Morro Bay Watershed Creek Health Memo
For Water Year 2025

Date Range: Water Year 2025 (October 1, 2024 to September 30, 2025)
Analytes: Temperature, Nitrate as Nitrogen (NO_3-N), Orthophosphate as Phosphorus (PO_4-P), Dissolved Oxygen, pH

1. Background

The Morro Bay National Estuary Program (Estuary Program) conducts monitoring in the Morro Bay estuary and surrounding watershed to track ambient water quality trends and to assess the impacts of specific implementation projects.

Estuary Program staff and volunteers collect data under the guidance of a Quality Assurance Project Plan (QAPP) which is reviewed and approved by EPA and the Central Coast Regional Water Quality Control Board (CCRWQCB). This QAPP document contains the monitoring locations, protocols, equipment specifications, and other details that allow users to assess the quality of the collected data. The full QAPP document is available at https://www.mbnep.org/qapp/.

2. Water Temperature

Water temperature plays a critical role in aquatic ecosystem health. For sensitive wildlife like the South-Central California Coast steelhead (*Oncorhynchus mykiss*), temperature has a direct impact on growth, reproduction, and survival potential. Elevated temperatures, especially those that are sustained for long periods of time, may impede the ability of *O. mykiss* to complete their lifecycle.

The Estuary Program monitors continuous water temperature in the Chorro Creek subwatershed to assess how frequently water temperature conditions are supportive of *O. mykiss*.

2.1 Equipment Specifications

The Estuary Program deploys HOBO TidbiT MX 2203 temperature data loggers at sites throughout the watershed (Section 2.2). These loggers monitor daily fluctuations and seasonal trends of creek water temperature. Loggers are deployed year-round and are programmed to collect readings at 30-minute intervals.

Table 1. *Specifications for the HOBO TidbiT MX 2203 temperature loggers.*

Specification	Value
Measurement/Operating Range	-20° to 70 °C in air -20° to 50 °C in water
Accuracy	±0.25°C from -20° to 0 °C ±0.2°C from 0° to 70 °C
Resolution	0.01°C

While the TidbiT temperature loggers do not require calibration, staff collect independent temperature measurements from a secondary meter during deployment and retrieval. Additional measurements are collected periodically throughout deployments for quality assurance.

2.2 Monitoring Locations

The Estuary Program monitored continuous temperature at six sites in the Chorro Creek subwatershed (Figure 1) during WY2025. Three of the six monitoring sites are located along the mainstem of Chorro Creek, which is known to support *O. mykiss*. Historical data indicates elevated temperatures on certain reaches of Chorro Creek which can impact *O. mykiss* success. The remaining sites were chosen along three tributaries to Chorro Creek: Pennington Creek, San Luisito Creek, and Dairy Creek. These tributaries provide critical refuge habitat and spawning grounds for *O. mykiss*.

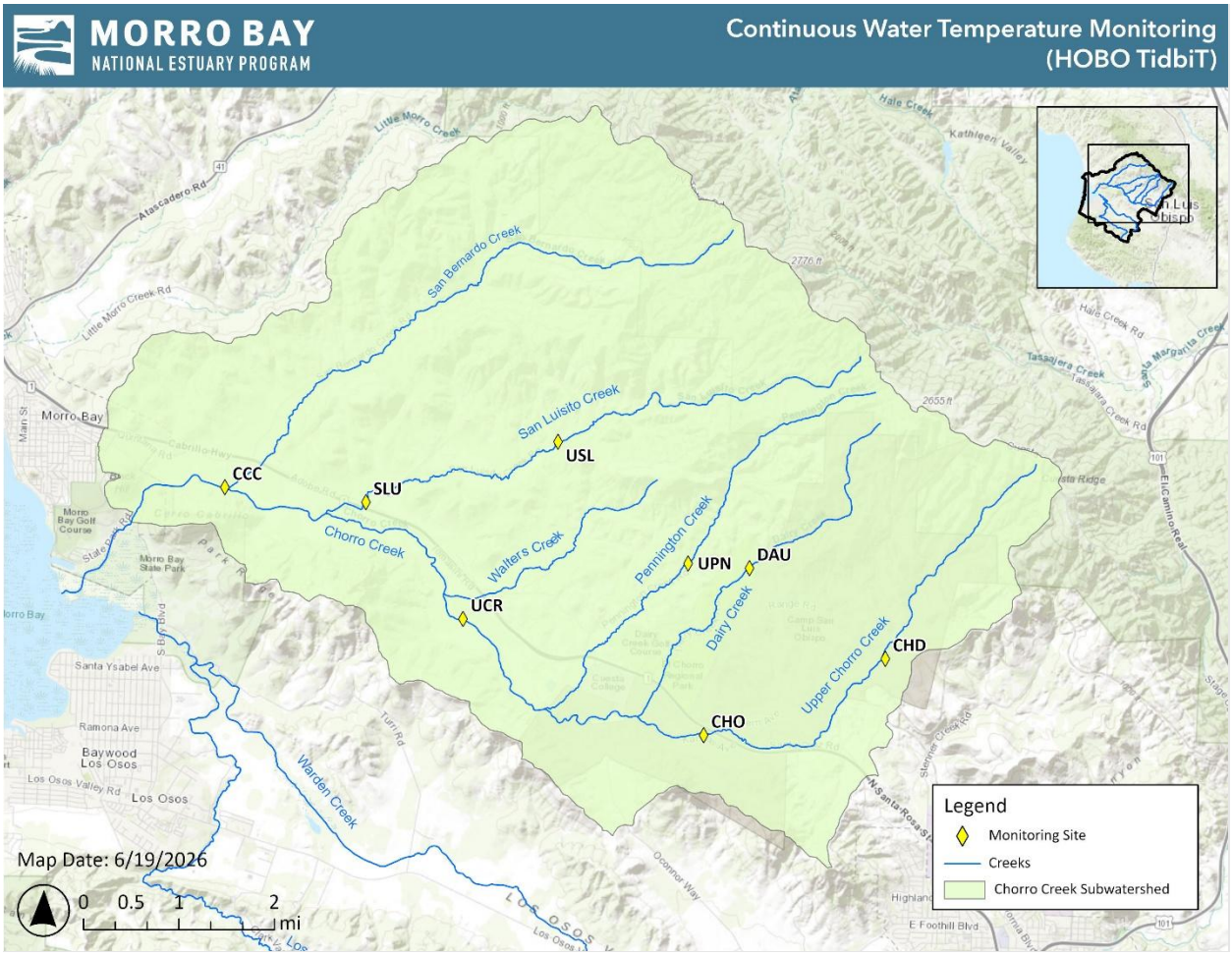

Figure 1. *Continuous temperature monitoring sites in the Chorro Creek subwatershed during WY2025.*

2.3 Results

Research has shown that prolonged exposure to temperatures above 18 °C can negatively impact *O. mykiss* reproduction, growth, migration timing, stress levels, and survival (Moyle 2002). This 18 °C temperature threshold was selected based on research that identified the optimal temperature range for *O. mykiss* as between 13 and 21 °C.

The following graphs illustrate water temperatures for the entire water year, color coded by season[1]. The multi-colored line indicates water temperature in degrees Celsius (°C) recorded at 30-minute intervals, and the horizontal red line indicates the 18 °C threshold protective of sensitive species.

Chorro Creek

Water temperature data was collected at three sites along Chorro Creek:

[1] Dates used to define the WY2024 seasons can be found in Appendix B.

- Chorro Creek at Camp San Luis Obispo (site code CHO): This is the uppermost monitoring site, located at Camp San Luis Obispo at the Highway 1 bridge.
- Chorro Creek at Upper Chorro Reserve (UCR): This site is downstream of the California Men's Colony wastewater treatment plant outfall and just upstream of the Chorro Creek Ecological Reserve.
- Chorro Creek at Chorro Creek Road (CCC): This is the furthest downstream site, located immediately upstream of Chorro Flats. It is above the zone of tidal influence from the bay.

Chorro Creek at Camp San Luis Obispo

The following graph (Figure 2) shows water temperature at Chorro Creek near Camp San Luis Obispo (CHO). Temperature data was collected from an InSitu Level TROLL 700 pressure transducer that was co-located with the historic logger location. Nearly five months of overlapping readings between the TidbiT and Level TROLL 700 in WY2024 verified that the temperature results were significantly similar ($p<0.001$, $R^2=0.954$, RPD<1.5%). Because the Level TROLL 700's specifications met the need of the project[2], temperature readings from this device were used to supplement WY2025.

