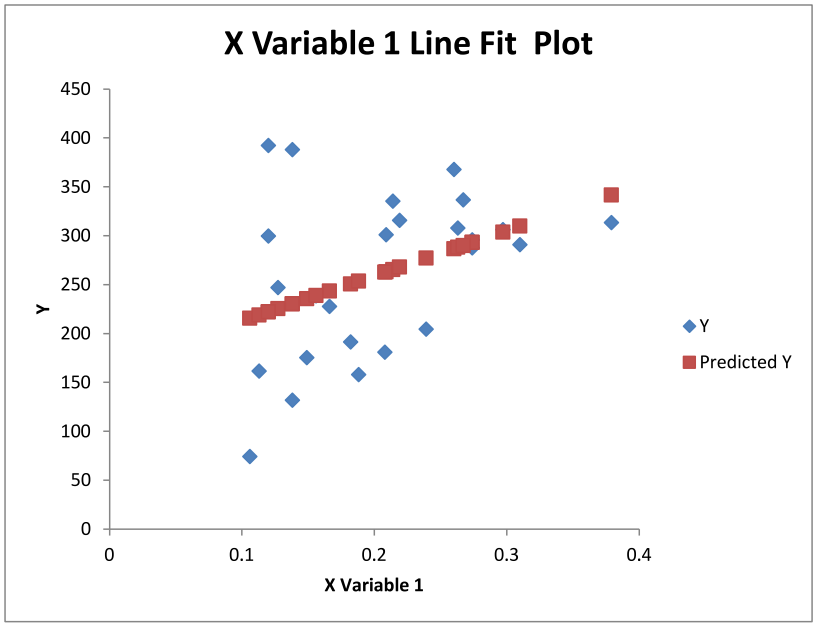


Figure D-2: Regression Analysis Summary Output
Mean Summer Temperature versus Summer 7-day Low Flow (2000-2024)

Y - Mean Summer Temperature (deg Celcius)
X - Summer 7-day Low Flow

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.024232146
R Square	0.000587197
Adjusted R Square	-0.042865534
Standard Error	1.512883845
Observations	25

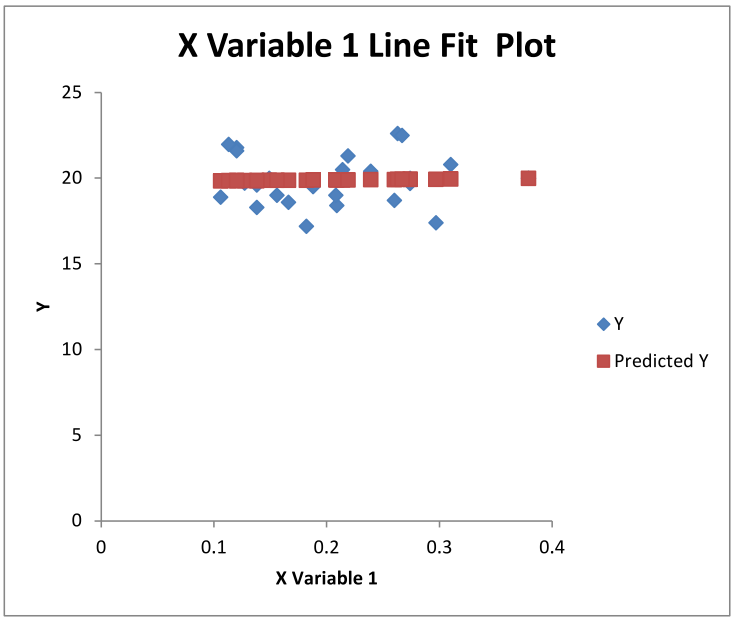
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.030929852	0.030929852	0.013513463	0.908465511
Residual	23	52.64280315	2.288817528		
Total	24	52.67373301			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	19.79812783	0.921337493	21.4884643	1.0056E-16	17.89219601	21.70405964	17.89219601	21.70405964
X Variable 1	0.494315477	4.252270407	0.116247423	0.908465511	-8.30217606	9.290807017	-8.30217606	9.290807017

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*
1	19.90143976	-1.50143976
2	19.86634336	-0.266343361
3	19.87178083	0.128219169
4	19.88018419	-1.280184194
5	19.88809324	-2.688093242
6	19.90391134	0.596088663
7	19.87524104	-0.87524104
8	19.85052527	-0.950525266
9	19.92664985	-1.226649849
10	19.94493952	-2.544939522
11	19.93357027	-0.233570266
12	19.90094544	-0.900945444
13	19.89105913	-0.391059135
14	19.95136562	0.848634377
15	19.91626922	0.483730776
16	19.93357027	0.066429734
17	19.9281328	2.671867204
18	19.98547339	0.014526609
19	19.93011006	2.569889942
20	19.90638291	1.393617085
21	19.86105419	-0.14879228
22	19.85744568	1.932554318
23	19.85398547	2.126014526
24	19.86634336	-1.566343361
25	19.85744568	1.742554318



APPENDIX E

Monthly Water Temperature Data

(Technical Appendix A - 2024 Surface Water Report)