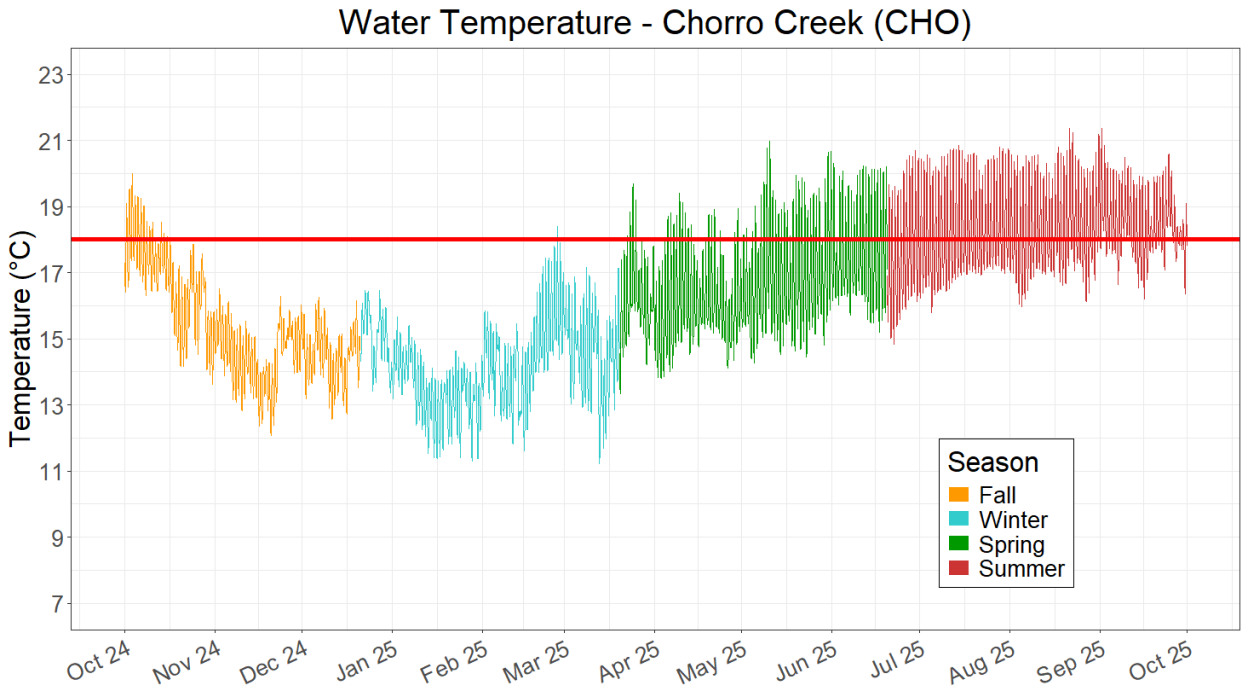

Figure 2. *Water temperature at Chorro Creek (CHO) during WY2025, colored by season. These data were collected using an InSitu Level TROLL 700 pressure transducer.*

Chorro Creek at Upper Chorro Reserve

Figure 3 shows water temperature at Chorro Creek upstream of the Chorro Creek Ecological Reserve (UCR). The temperature logger at UCR was deployed for the entirety of WY2025 (October 1, 2024 - September 30, 2025).

[2] For InSitu Level TROLL 700 Specifications, see Appendix D.

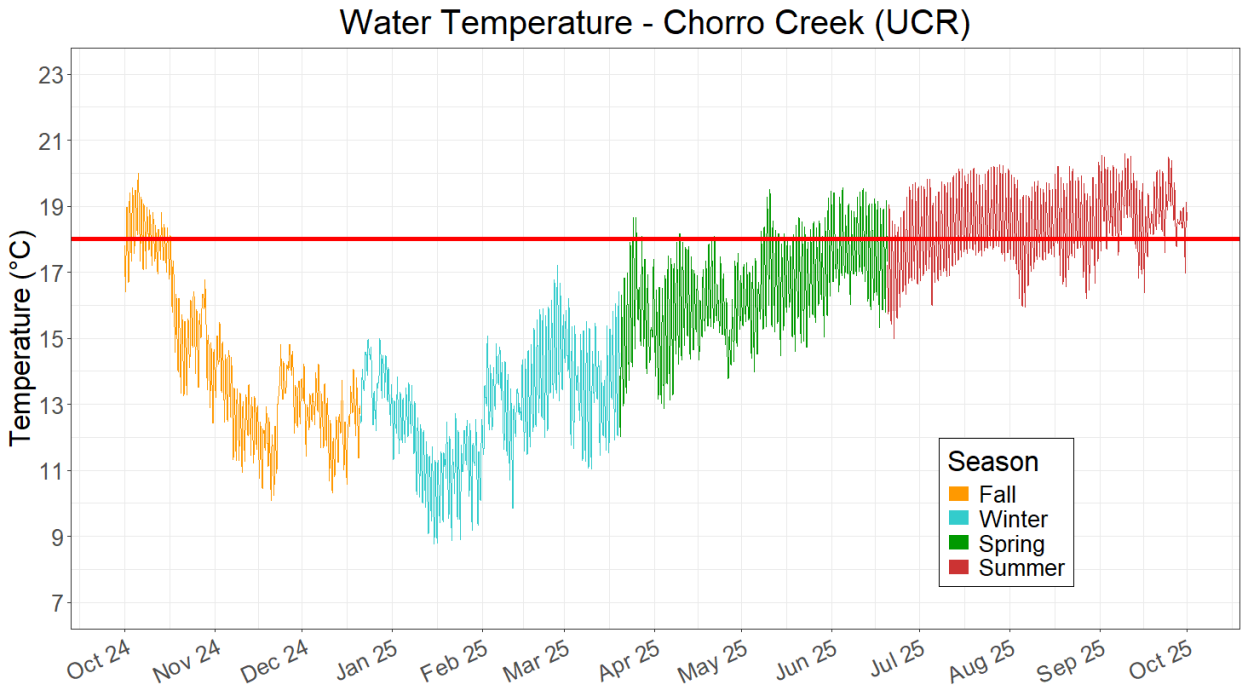

Figure 3. *Water temperature at Chorro Creek (UCR) during WY2025, colored by season.*

Chorro Creek at Chorro Creek Road

Figure 4 shows water temperature at Chorro Creek near Chorro Creek Road (CCC). The temperature logger at CCC was deployed for the entirety of WY2025 (October 1, 2024- September 30, 2025).

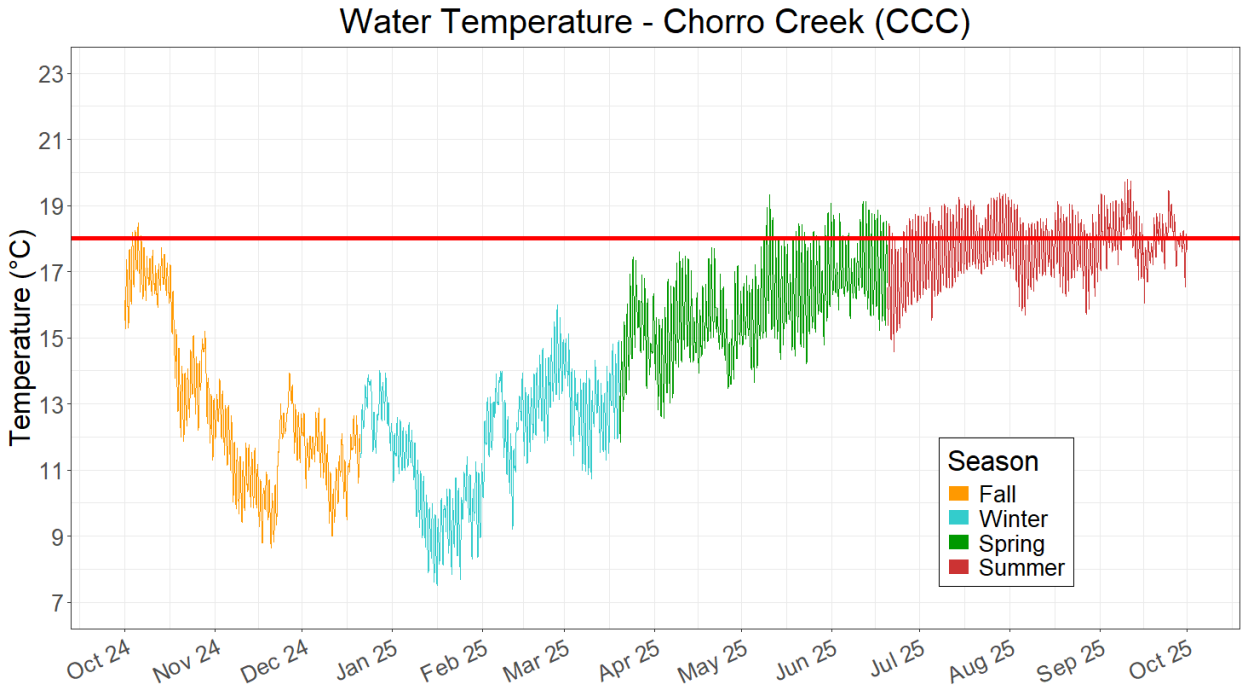

Figure 4. *Water temperature at Chorro Creek (CCC) during WY2025, colored by season.*

Chorro Creek Tributaries

Water temperature data was collected from three tributaries to Chorro Creek:

- San Luisito Creek (SLU): This site is located on Adobe Road, about 0.5 miles upstream of the confluence with Chorro Creek.
- Pennington Creek (UPN): This site is located about 2.5 miles upstream of the confluence with Chorro Creek, upstream of the former Rancho El Chorro Outdoor School campus and near the Cal Poly Beef Center at Escuela Ranch.
- Dairy Creek (DAM): This site is located within El Chorro Regional Park near the El Chorro Dog Park, approximately 1 mile upstream of the confluence of Dairy and Chorro Creeks.

San Luisito Creek

Figure 5 shows water temperature at San Luisito Creek at Adobe Road (SLU) during WY2025. The temperature logger at SLU was deployed from the start of WY2025 (October 1, 2024) until August 27, 2025. No data was collected from August 28, 2025 - September 30, 2025 due to sensor issues.

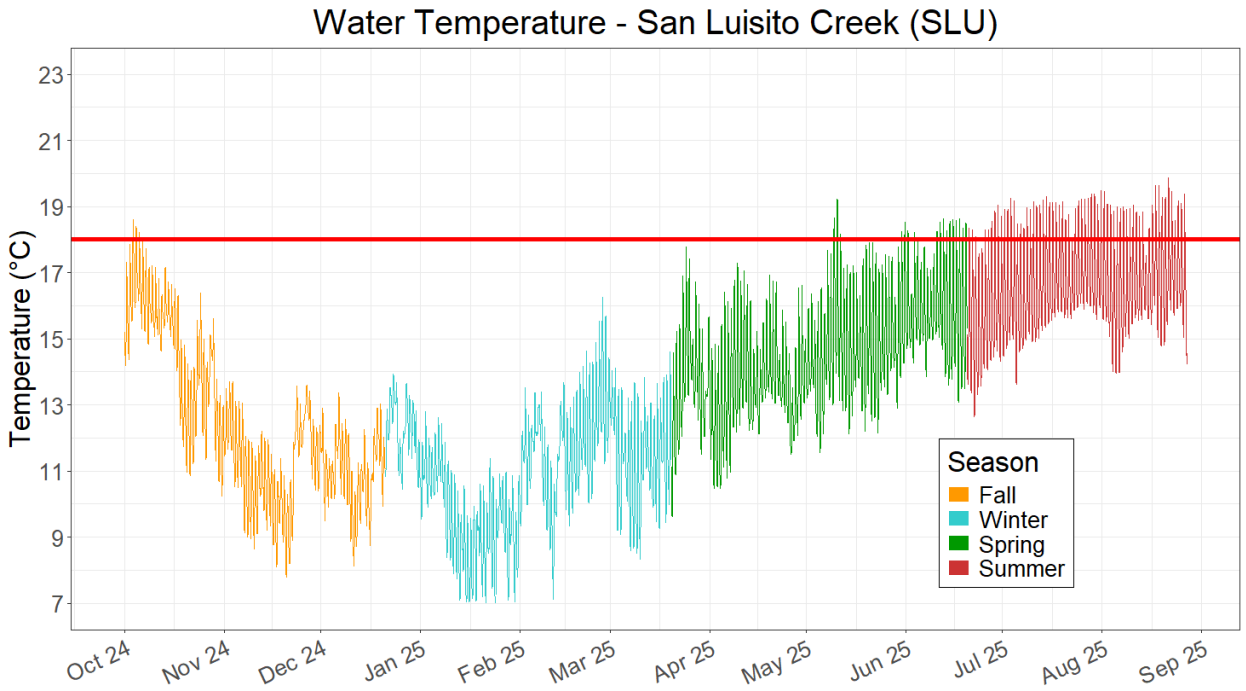

Figure 5. *Water temperature at San Luisito Creek (SLU) during WY2025, colored by season. No data were collected from August 28, 2025 to the end of WY2025 (September 30, 2025).*

Pennington Creek

The following graph (Figure 6) shows water temperature at Pennington Creek on Escuela Ranch (UPN) during WY2025. The temperature logger at UPN was deployed for the entirety of WY2025 (October 1, 2024 - September 30, 2025).

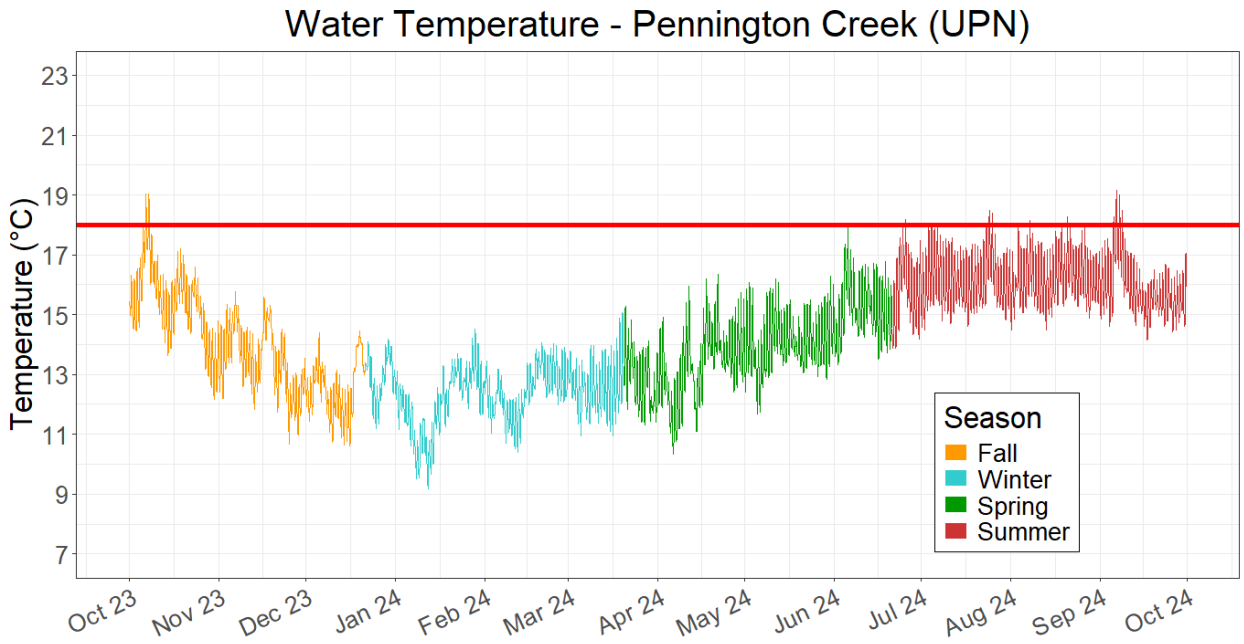

***Figure 6**. Water temperature at Pennington Creek (UPN) during WY2025, colored by season.*

Dairy Creek

The Estuary Program has historically analyzed water temperature from Upper Dairy Creek at El Chorro Regional Park (DAU) but changes in stream morphology in WY2025 caused the logger to become stranded, making the data unusable for this analysis. To supplement, water temperature data was collected from an InSitu Level TROLL 700 pressure transducer installed at Middle Dairy Creek at El Chorro Regional Park (DAM). The Level TROLL 700's specifications meet the needs of this project and are described in Appendix D. Dairy Creek at DAM is located approximately one mile downstream of the historic location at DAU.

Figure 7 shows water temperature at middle Dairy Creek in El Chorro Regional Park (DAM) during WY2025. Data presented in this memo represents the beginning of WY2025 (October 1, 2024) through June 4, 2025. This end date was selected based on when the reach upstream of the sensor went dry.

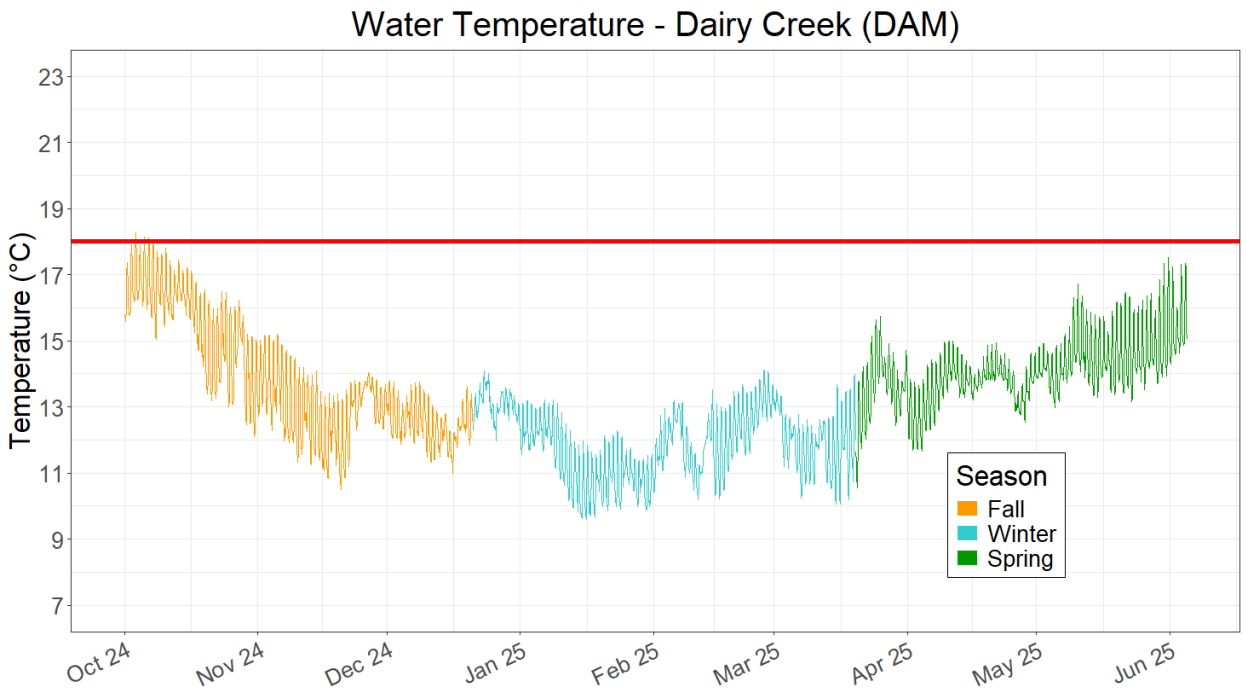

Figure 7. *Water temperatures at Dairy Creek (DAM) during WY2025, colored by season. Data were collected from the beginning of WY2025 (October 1, 2024) until June 4, 2025.*

2.4 Discussion

Water temperature results from WY2025 were analyzed using a variety of metrics. First, percent exceedance was calculated to see how frequently water temperature was higher than 18 °C at each site. Exceedance was calculated for the entire deployment period of the logger, which varied by site, and on a seasonal basis (Table 2). Because deployment periods for each logger varied, percent exceedance for each site cannot be directly compared between sites. Deployment periods for each temperature logger are outlined in Appendix A.