Figure E-1: Water Temperature at SWM1 and SWM2
January 2024

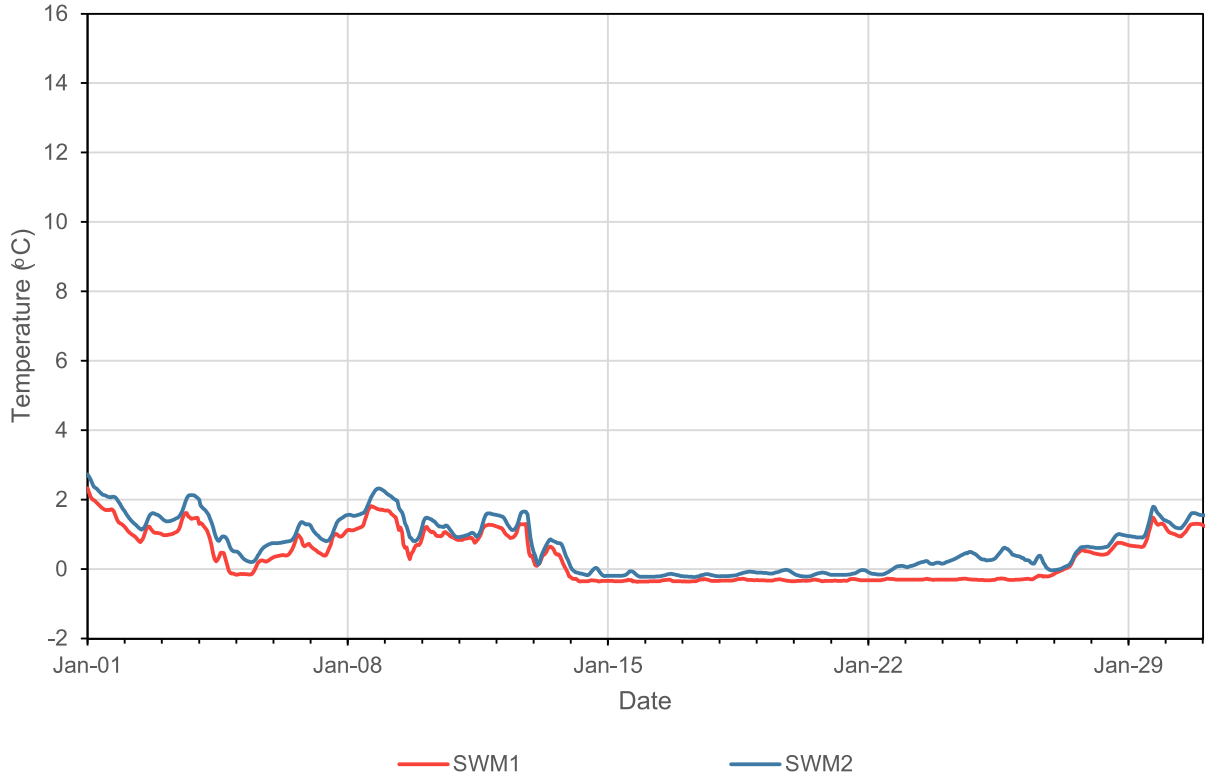


Figure E-2: Water Temperature at SWM3 and SWM4
January 2024

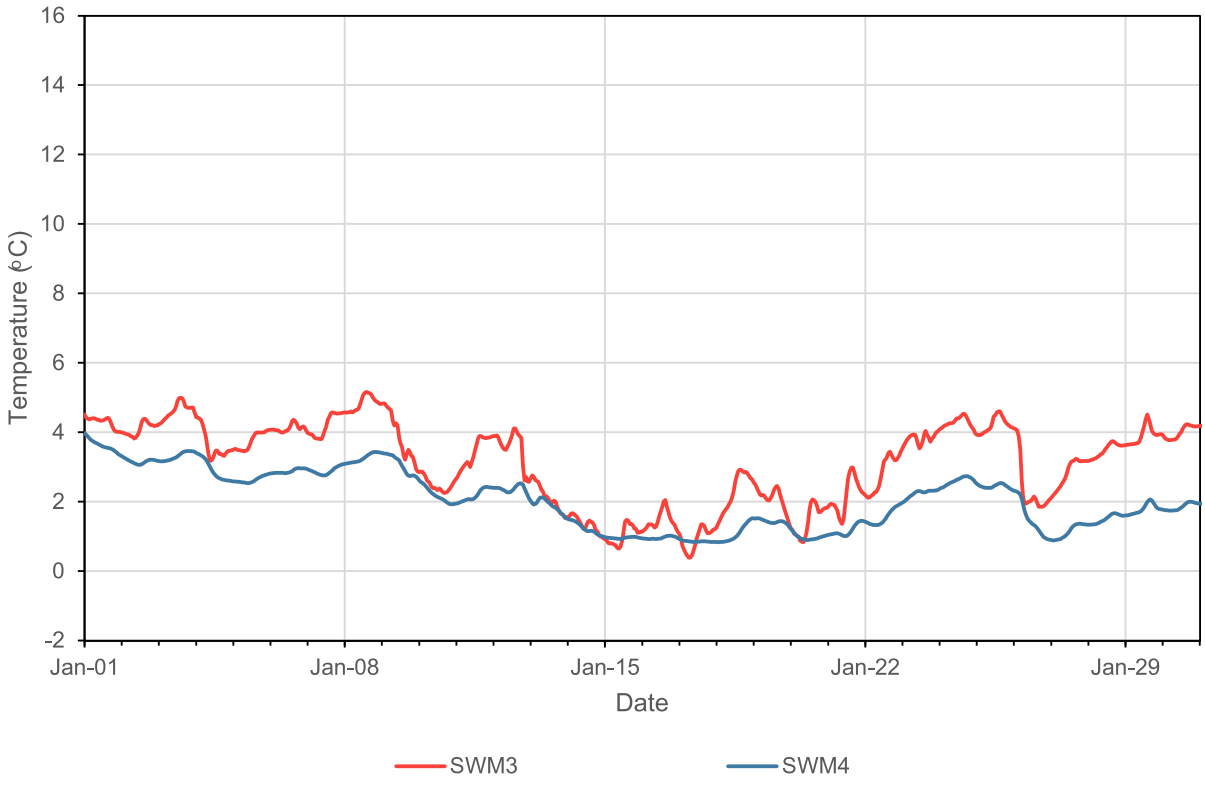


Figure E-3: Water Temperature at SWM1 and SWM2
February 2024

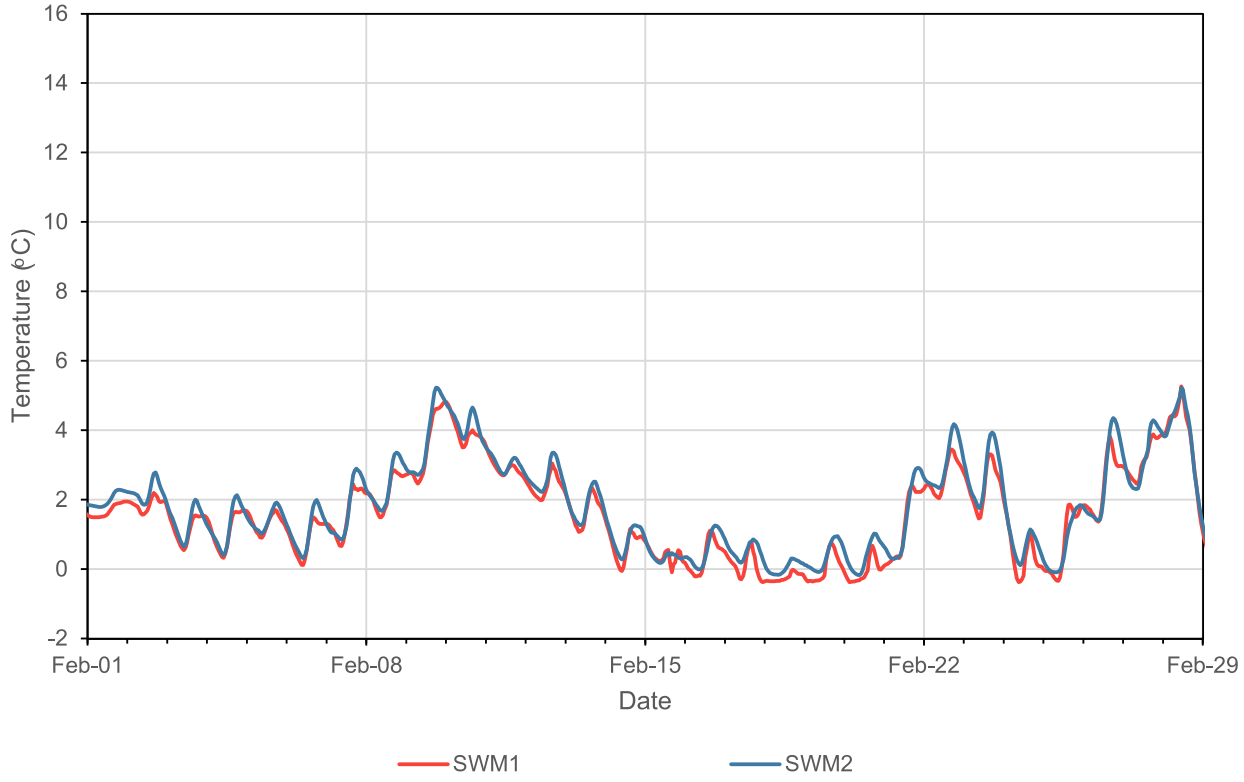


Figure E-4: Water Temperature at SWM3 and SWM4
February 2024

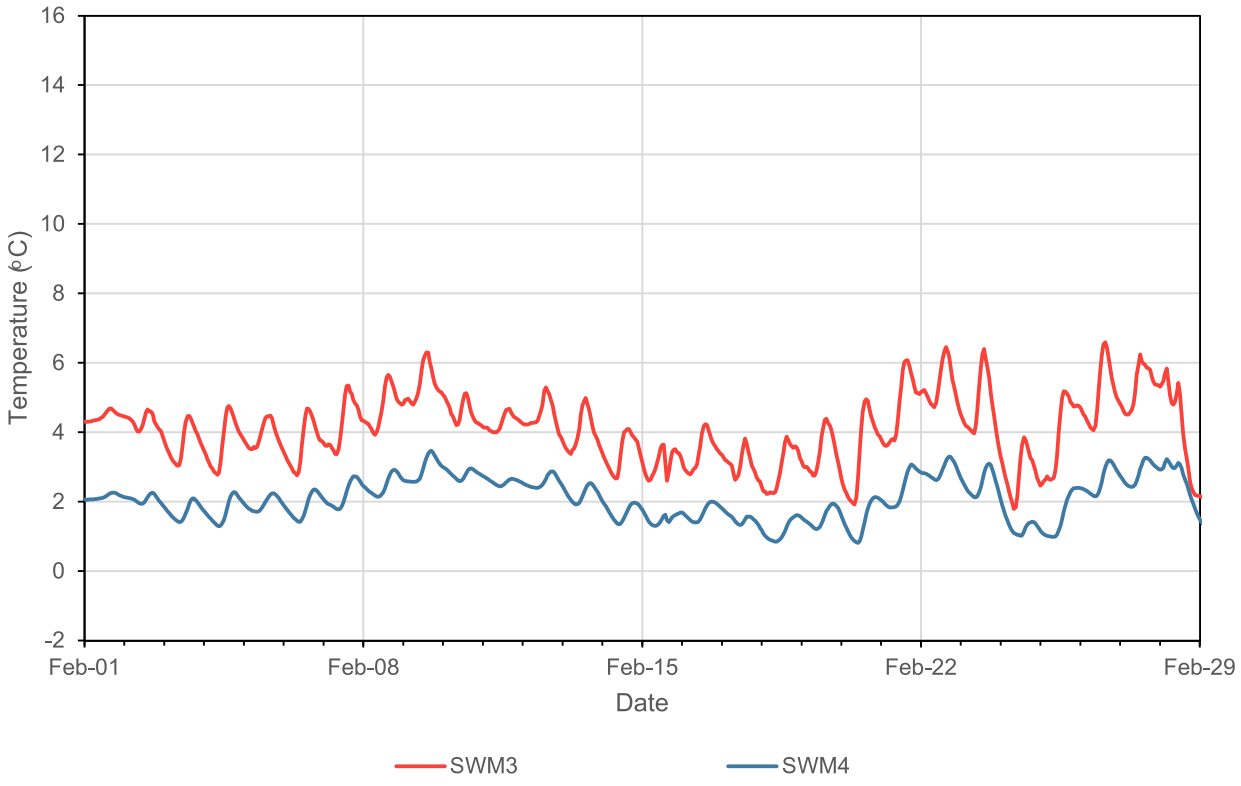


Figure E-5: Water Temperature at SWM1 and SWM2
March 2024

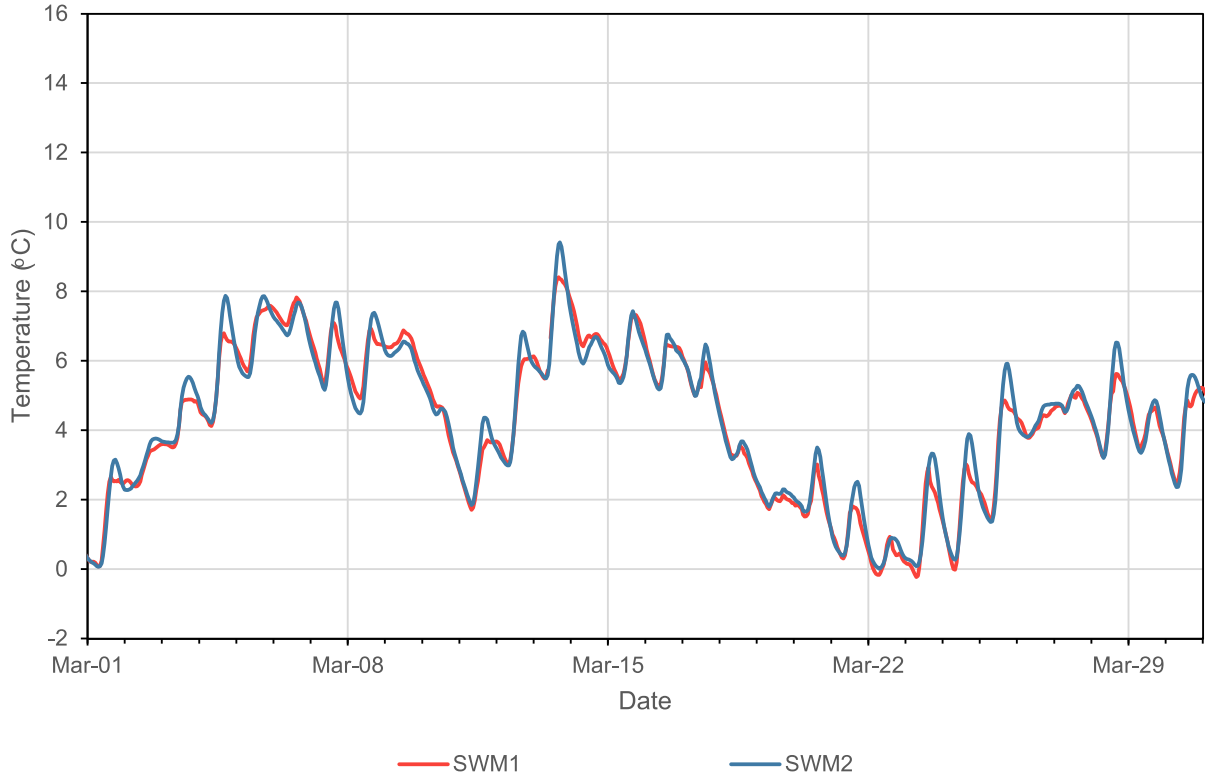


Figure E-6: Water Temperature at SWM3 and SWM4
March 2024

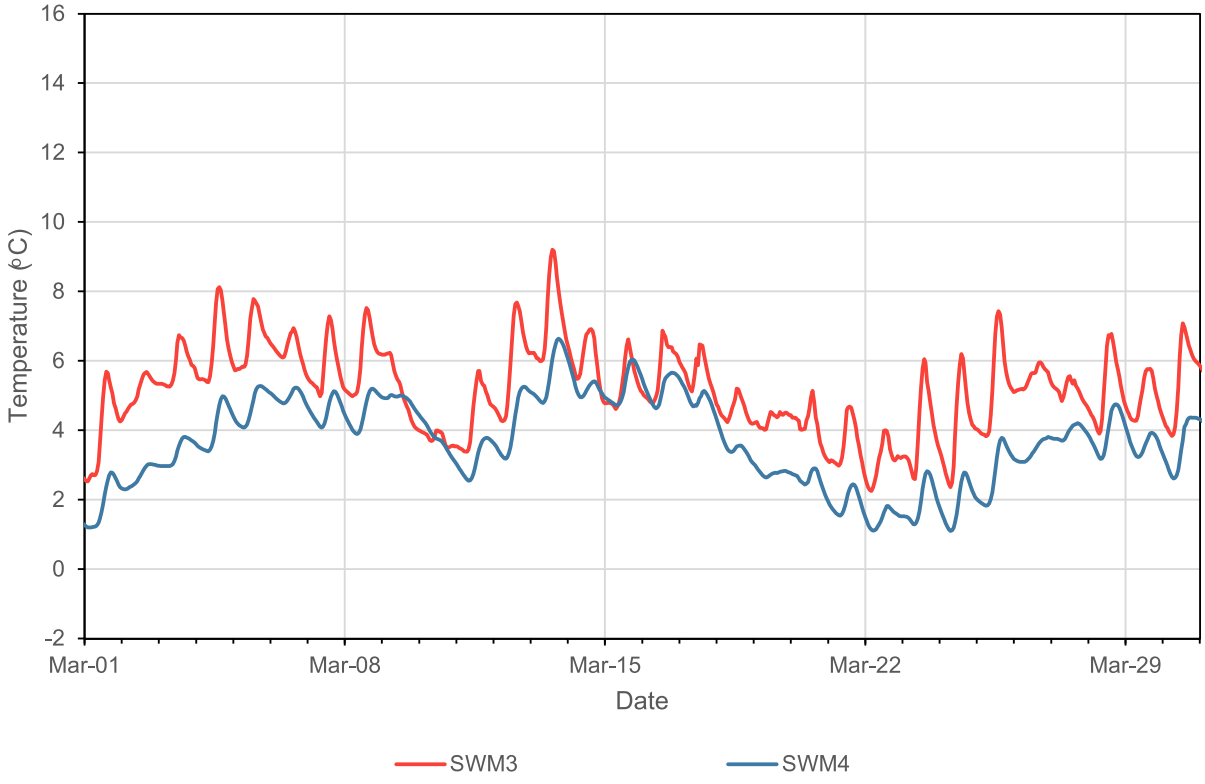


Figure E-7: Water Temperature at SWM1 and SWM2
April 2024

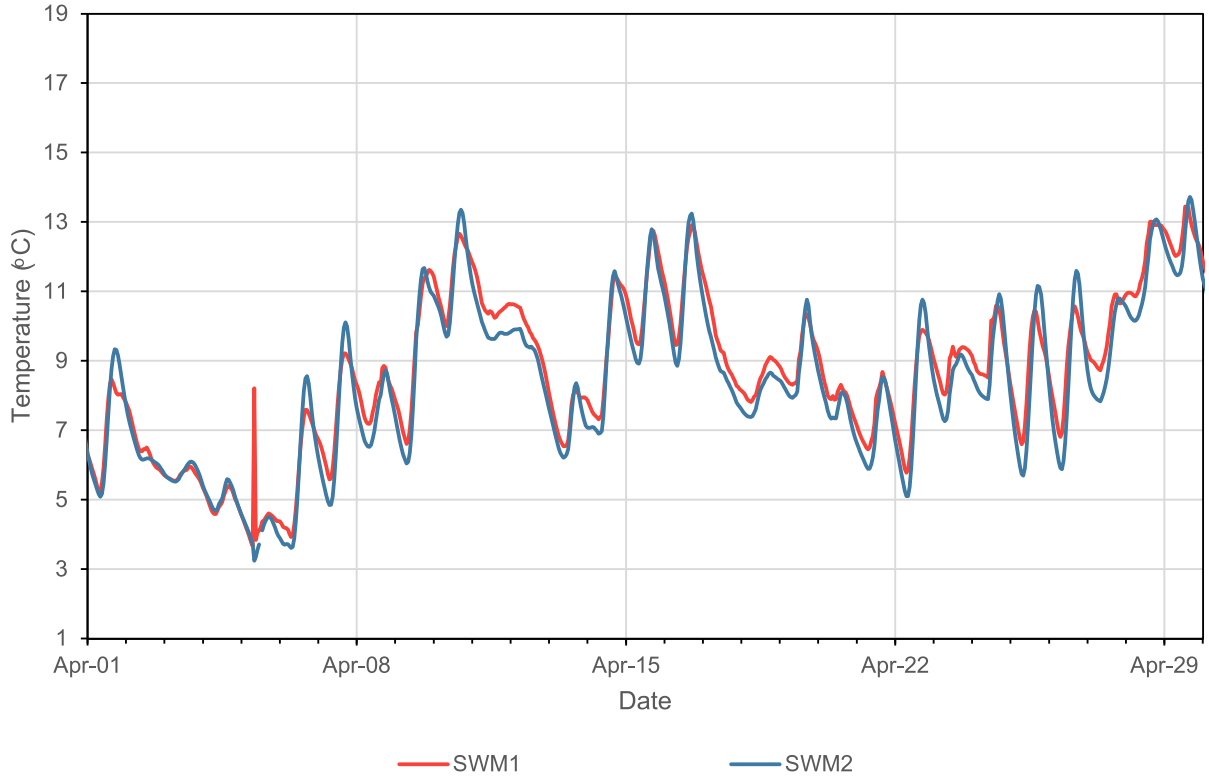