Table 2. *Percent exceedance of the 18 °C threshold for sensitive species at each monitoring site for WY2025. The deployment periods vary based on site locations. Summer temperature readings from DAM were excluded due to subsurface, disconnected conditions.*

Timeframe	CHO	UCR	CCC	UPN	SLU	DAM
Full Deployment Period	21.4%	24.6%	11.3%	1.3%	4.7%	0%
Fall	5.8%	10.8%	1.1%	0.8%	0.5%	0%
Winter	0.2%	0%	0%	0%	0%	0%
Spring	19.3%	13.7%	6.9%	0%	2.6%	0%
Summer	54.0%	66.6%	40.9%	4.2%	18.6%	N/A
Total days deployed in WY2025	365	365	365	365	331	247

The U.S. Environmental Protection Agency (EPA) set forth water temperature criteria in the 1986 Quality Criteria for Water (also known as the "Gold Book"), where it recommends the use of a maximum weekly average temperature (MWAT) as an index for assigning protective temperature standards for fisheries. The MWAT is the highest single temperature value of the seven-day moving average. This index is calculated relative to an upper limit, such as the 18 °C threshold mentioned previously.

Despite being a standard outlined by the EPA, several case studies have found the MWAT to be inadequately protective (McCullough, 2010). Because high daily maximum temperatures are often accompanied by low daily minimums, averages may remain relatively constant even if the daily maxima are much higher than ideal (Beschta et al. 1987). For a more protective metric, the maximum weekly maximum temperature (MWMT), also known as the seven-day average of the daily maximum temperatures (7-DADM), has been adopted more recently in some watersheds for assessing temperature regimes. The MWMT is defined as the maximum seasonal or yearly value of the daily maximum temperatures over a running seven-day consecutive period (Welsh et al., 2001).

In addition to percent exceedance of the 18 °C threshold, both MWAT and MWMT were calculated monthly to further assess thermal suitability for sensitive species. These values were compared to thermal thresholds for salmon and trout life stages, as designated by the EPA (Table 3).

Table 3. *Maximum weekly average temperatures (MWAT) and maximum weekly maximum temperatures (MWMT) for monitoring sites during WY2025. Salmon and trout life stage thresholds adapted from EPA, 2003.*

Maximum Weekly Average Temperature (MWAT) - WY 2025												
Site	Oct '24	Nov '24	Dec '24	Jan '25	Feb '25	Mar '25	Apr '25	May '25	Jun '25	Jul '25	Aug '25	Sep '25
CHO	18.0	15.1	15.3	14.3	15.7	16.5	16.4	17.3	17.8	18.4	18.6	18.7
UCR	18.5	13.8	13.9	12.6	14.5	16.0	16.3	17.2	17.8	18.7	18.5	19.2
CCC	17.1	12.6	13.0	11.6	13.9	15.5	15.7	16.7	17.3	18.2	17.8	18.5
UPN	17.0	13.0	12.7	11.7	12.7	13.5	13.4	14.5	15.1	16.1	16.9	17.4
DAM	16.8	13.7	13.2	12.4	12.9	13.9	14.1	14.9	15.4	-	-	-
SLU	16.5	12.3	12.4	11.1	12.7	14.2	14.2	15.3	16.0	17.2	17.1	-

Maximum Weekly Maximum Temperature (MWMT) - WY 2025												
Site	Oct '24	Nov '24	Dec '24	Jan '25	Feb '25	Mar '25	Apr '25	May '25	Jun '25	Jul '25	Aug '25	Sep '25
CHO	19.4	15.9	16.0	15.1	17.7	18.4	18.9	19.8	20.3	20.7	20.8	20.4
UCR	19.4	14.6	14.4	13.5	16.3	17.8	17.8	18.7	19.3	20.2	20.0	20.3
CCC	18.0	13.1	13.5	12.3	15.1	16.8	17.2	18.4	18.9	19.3	18.9	19.4
UPN	18.0	13.8	13.2	12.3	14.0	14.7	15.0	16.1	16.6	17.4	18.3	18.3
DAM	18.0	15.0	13.6	13.1	13.7	15.0	14.8	16.7	17.0	-	-	-
SLU	18.0	13.2	13.2	12.2	15.1	16.5	16.7	17.9	18.5	19.3	19.5	-

> 20°C, Exceeds EPA Threshold for Salmon/Trout Migration
> 18°C, Exceeds EPA Threshold for Salmon/Trout Migration plus Non-Core Juvenile Rearing
> 16°C, Exceeds EPA Threshold for Salmon/Trout "Core" Juvenile Rearing
> 14°C, Exceeds EPA Threshold for Steelhead Smoltification
> 13°C, Exceeds EPA Threshold of Salmon/Trout Spawning and Egg Incubation
< 13°C, EPA Optimal Range for Salmon/Trout Egg Incubation
\- = insufficient data

Table 3 illustrates how MWMT is a more protective metric than MWAT. All temperature monitoring sites that have a full temperature data set show elevated summer temperatures that exceeded a MWMT of 18 °C for at least one month. The MWAT table similarly shows elevated temperatures during this time, however only the mainstem sites crossed the 18 °C threshold. Water year 2024 had an unusually warm winter, where no months were protective for all salmonid life stages, while in WY2025 there was a return to supportive conditions for at least one month at all sites except for CHO (farthest upstream site along mainstem Chorro Creek). During the winter months, the MWAT table shows that tributaries and CCC (the furthest downstream site on mainstem Chorro Creek) could support all salmonid life stages from November to February, while the MWMT table shows little sustained viability for salmonid egg incubation during the most crucial time of year.

The highest MWAT and MWMT values from WY2025 occurred on Chorro Creek at CHO (upstream of the CA Men's Colony wastewater treatment plant), followed by Chorro Creek at UCR, which is located approximately two miles downstream of CHO. Both sites have had frequent and sustained issues with elevated temperatures. CHO is the furthest upstream of the three mainstem sites. This site is more exposed to sunlight when compared to downstream sites and does not receive cooler incoming water from tributaries. Water temperatures at UCR could also be affected by incoming treated effluent from the wastewater treatment plant. Warmer temperatures are less frequent downstream at CCC, likely due to increased canopy cover and cooler water coming in from tributaries.

3. Bimonthly Nutrient Monitoring

Nutrient impairment can lead to degraded water quality conditions and eutrophication, which can harm aquatic life and compromise ecosystem function. The Estuary Program assesses ambient nutrient concentrations throughout the Morro Bay watershed to identify long-term trends and prioritize restoration and conservation efforts. Staff collect samples for laboratory analysis for nitrate as nitrogen and orthophosphate as phosphorus every other month, or six times per year.

3.1 Analytical Specifications

The Estuary Program collects samples using standard sampling techniques. The samples are stored in the dark on ice and then delivered to a certified laboratory for analysis within the specified hold time. The analysis specifications for nitrate as nitrogen and orthophosphate as phosphorus are outlined below.

Table 4. *Nitrate as nitrogen (NO_3-N, mg/L) analysis specifications.*

Specification	Value
Method Number	SM 4500-NO3 F
Minimum Detection Limit	0.11 mg/L
Reporting Limit	0.4 mg/L
Hold Time	48 hours
Sample storage conditions	6 °C in the dark

Table 5. *Orthophosphate as phosphorus (PO_4-P, mg/L) analysis specifications.*

Specification	Value
Method Number	EPA 365.1
Minimum Detection Limit	0.031 mg/L
Reporting Limit	0.1 mg/L
Hold Time	48 hours
Sample storage conditions	6 °C in the dark

The laboratory occasionally dilutes the sample prior to analysis if the nutrient concentrations are elevated, which impacts the minimum detection limit (MDL) and reporting limit (RL) for the results. For each result that is less than the RL, a random number between zero and the RL is generated and used for analysis[3].

3.2 Monitoring Locations

Nine sites were selected to represent Chorro and Los Osos Creeks and their respective tributaries (Figure 8). The sites include upper Chorro Creek (site code CHO), middle Chorro Creek (UCR), lower Chorro Creek (TWB), middle Dairy Creek (DAM), Pennington Creek (UPN), San Luisito Creek (SLU), Warden Creek (TUR), and upper Los Osos Creek (CLV). Please note that San Bernardo Creek is included in this analysis (Section 3.3) but the location is not disclosed in Figure 8 to be protective of landowner privacy.

[3] This is the same method utilized by the CCRWQCB to manage non-detects in their own analysis.