Figure E-8: Water Temperature at SWM3 and SWM4
April 2024

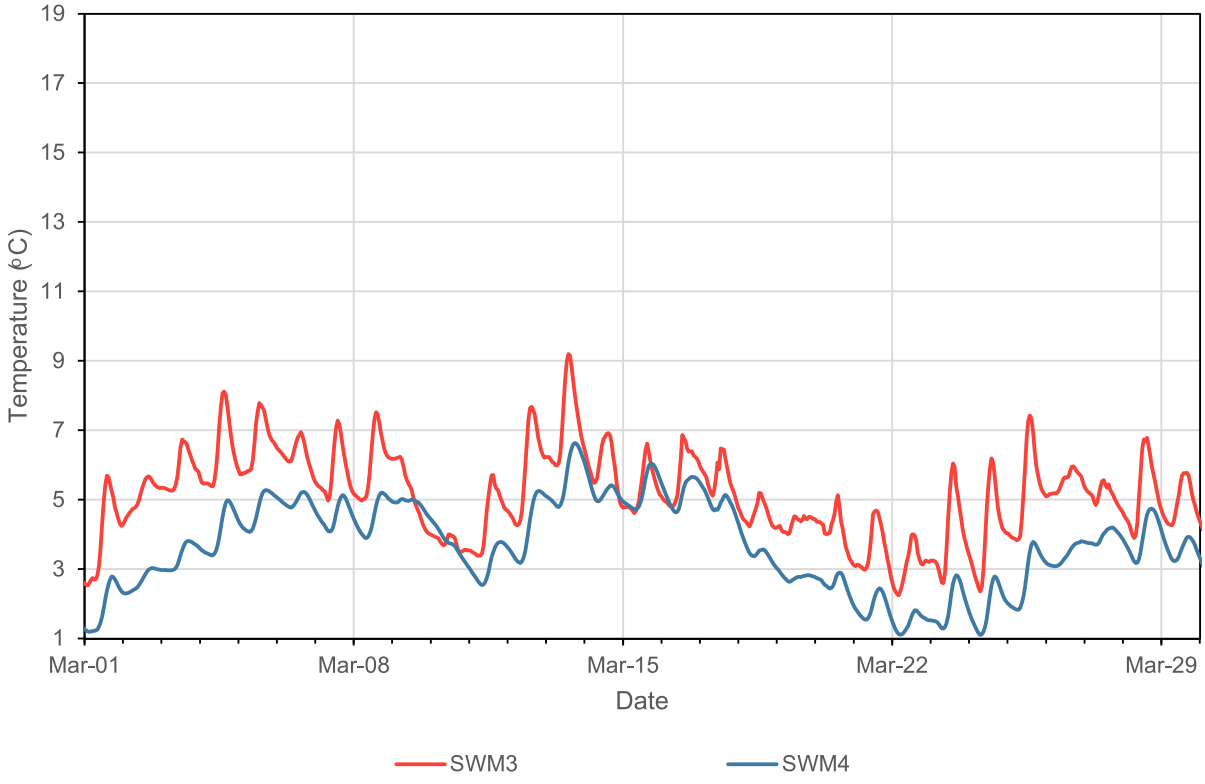


Figure E-9: Water Temperature at SWM1 and SWM2
May 2024

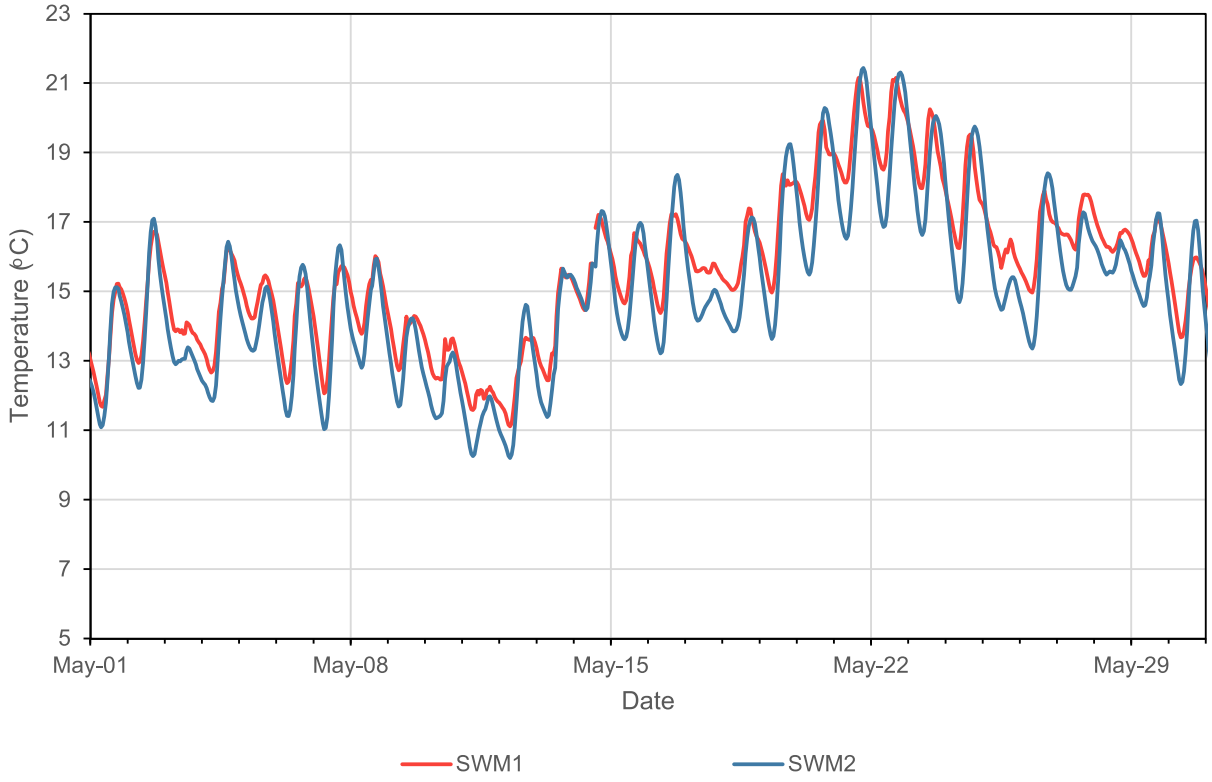


Figure E-10: Water Temperature at SWM3 and SWM4
May 2024

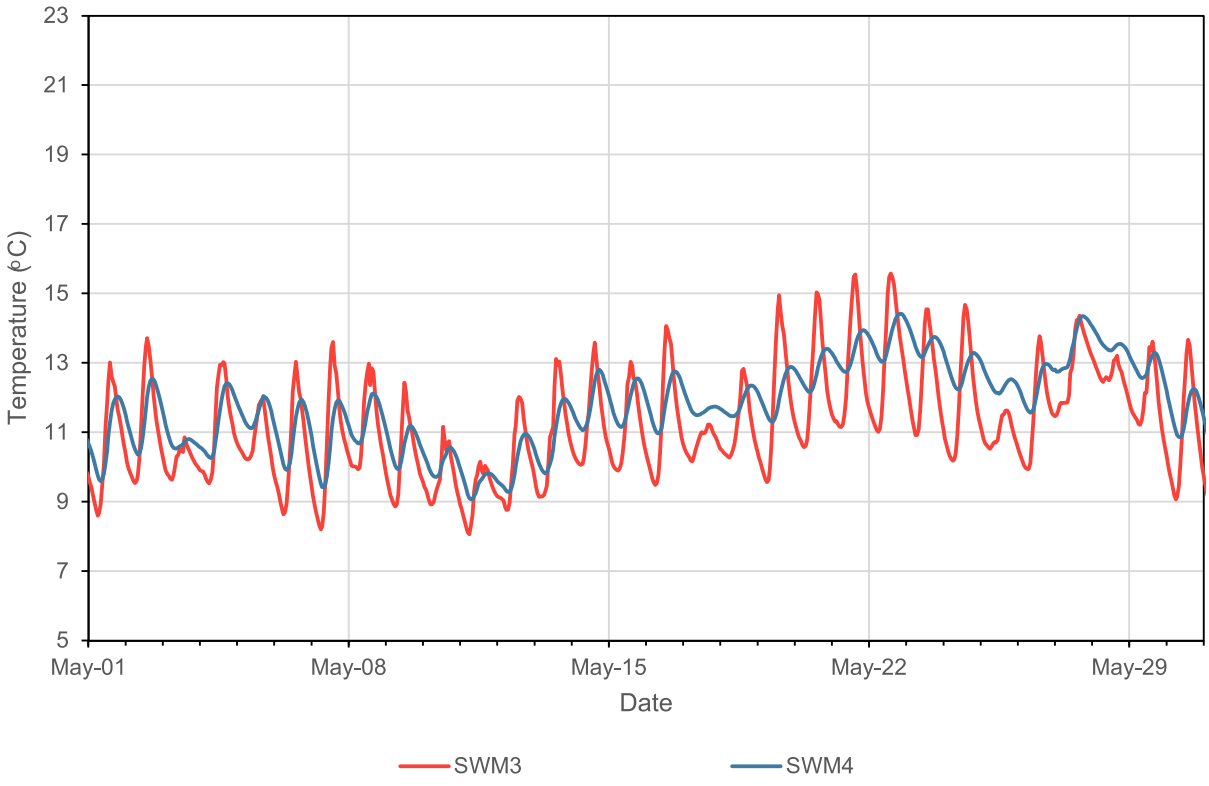


Figure E-11: Water Temperature at SWM1 and SWM2
June 2024