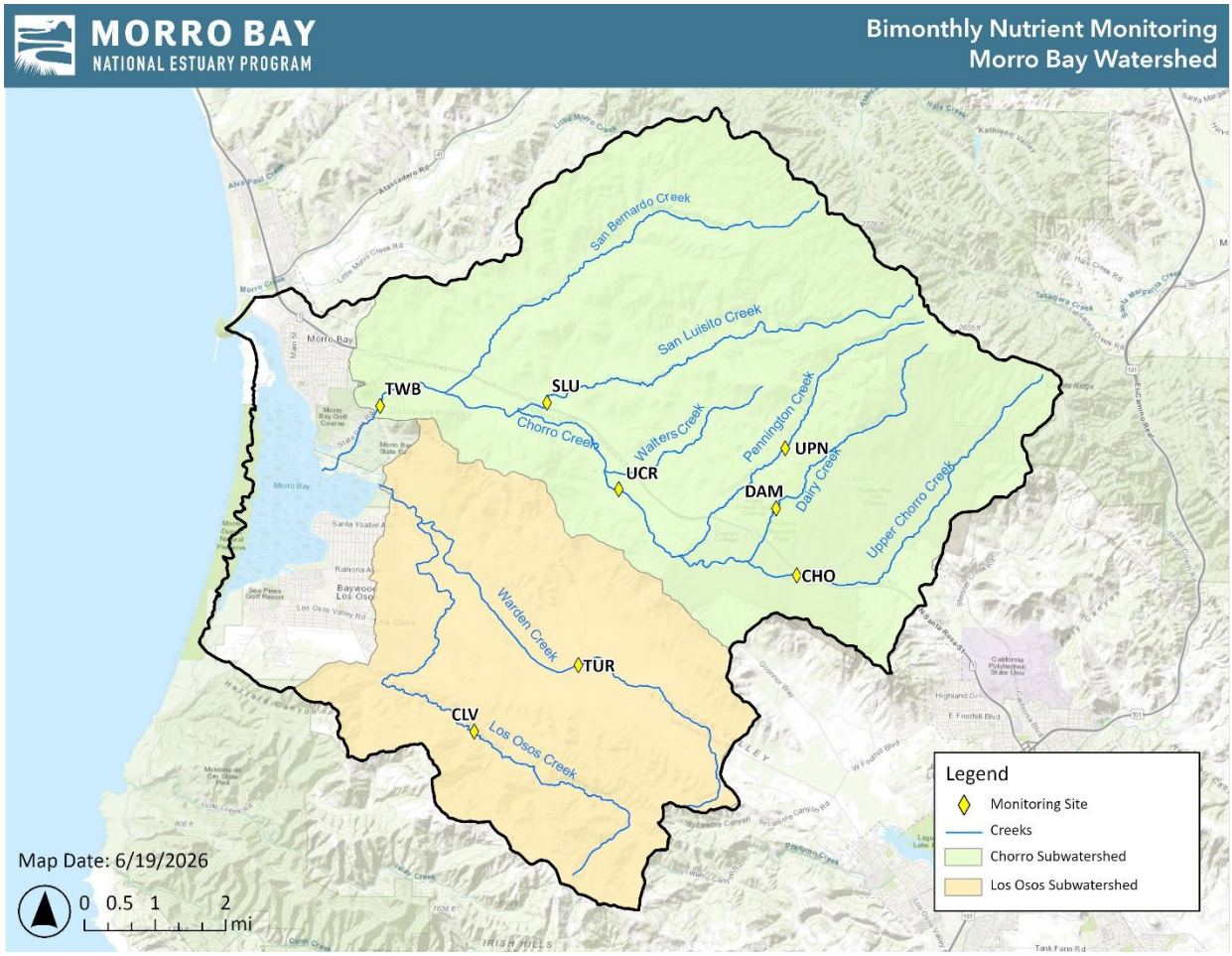

Figure 8. *Bimonthly nutrient monitoring locations in the Morro Bay watershed.*

3.3 Results

Nitrate as nitrogen

Nitrate as nitrogen (NO_3-N) concentrations are compared to two standards. In freshwater systems, a water body is considered likely to be impaired by nitrates if concentrations are greater than or equal to 1 mg/L as N when accompanied by other signs of ecological impact, such as widespread algal growth and excessively low or high dissolved oxygen concentrations. This is a 303(d) Listing Guidance Value utilized by the CCRWQCB and others to assess potential impairment. The EPA has a maximum contaminant level (MCL) of 10 mg/L NO_3-N for drinking water for protection of human health.

The Estuary Program assessed NO_3-N concentrations using the following criteria:

Good	- for NO_3-N concentrations < 1 mg/L (protective of aquatic and human health)
Fair	- for NO_3-N concentrations ≥ 1 mg/L and < 10 mg/L
Poor	- for NO_3-N concentrations ≥ 10 mg/L (exceeds level protective of human health)

Figure 9 shows the NO_3-N conditions for sites monitored in WY2025. This analysis represents 54 unique samples collected across nine sites and is not intended to represent year-round or watershed-wide trends. The number of samples varies by site, as some sites go dry during the summer.

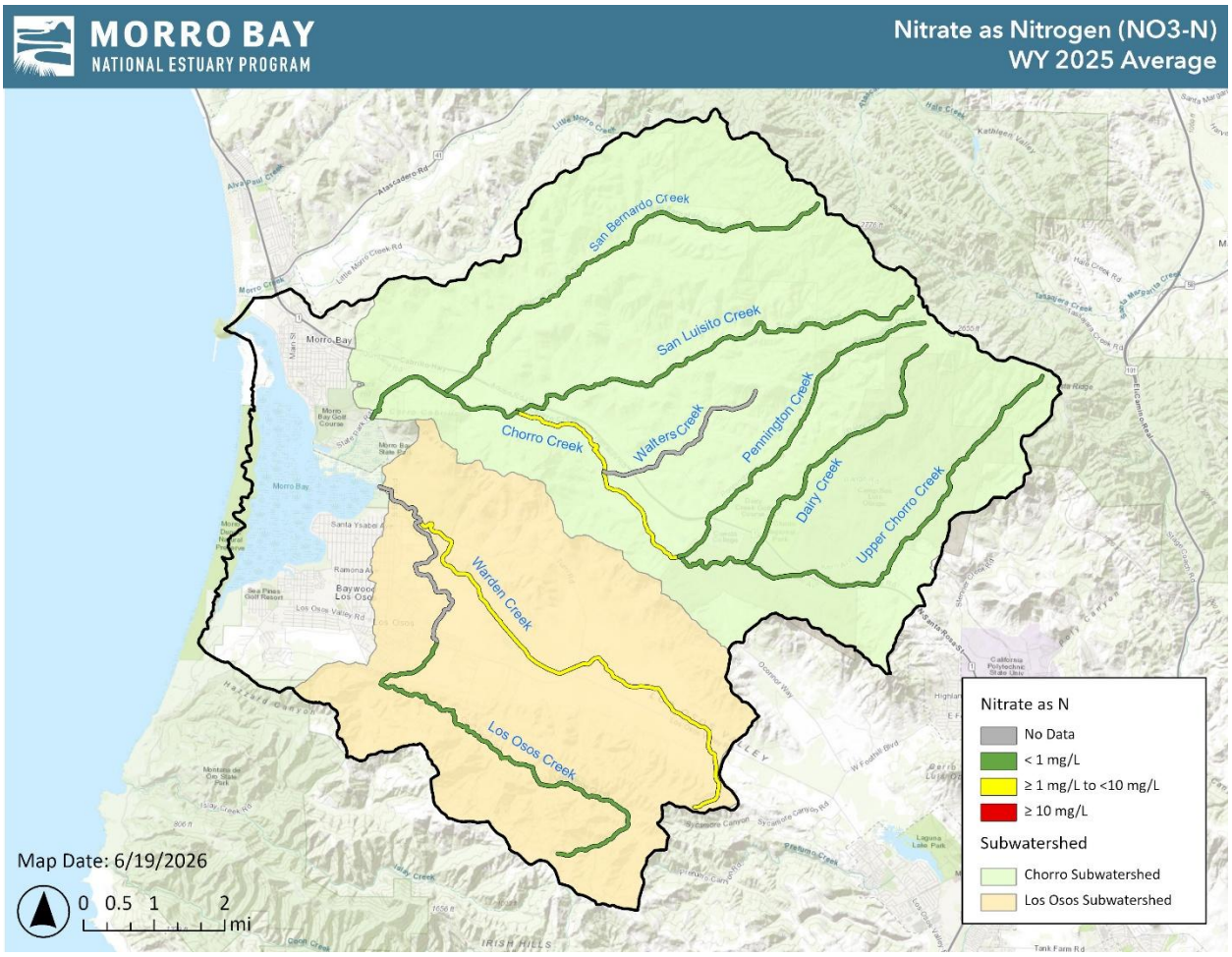

Figure 9. *NO_3-N assessment for monitoring locations in the Morro Bay watershed, WY2025.*

Orthophosphate as phosphorus

Orthophosphate as phosphorus (PO_4-P) results are compared to targets outlined in the Pajaro River nutrient objectives guidance document (Williamson, 1994). A value of 0.12 mg/L is used for comparison since freshwater systems with concentrations less than 0.12 mg/L are considered to be at low risk for eutrophication. To date, there is no standard protective of human health, and no established guidance value for the Morro Bay watershed.

The Estuary Program assessed PO_4-P concentrations using the following criteria:

Good	- for PO_4-P concentrations < 0.12 mg/L
Fair	- for PO_4-P concentrations ≥ 0.12 mg/L

Figure 10 shows the PO_4-P conditions for sites monitored in WY2025. This analysis represents 51 unique samples collected across nine sites and is not intended to represent year-round or watershed-wide trends. The number of samples varies by site, as some sites go dry during the summer.

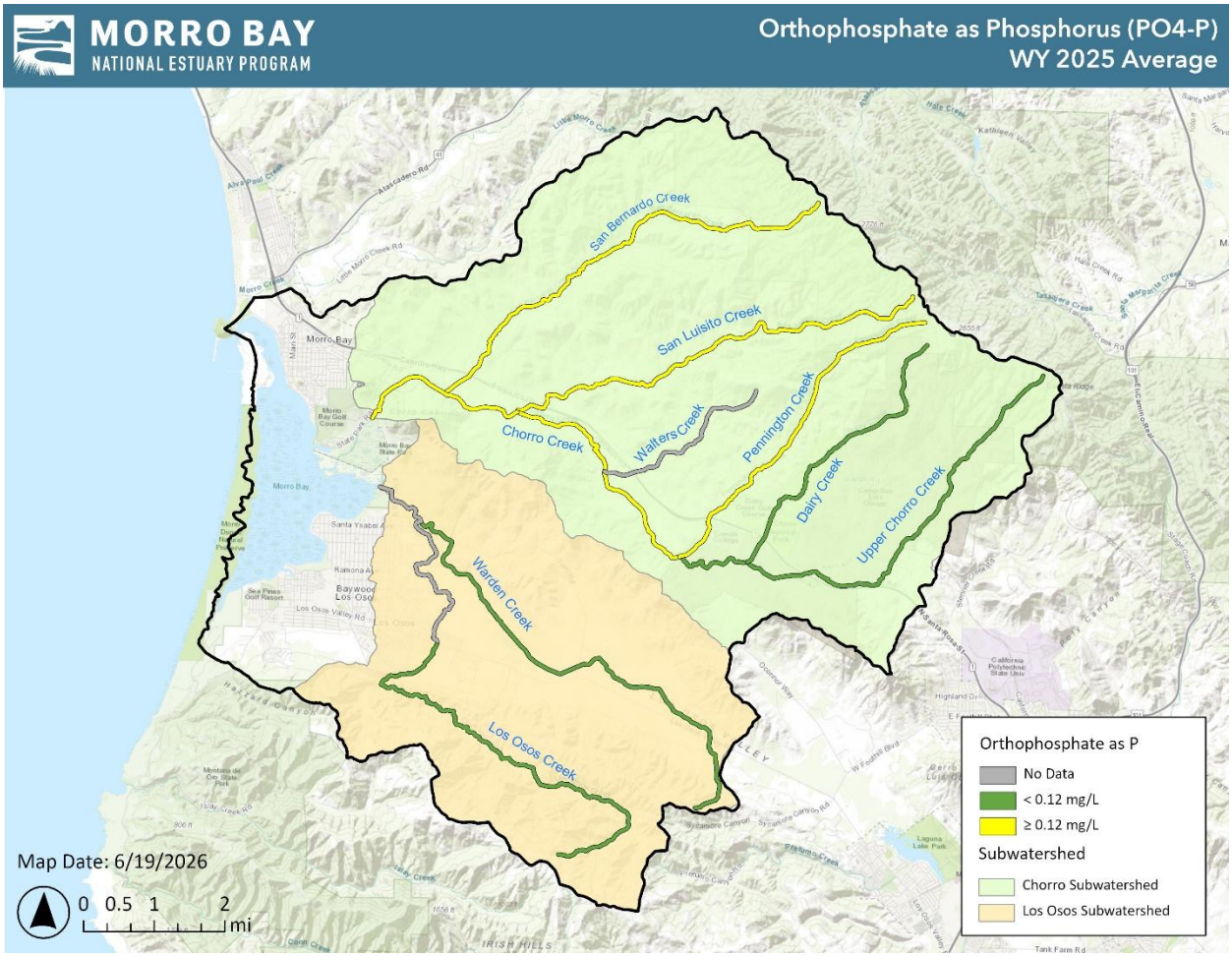

Figure 10. *PO_4-P assessment for monitoring locations in the Morro Bay watershed, WY2025.*

3.4 Discussion

Concentrations of PO_4-P are typically higher in the Chorro Creek subwatershed than in the Los Osos Creek subwatershed. Sites located along the mainstem of Chorro Creek, especially those downstream of the CA Men's Colony wastewater treatment plant, tend to exhibit higher PO_4-P concentrations than the surrounding tributaries. Middle Chorro Creek at UCR, located approximately two miles downstream of the plant, represents the higher end of PO_4-P concentrations in the watershed, followed by lower Chorro Creek at TWB.

The highest NO_3-N values in the Morro Bay watershed have consistently been detected on Warden Creek at TUR, which is heavily impacted by surrounding agricultural cropland. Elevated NO_3-N values at TUR have consistently exceeded the level of protection for both human and aquatic health (≥ 10 mg/L NO_3-N). In WY2025, average NO3-N concentrations at TUR were lower than in recent years, with an average concentration of 9.55 mg/L compared to 13.24 mg/L in WY2024. However, the WY average calculated for WY2025 only represents five sampling events, as the site was not sampled during November, December, and January due to intermittent surface flow conditions. As such, TUR continues to be a site of concern for persistent nutrient impacts to the watershed.

Data collected from Middle Chorro Creek at UCR have historically indicated elevated NO_3-N concentrations relative to upstream and downstream levels. Concentrations at this site have periodically exceeded the level of protection for aquatic health (≥ 1.0 mg/L NO_3-N) but not the level of protection for human health (≥ 10 mg/L NO_3-N). In WY2025, average NO_3-N concentrations increased from 0.72 mg/L in WY2024 to 2.10 mg/L in WY2025, exceeding the level of protection for aquatic health and returning to concentrations more consistent with those observed prior to WY2024. These results indicate that nutrient inputs along Middle Chorro Creek remain elevated and that the improvement observed in WY2024 was not sustained into WY2025.

4. Continuous Water Quality Monitoring

The Estuary Program collects continuous water quality data throughout the watershed using multiparameter sondes. The data collected provides insight into water quality trends and diurnal variations that may otherwise be missed with instantaneous measurements. The following data represents results of water quality sonde deployments and is not meant to serve as a continuous timeseries nor represent year-round trends.

4.1 Equipment Specifications

The Estuary Program deploys YSI EXO3 multiparameter sondes that collect dissolved oxygen, specific conductivity, water temperature, chlorophyll, and pH at one-hour intervals. A central wiper brush installed on the sonde cleans off the sensors between each interval, preventing sediment buildup and biofouling during deployments.

Table 6. *Specifications for the YSI EXO3 multiparameter sondes.*

Specification	Value
Measurement/Operating Range	Dissolved Oxygen: 0 to 50 mg/L Specific Conductance: 0 to 100,000 µS/cm Temperature: -5 to 50 °C Chlorophyll: 0 to 100 RFU pH: 0 to 14 units
Accuracy	Dissolved Oxygen 0 to 20 mg/L: ±0.1 mg/L Dissolved Oxygen 20-50 mg/L: ± 5% of reading Specific Conductance: ± 2 µS/cm Temperature: ± 0.2 °C Chlorophyll: Not reported pH: ± 0.2 pH units
Resolution	Dissolved Oxygen: 0.01 mg/L Specific Conductance: 0.1 µS/cm Temperature: 0.001 °C Chlorophyll: 0.01 RFU pH: 0.01 units

4.2 Monitoring Locations

The Estuary Program deployed YSI EXO3 water quality sondes at two sites along Chorro Creek during WY2025 (Figure 11). Deployment timelines ranged from 14 to 56 days, depending on creek conditions, access, and equipment availability[4]. Sites were co-located with TidbiT water temperature monitoring sites. Chorro Creek at CHO is located approximately three miles upstream of UCR.