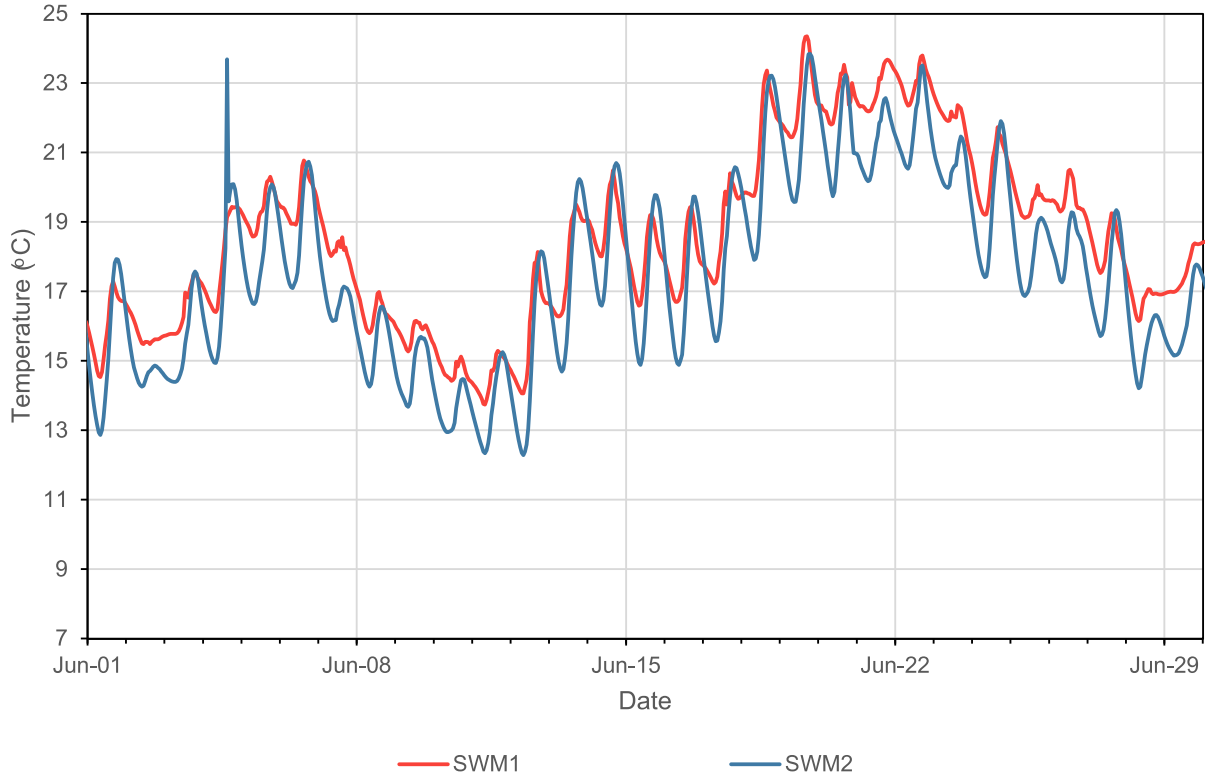


Figure E-12: Water Temperature at SWM3 and SWM4
June 2024

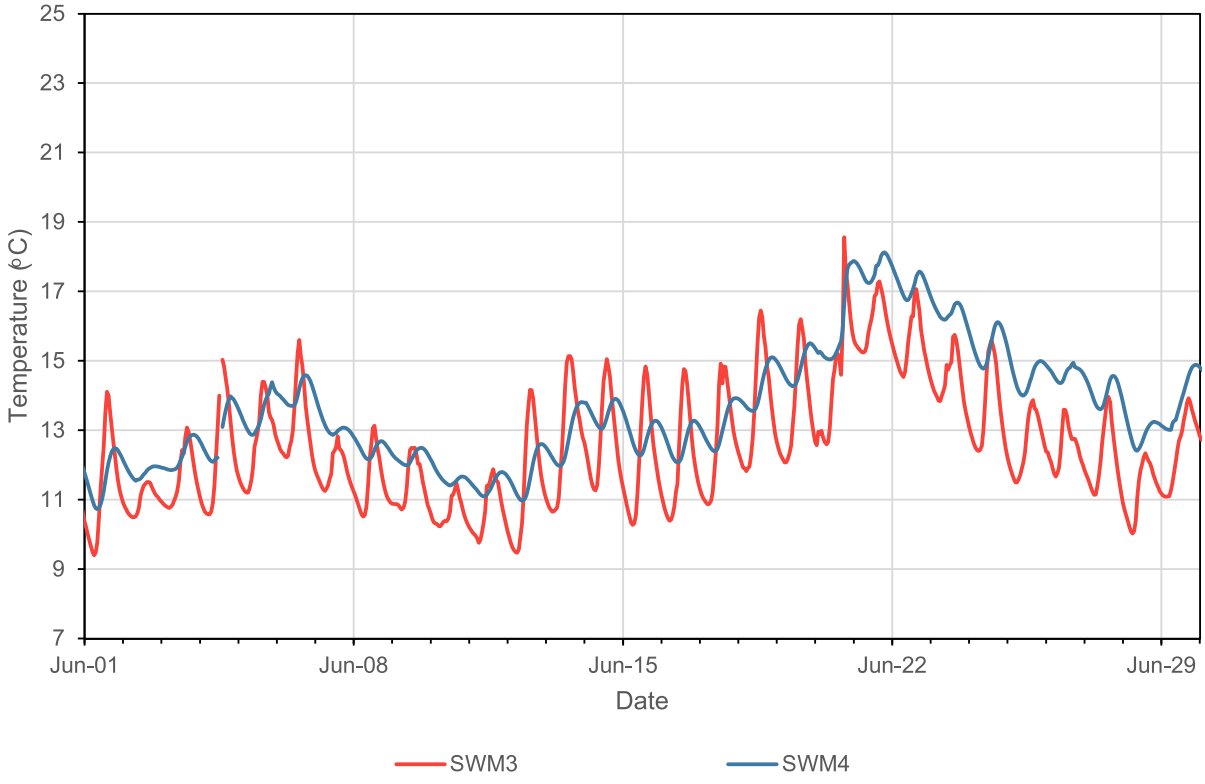


Figure E-13: Water Temperature at SWM1 and SWM2
July 2024

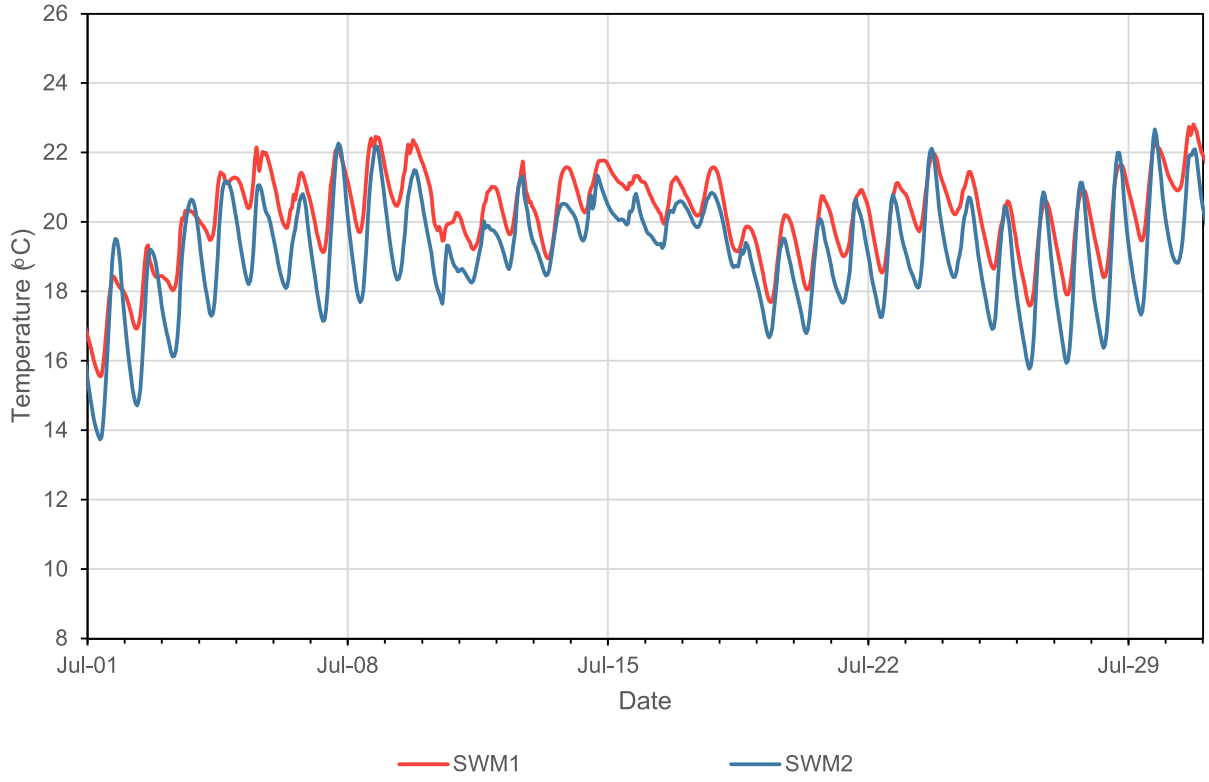


Figure E-14: Water Temperature at SWM3 and SWM4
July 2024

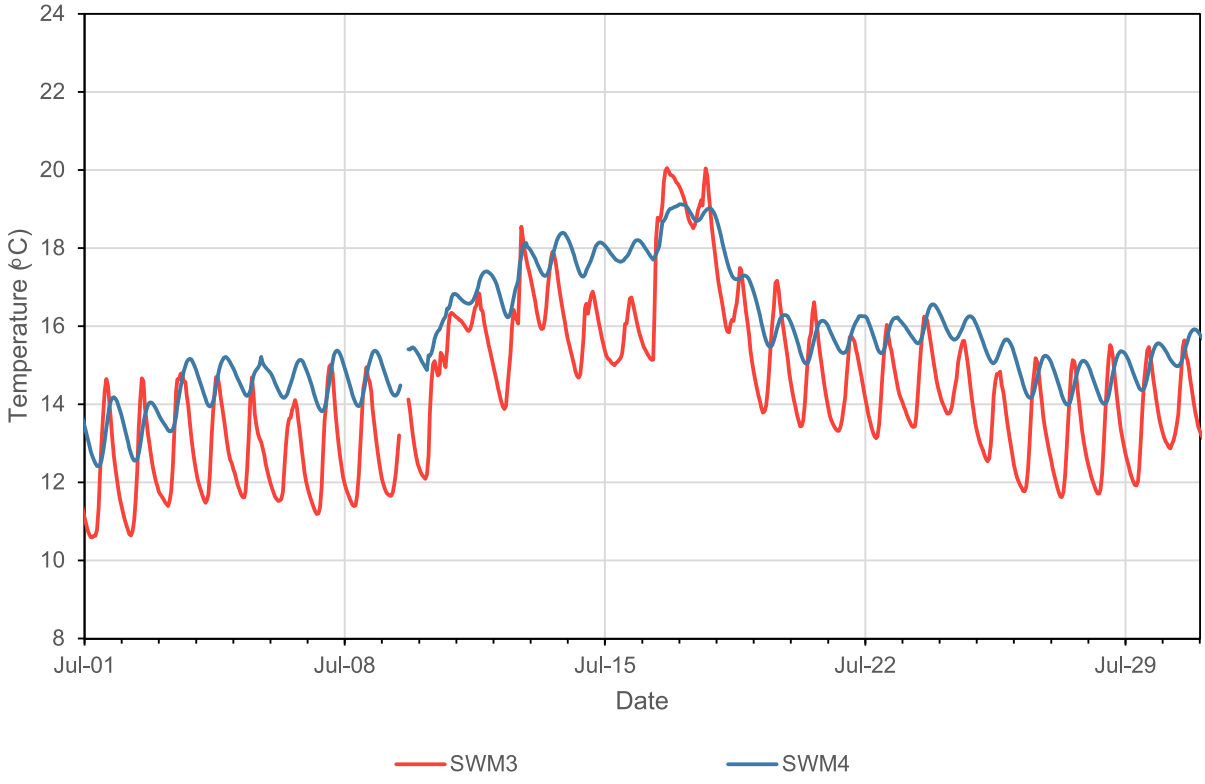