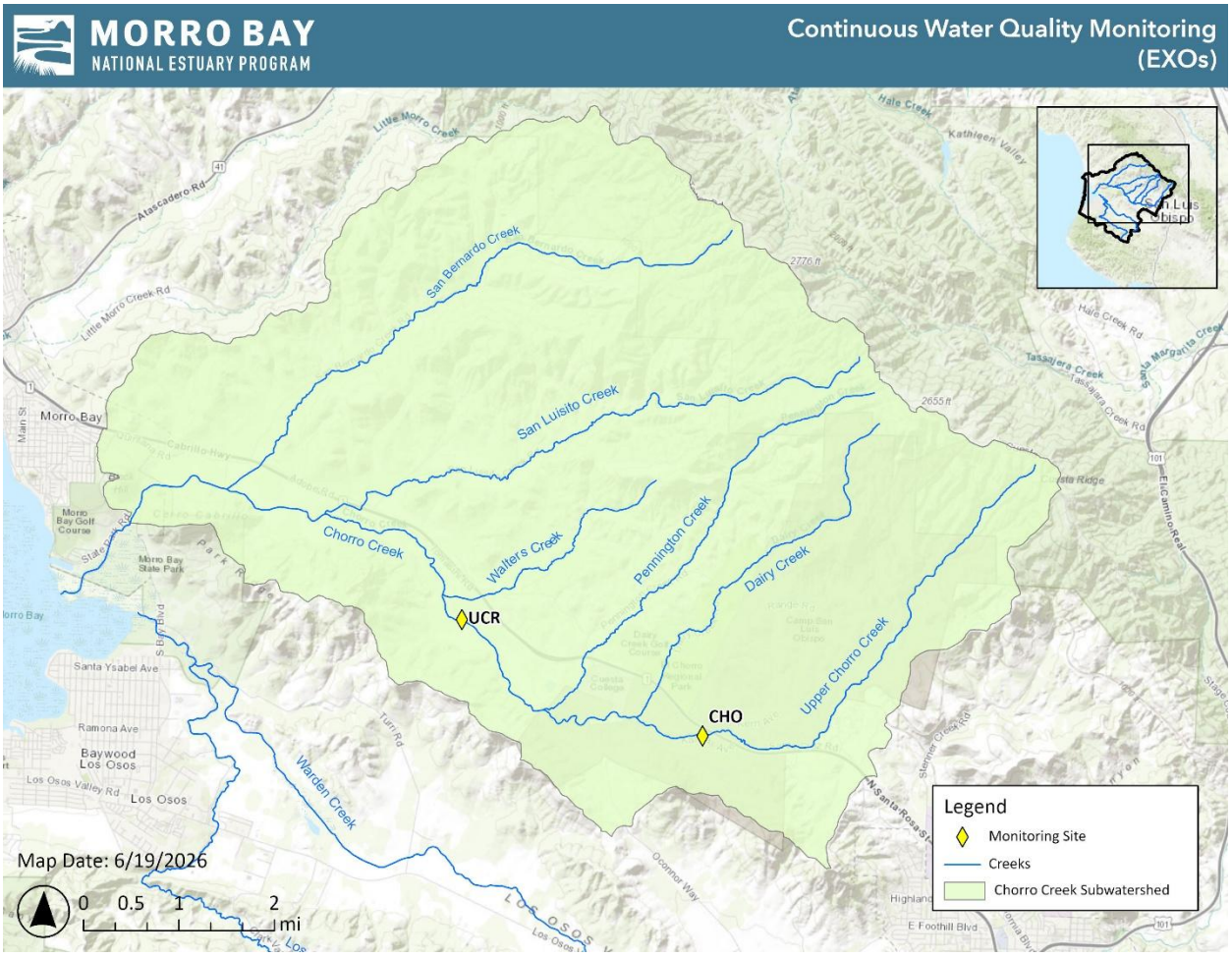

Figure 11. *YSI EXO3 multiparameter sonde deployment locations on Chorro Creek during WY2025.*

4.3 Results

The CCRWQCB Basin Plan outlines water quality objective numeric targets to protect designated beneficial uses. Chorro Creek and Los Osos Creeks support several beneficial uses including cold freshwater habitat (COLD) and fish spawning (SPWN). To be protective of these uses, dissolved oxygen concentrations should not drop below the 7.0 mg/L numeric target at any time, and surface waters must not have pH values below 7.0 or above 8.5, with changes in ambient pH levels less than 0.5. Temperature results ideally remain below 18°C, as described in Section 2.4.

[4] For YSI EXO3 deployment timelines, see Appendix C.

Table 7. *Water quality objective numeric targets and sources for Chorro Creek.*

Analyte	Criteria	Source
Dissolved oxygen	< 7 mg/L (COLD, SPWN)	CCRWQCB Basin Plan Water Quality Objectives for Specific Beneficial Uses (Section 3.3.2.2)
Temperature	> 18 °C	Moyle, 2002
pH	< 7.0 and > 8.5 (COLD, SPWN)	CCRWQCB Basin Plan Water Quality Objectives for Specific Beneficial Uses (Section 3.3.2.2)

While the Estuary Program's YSI EXO3 multiparameter sondes measure chlorophyll during deployments, chlorophyll results are not presented since no relevant water quality objectives or other standards exist for comparison at this time. For more information, please contact the Estuary Program.

Dissolved Oxygen

Figure 12 describes the mean and range of dissolved oxygen (DO) concentrations during each month of deployments in WY2025. Data used in this analysis were adjusted to only include timeframes when sondes were deployed at both sites. The red dotted line indicates the CCRWQCB water quality objective for dissolved oxygen outlined in Table 7.

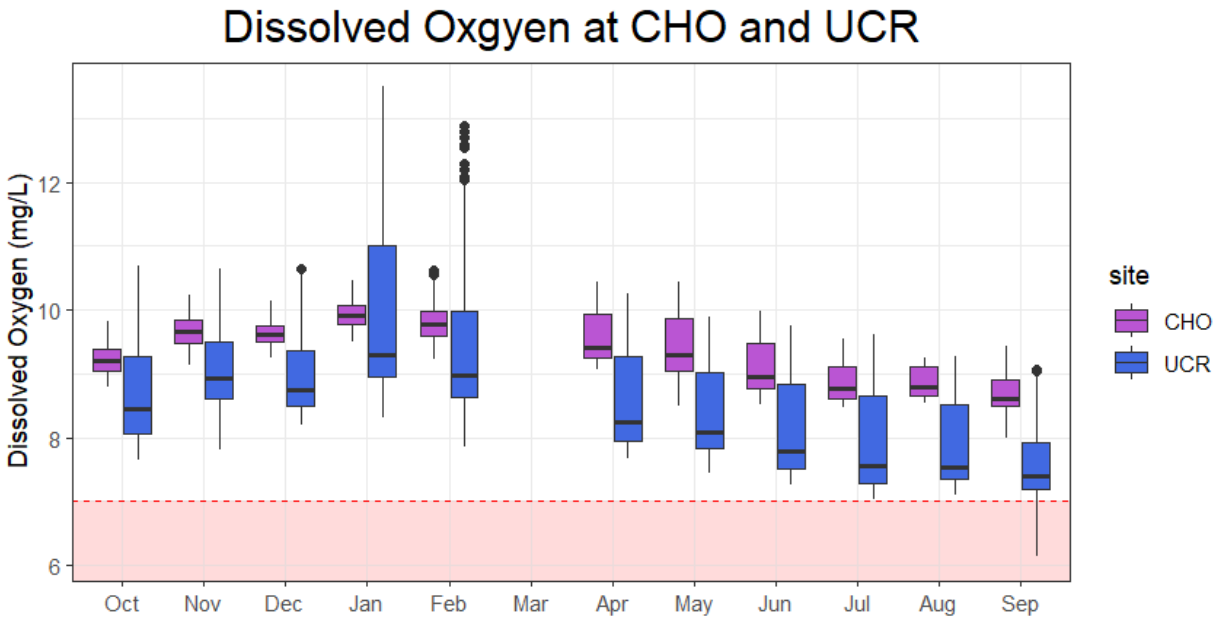

Figure 12. *Dissolved oxygen concentration (mg/L) from two Chorro Creek sites (CHO, UCR) during WY2025. The horizontal red line represents the CCRWQCB Basin Plan objective (7 mg/L). The colored boxplots represent the middle 50% of dissolved oxygen readings, and the dark line represents the average value. Error bars represent the range in dissolved oxygen. Deployment length varied and there were no deployments during March 2025.*

Temperature and pH

Figures 13 and 14 describe the monthly mean and range in temperature and pH during WY2025 deployments. In Figure 13, the area shaded in red represents temperatures above the 18°C threshold as described in Table 7 and Section 2.4. In Figure 14, the area shaded in red indicates pH levels above or below the CCRWQCB water quality objective thresholds of 7.0 and 8.5 pH.

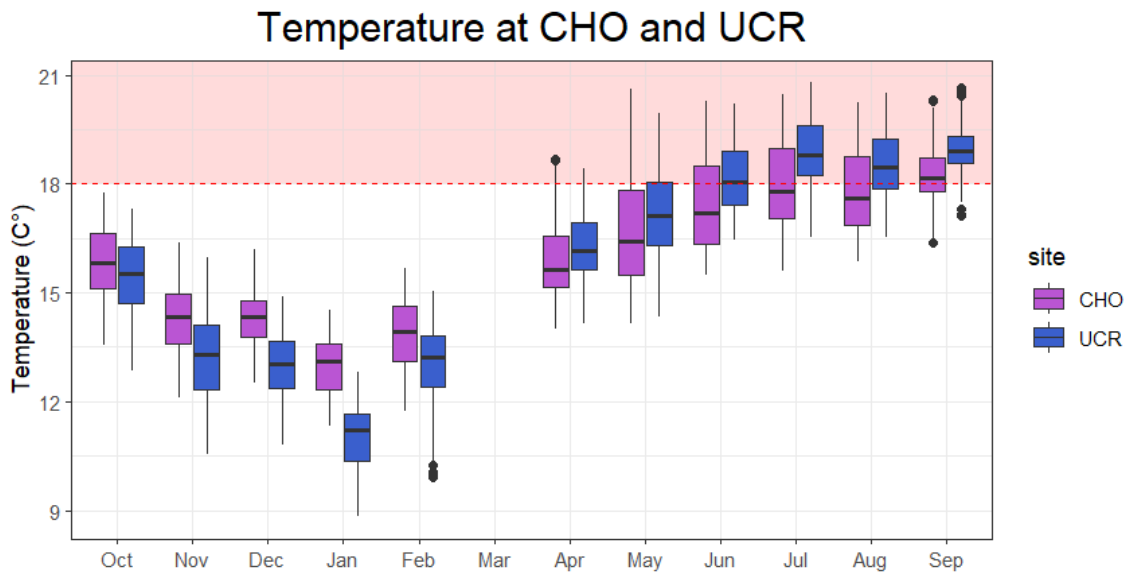

Figure 13. *Monthly mean water temperature (°C) from two deployment locations in Chorro Creek (CHO, UCR) during WY2025. The red shading represents the 18 °C threshold for temperature (Moyle, 2002).*