Figure E-15: Water Temperature at SWM1 and SWM2
August 2024

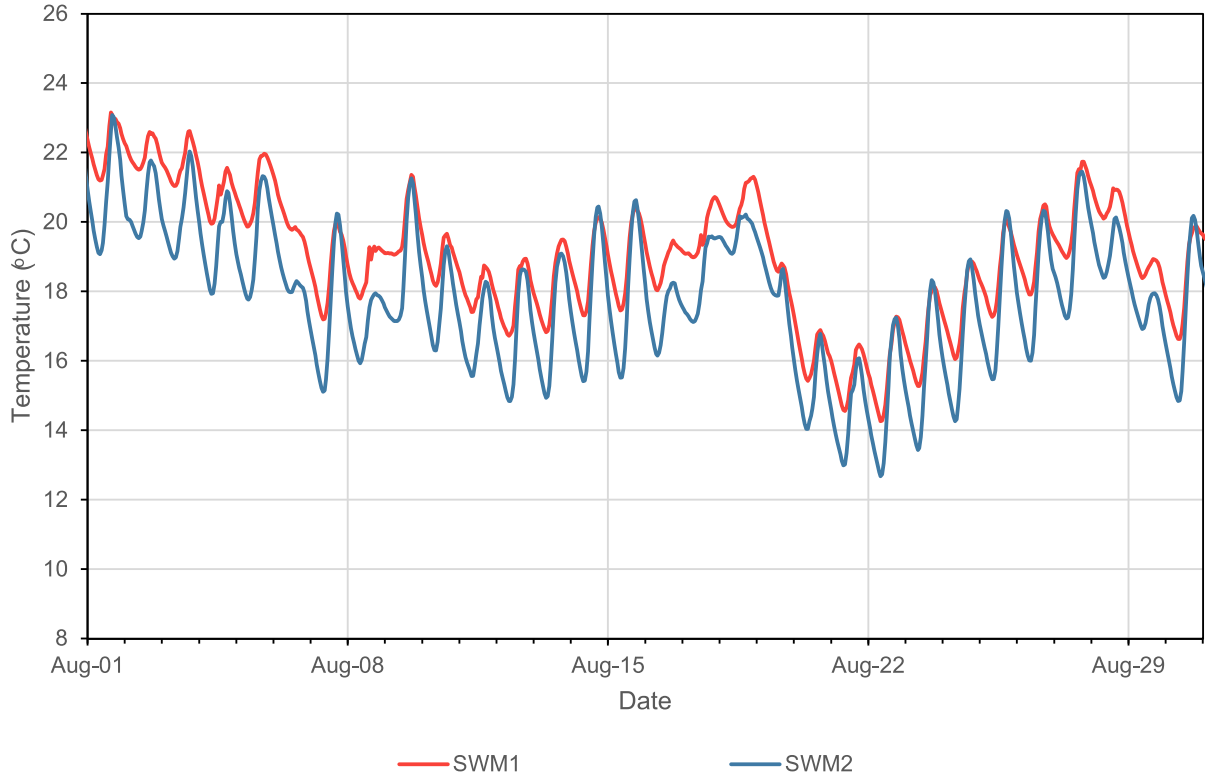


Figure E-16: Water Temperature at SWM3 and SWM4
August 2024

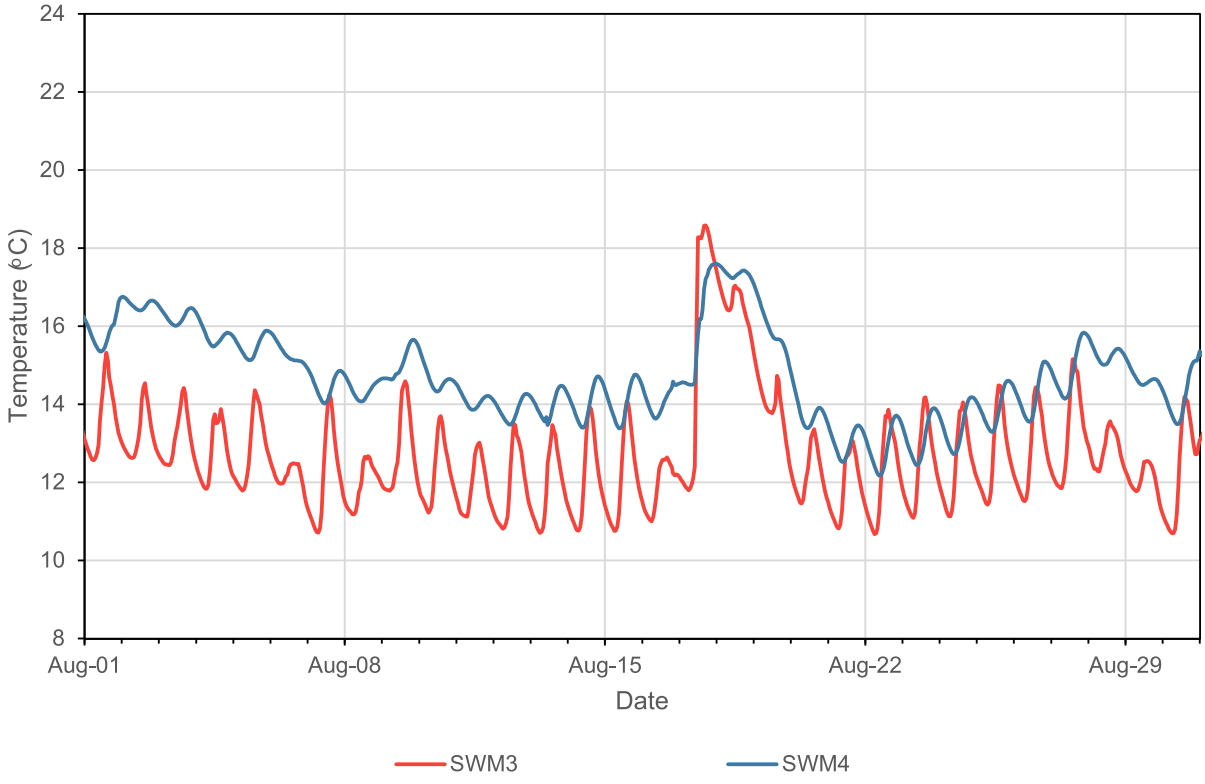


Figure E-17: Water Temperature at SWM1 and SWM2
September 2024

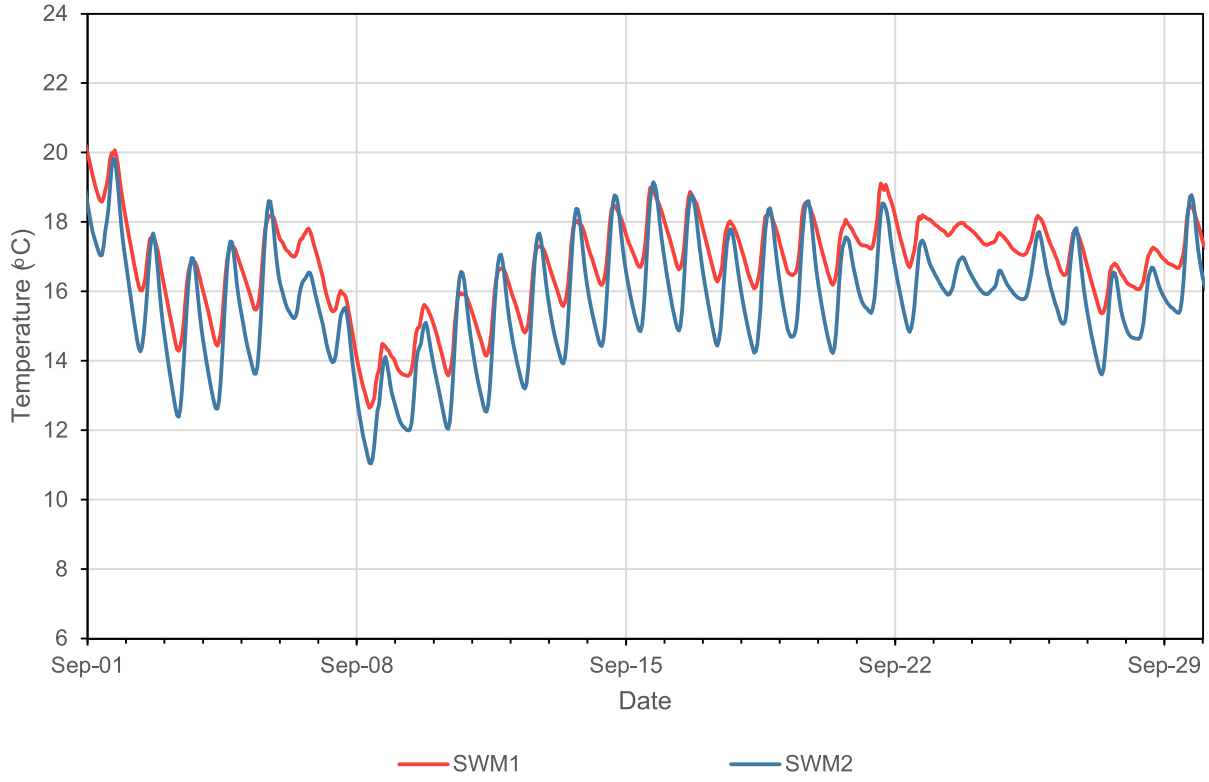


Figure E-18: Water Temperature at SWM3 and SWM4
September 2024