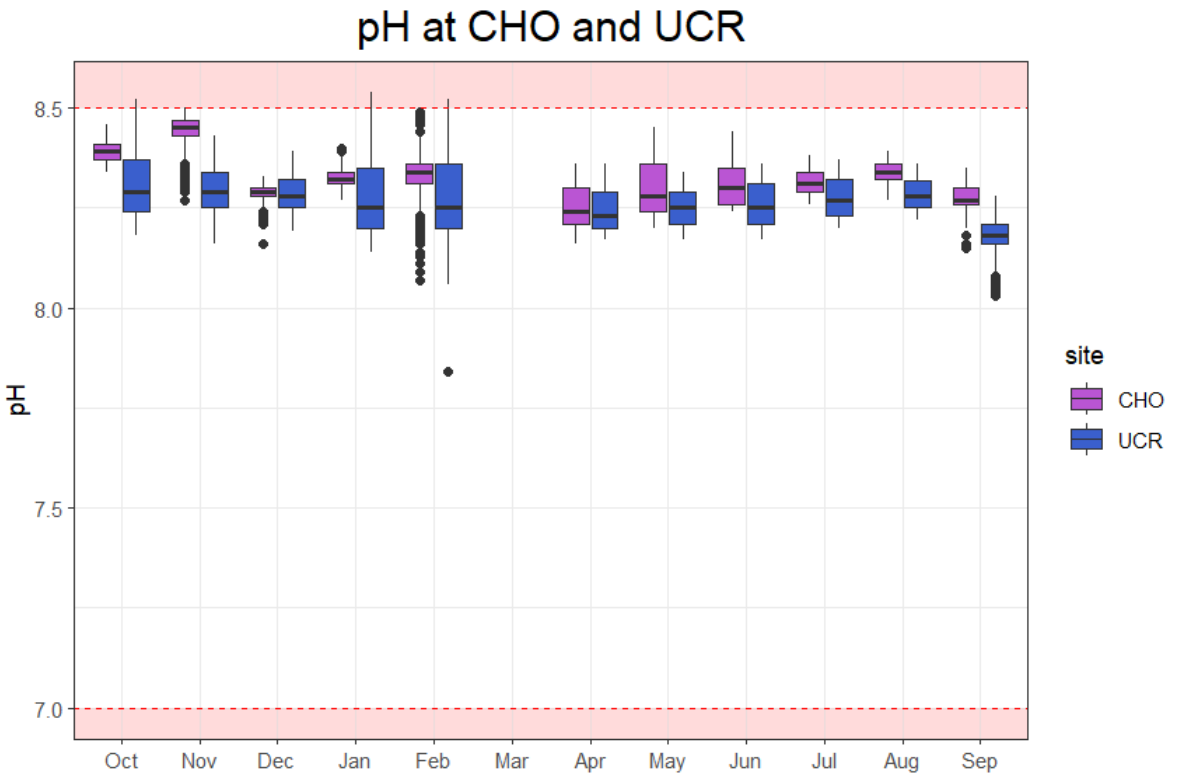

Figure 14. *Monthly mean pH values from two deployment locations in Chorro Creek (CHO, UCR) during WY2025. The red shaded area represents pH values of < 7.0 and > 8.5 (CCRWQCB, 2019).*

4.4 Discussion

Depressed DO concentrations in systems have immediate implications for the health of aquatic organisms. DO concentrations fluctuate throughout the day, making instantaneous measurements less effective for characterizing oxygen dynamics. Continuous monitoring allows for a more complete characterization of temporal variability in DO conditions and the potential impacts on aquatic life.

The results from the WY2025 sonde deployments indicate that DO concentrations along Chorro Creek are generally above the 7.0 mg/L threshold for most of the year. Concentrations dropped below 7 mg/L for a small fraction of the August and September deployment at UCR. All readings from the deployment at CHO were above the 7.0 mg/L threshold (Table 8).

Table 8. *Percentage of readings collected during each deployment that were outside of CCRWQCB Basin Plan objectives for dissolved oxygen concentration in WY2025.*

Percentage of Deployment Below 7 mg/L DO Concentration												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CHO	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
UCR	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	1.4	10.4

	76 - 100%
	51 - 75%
	26 - 50%
	1 - 25%
	0%

Water temperature trends on Chorro Creek at CHO and UCR followed the same trend observed in Sections 2.3 and 2.4. Chorro Creek at UCR experiences more frequent exceedances of the 18 °C threshold than CHO. Average water temperature for UCR exceeded 18 °C for four consecutive deployments (June to September 2025) while upstream at CHO, the mean only exceeded this threshold during the September deployment. Warmer temperatures along Chorro Creek may be due in part to differences in riparian cover and effluent from the wastewater treatment plant.

Average pH levels were within the CCRWQCB range for cold freshwater habitat (COLD) and fish spawning habitat (SPWN) in all deployments. However, UCR experienced brief exceedances of the upper threshold in January and February, along with one reading of 8.51 in October. CHO experienced several readings at 8.5 in November, but none that exceeded this threshold. Brief periods of elevated pH are likely due to runoff from nearby gravel roads that raise the concentration of carbonate ions in the water, or high photosynthetic activity from freshwater algae that reduce carbon dioxide concentrations (EPA, 2005). These brief pH exceedances are not expected to negatively impact aquatic health, especially since large pH swings were not observed over the course of the deployments.

5. Data Availability

Bimonthly nutrient monitoring data is publicly available from the California Environmental Data Exchange Network (CEDEN), a State Water Resources Control Board managed data portal. For continuous monitoring data, please contact the Estuary Program.

To retrieve nutrient data, visit https://ceden.waterboards.ca.gov.

- Select “Find Data” to retrieve data
- Click “CEDEN Query Tool”
- Under “Category,” select “Water Quality (Chemistry)”
- Under “Program,” select “Morro Bay National Estuary Program”
- Under “Analyte,” select “Orthophosphate as P, Dissolved” and/or “Nitrate as N, Dissolved”
- Under “FromDate” and “ToDate,” select the date range desired.
- Click on “Submit” to retrieve results.

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Appendix A. WY2025 TidbiT Deployment Timelines

Site	Deployments
CHO	10/01/2024-09/30/2025
UCR	10/01/2024-09/30/2025
CCC	10/01/2024-09/30/2025
DAM	10/01/2024-06/04/2025
UPN	10/01/2024-09/30/2025
SLU	10/01/2024-08/27/2025

Appendix B. WY2025 Dates for Each Seasonal Period

Time Period	Start	End
Water Year 2024	10/1/2024	9/30/2025
Fall Season	10/1/2024	12/20/2024
Winter Season	12/21/2024	3/19/2025
Spring Season	3/20/2025	6/19/2025
Summer Season	6/20/2025	9/30/2025

Appendix C. WY2025 EXO3 Deployment Timelines

Season	CHO	UCR
Fall	10/22/2024-11/26/2024 *(35 days)* 12/3/2024-12/17/2024 *(14 days)*	10/01/2024-11/26/2024 *(56 days)* 12/3/2024-12/17/2024 *(14 days)*
Winter	1/14/2025-2/13/2025 *(30 days)*	1/14/2025-2/20/2025 *(37 days)*
Spring	4/18/2025-06/04/2025 *(47 days)*	04/18/2025-06/04/2025 *(47 days)*
Summer	06/23/2025-08/06/2025 *(44 days)* 09/16/2025-end of WY *(15 days)*	06/23/2025-08/06/2025 *(44 days)* 09/16/2025-end of WY *(15 days)*

Appendix D. InSitu Level TROLL 700 Specifications

Specifications for the InSitu Level TROLL 700 pressure transducer are as follows:

Specification	Value
Measurement/Operating Range	-20 ° to 80 °C
Accuracy	±0.1 °C
Resolution	0.01 °C

Appendix E. List of Acronyms

Acronym	Definition
CCRWQCB	Central Coast Regional Water Quality Control Board
CEDEN	California Environmental Data Exchange Network
DO	Dissolved oxygen
EPA	Environmental Protection Agency
EXO3	YSI Multiparameter Sonde Model EXO3
MDL	Method Detection Limit
MWAT	Maximum Weekly Average Temperature
MWMT	Maximum Weekly Maximum Temperature
NO3-N	Nitrate as Nitrogen (dissolved)
O. mykiss	*Oncorhynchus mykiss*, rainbow trout (resident) or steelhead trout (anadromous)
PO4-P	Orthophosphate as Phosphorus (dissolved)
RL	Reporting Limit
RPD	Relative Percent Difference
SD	Standard deviation
WY	Water Year (Oct 1 to September 30; named for the year in which it ends)