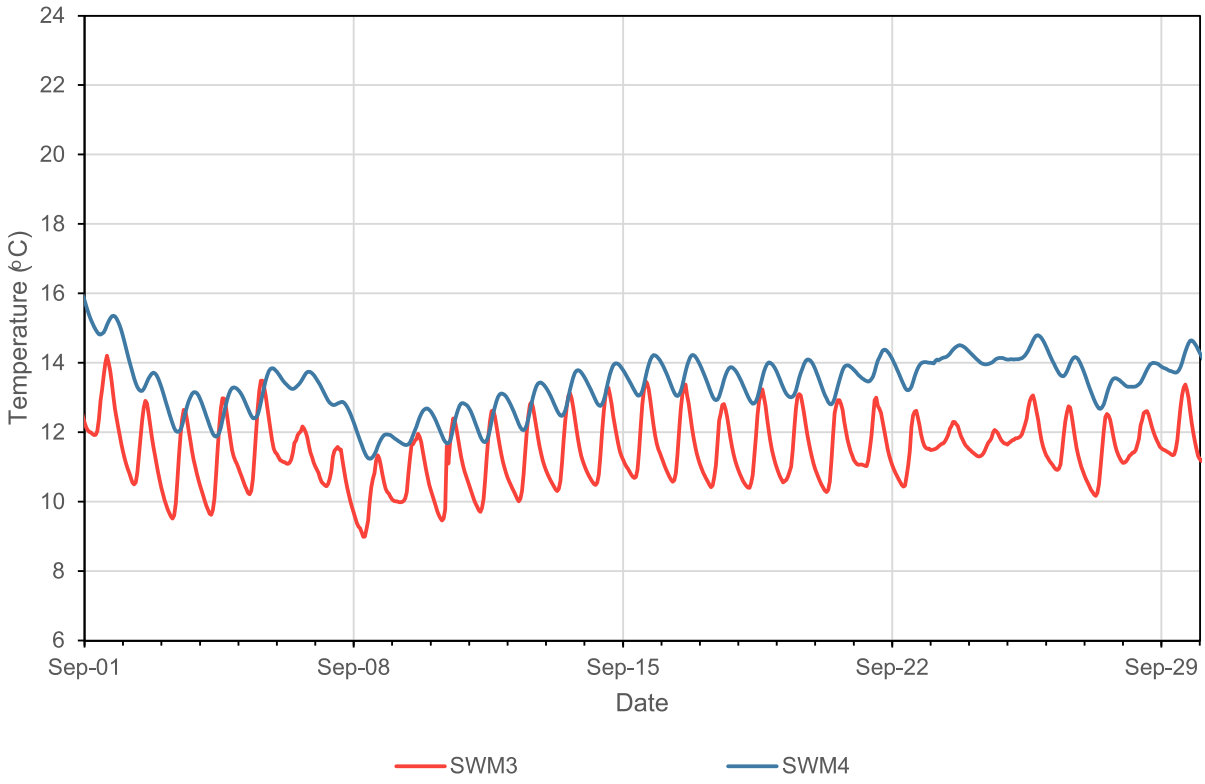


Figure E-19: Water Temperature at SWM1 and SWM2
October 2024

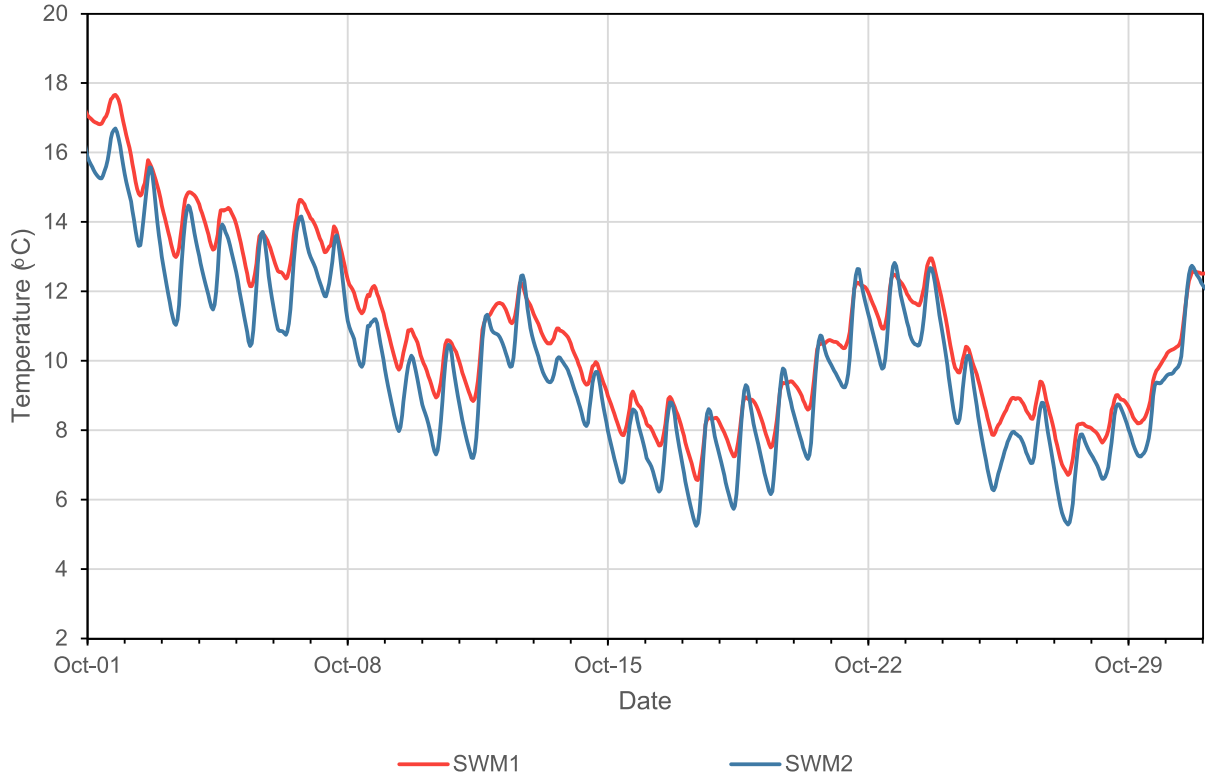


Figure E-20: Water Temperature at SWM3 and SWM4
October 2024

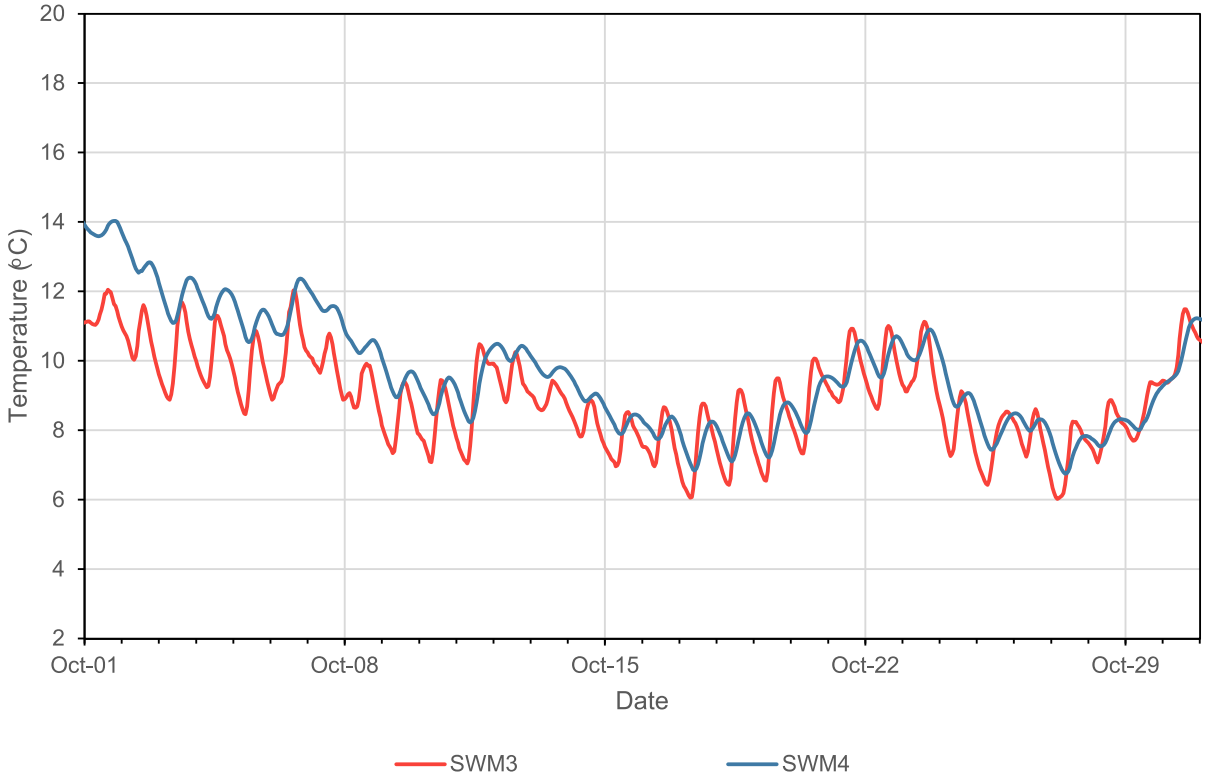


Figure E-21: Water Temperature at SWM1 and SWM2
November 2024

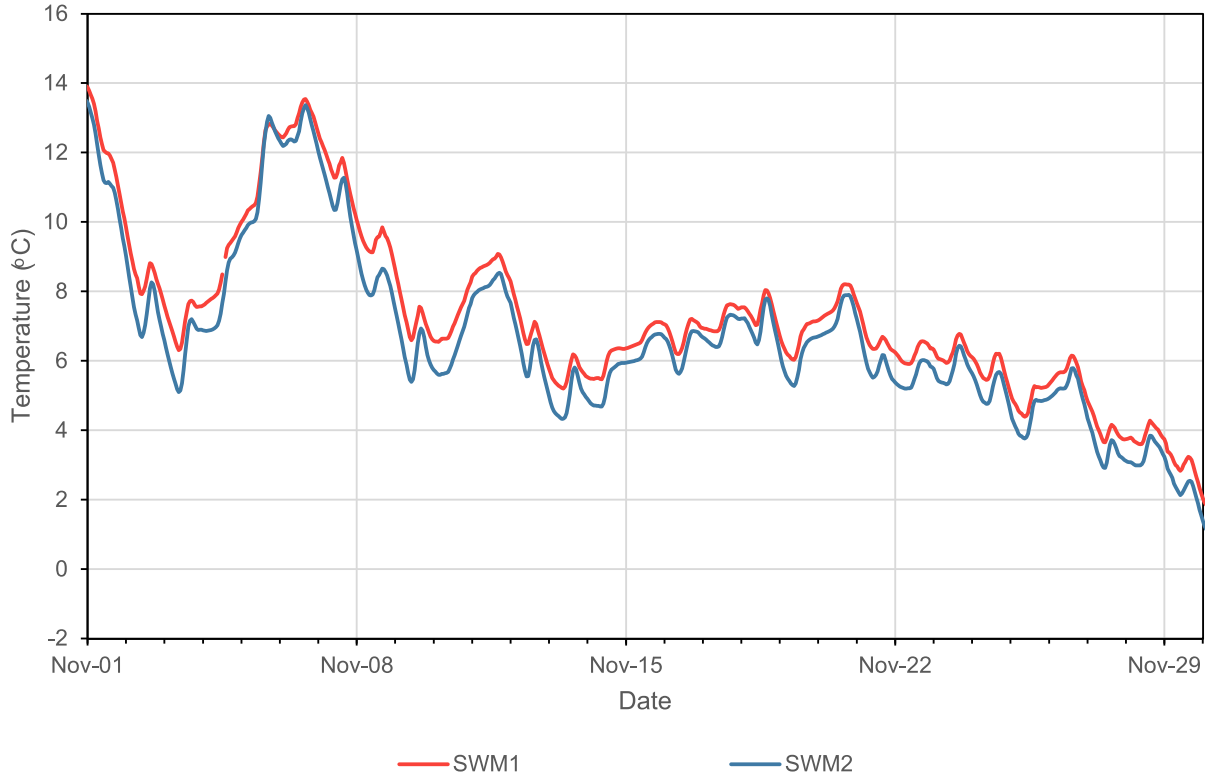


Figure E-22: Water Temperature at SWM3 and SWM4
November 2024

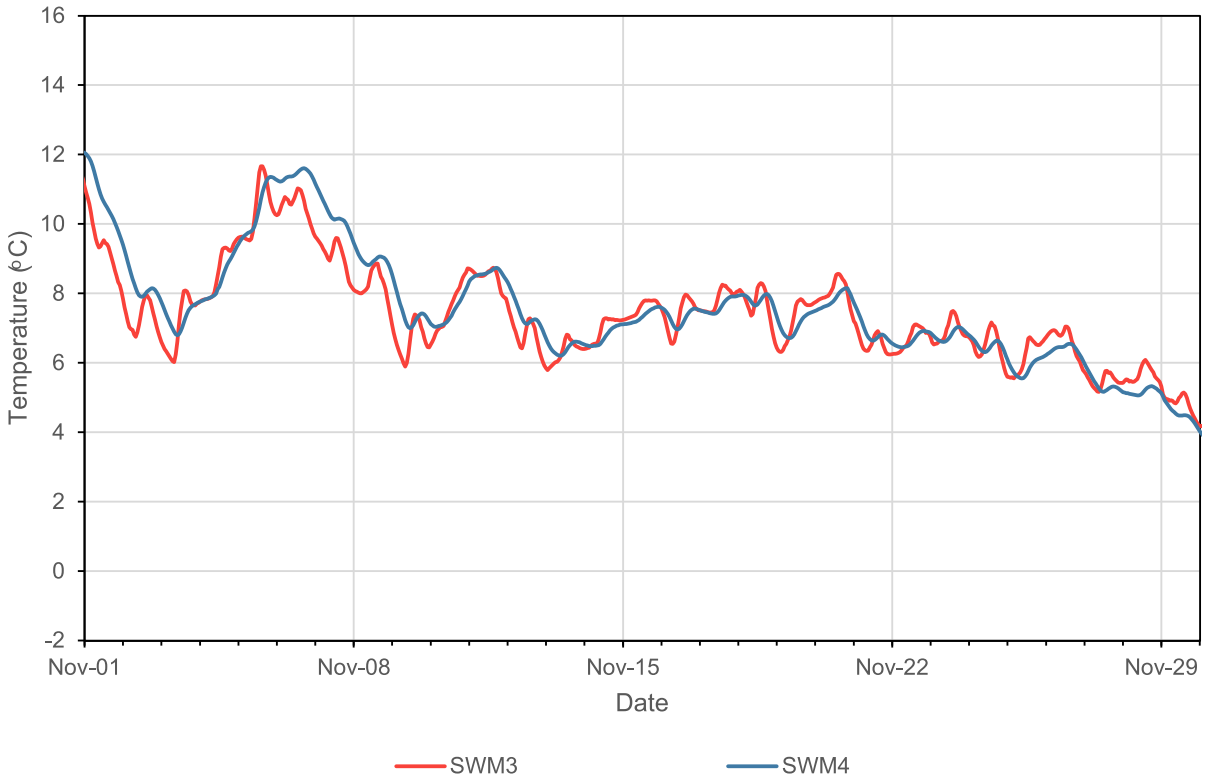


Figure E-23: Water Temperature at SWM1 and SWM2
December 2024

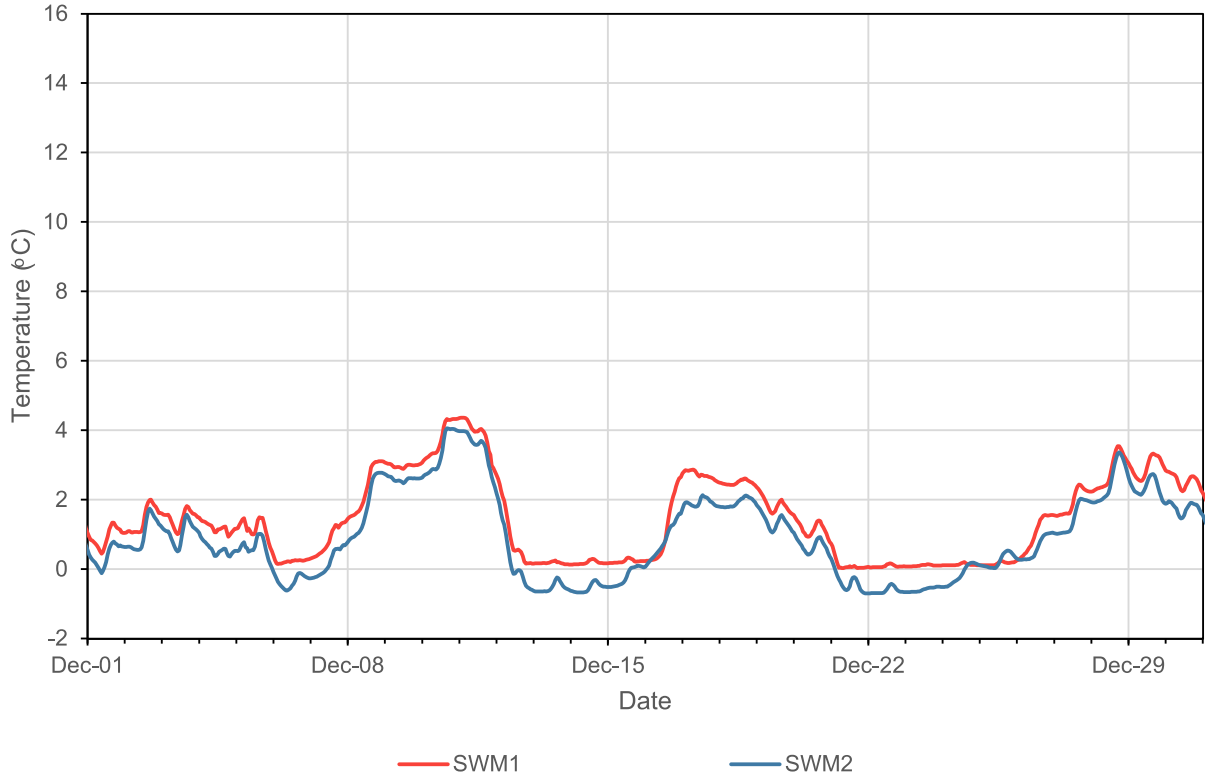
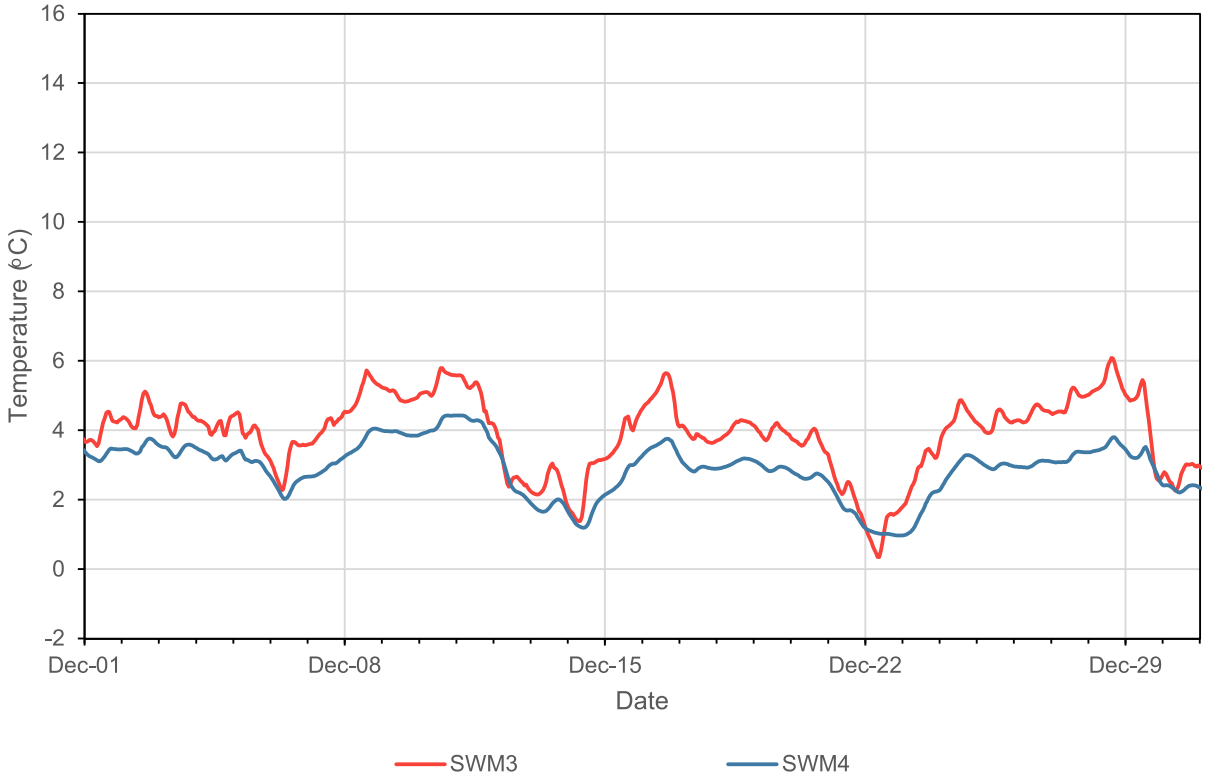


Figure E-24: Water Temperature at SWM3 and SWM4
December 2024



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