

City of Layton Canal System Water Monitoring Report 2025 Year-End Summary

Water quality is a critical concern for the Florida Keys and its surroundings with unique marine ecosystems. The City of Layton recognizes the critical importance of regular monitoring and characterizing water quality within its canal system.

Monitoring protocols: Morning canal water monitoring occurred dockside at site-2 western finger canal and site-5 main canal (figure 1) using a YSI Professional Plus multiparameter instrument for water data (YSI Incorporated, Yellow Springs, Ohio, USA). Data was typically recorded daily by 9:00 am. At site-2 three canal aerators, purchased by the City of Layton, were currently operating within a 50-yard radius of this monitoring site. At site-5 there is currently one operational aerator within the immediate vicinity. Additional sites within the canal system (1: mouth of Long Key Lake, 3: City Hall dock, and 4: Causeway end of canal by ‘the Pipes’) were monitored weekly by 10:00 am to track fluctuations within the Layton canal system. Water monitoring at sites 6 (natural Zane Grey Creek) and 7 (Long Key Bight) occurred at least monthly or as access permitted. Tide status for Long Key Lake and Long Key Bight was determined using [Saltwater Tides for the Florida Keys region](#) and measured on a stationary tide pole dockside each morning at site-2 (figure 1). Meteorological data (air temperature, wind speed, and rainfall) was acquired from the Keys Marine Laboratory (KML) Weather Station (Vantage Vue Pro weather station, Davis Instruments) <https://www.fio.usf.edu/keys-marine-lab/kml-services/kml-weather-station/>.



Figure 1. Water monitoring sites within the City of Layton canal system. #1 mouth of Long Key Lake #2 dockside western finger canal #3 dockside behind City Hall #4 causeway near canal outflow pipes #5 dockside central Layton canal #6 undeveloped Zane Grey Creek #7 Long Key Bight.

Daily monitoring

Daily canal water monitoring was performed dockside at site-2 western finger canal and site-5 main canal (figure 1) using a hand-held YSI Professional Plus multiparameter instrument. Data collected included morning air temperature, 24-hr rainfall, tide stage and height on tide pole, water temperature, dissolved oxygen (DO), salinity (ppt), and pH. Data was typically recorded daily by 9:00 am. (table 1A & B). Dissolved oxygen is typically lowest in the early morning before photosynthetic activity enhances DO but can also be affected by water temperatures. Florida Keys Reef salinity is typically 34-35 ppt and pH is typically 7.9 - 8.2.

Total rainfall in the City of Layton for 2025 was 44.04" (table 3). Tidal range in the canals was 3.1 feet for 2025 with observed low 10.3' in February and high of 13.5' in October (table 1 & 3). Tide pole measurements are relative to the top of canal seawall (13.2') and top of dock (14.0') at Site #2. Fall King Tides causing potential nuisance flooding was observed beginning in September and continuing through December. Full and new moons, King Tides in the fall, and the passing of storms and hurricanes can produce noticeable high tides and storm surge in the canal system and may temporarily inundate the Causeway on South Layton Drive.

Table 1A. 2025 annual summary of daily monitoring at Site 2 and Site 5.

2025	morning		Site #2 western finger canal				Site #5 central canal			
	tide	air (F)	water (F)	DO %	salinity ppt	pH	water (F)	DO %	salinity ppt	pH
mean	11.4	75.1	80.16	44.44	39.63	7.45	80.39	41.07	39.36	7.44
max	13.5	85.0	91.22	82.60	54.84	7.93	92.12	73.70	46.67	7.87
min	10.3	53.0	61.70	21.30	30.83	6.84	62.42	16.70	29.90	6.54

Table 1B. 2025 Summary of daily canal monitoring by month at site #2 and site #5

2025		morning		Site #2 western finger canal				Site #5 central canal			
		tide	air (F)	water (F)	DO %	salinity ppt	pH	water (F)	DO %	salinity ppt	pH
Jan	mean	11.0	62.9	73.1	68.48	66.51	35.39	7.74	68.39	60.15	35.50
	max	11.4	73.0	81.0	75.20	82.60	36.32	7.93	74.84	73.70	38.62
	min	10.6	53.0	59.0	61.70	42.40	30.86	7.57	62.42	24.80	30.21
Feb	mean	10.9	72.4	78.9	75.96	45.65	37.54	7.71	76.25	45.00	37.75
	max	11.6	77.0	83.0	79.34	62.90	39.78	7.77	79.52	61.30	39.77
	min	10.3	64.0	74.0	71.24	22.10	33.40	7.42	71.06	22.60	35.77
Mar	mean	11.2	70.1	79.2	75.02	49.30	40.43	7.71	75.71	48.25	40.32
	max	12.1	77.0	85.0	80.24	63.50	41.77	7.82	80.24	71.20	41.69
	min	10.5	59.0	72.0	70.52	31.60	38.63	7.55	72.14	27.70	38.83
Apr	mean	11.1	74.8	81.0	78.68	54.63	42.68	7.36	79.11	54.75	42.45
	max	11.8	79.0	84.0	81.50	64.90	45.65	7.80	82.40	69.00	44.06
	min	10.6	65.0	76.0	75.38	37.30	41.07	7.50	76.46	34.00	41.44
May	mean	11.3	78.7	86.6	84.84	37.20	42.03	7.61	84.79	36.93	41.88
	max	11.9	82.0	89.0	88.70	50.40	45.50	7.85	87.98	50.10	45.30
	min	10.5	72.0	82.0	79.16	27.70	37.75	7.48	80.96	28.40	37.25
Jun	mean	11.4	80.4	87.1	85.76	38.53	40.06	7.57	85.79	38.77	38.95
	max	12.1	83.0	89.0	88.34	46.60	43.47	7.86	89.96	51.30	43.62
	min	10.8	70.0	80.0	79.34	31.00	30.83	7.44	77.72	25.50	29.90
Jul	mean	11.2	80.9	88.9	87.03	29.85	42.53	7.44	87.17	31.34	41.99
	max	11.9	84.0	91.0	89.60	42.00	49.30	7.77	89.60	41.10	44.25
	min	10.7	75.0	86.0	84.74	21.30	39.56	7.26	85.82	17.90	39.69
Aug	mean	11.7	81.3	90.5	89.19	33.96	45.03	7.37	89.09	29.64	44.69
	max	12.6	85.0	93.0	91.22	49.40	54.84	7.46	92.12	41.70	46.67
	min	10.9	75.0	85.0	84.38	25.70	42.57	7.28	85.46	22.50	41.66
Sept	mean	12.0	79.4	88.2	86.00	33.11	38.19	7.29	86.25	26.36	38.28

	max	12.9	84.0	91.0	88.30	46.40	41.62	7.41	88.00	35.20	41.04
	min	11.2	74.0	84.0	82.76	23.40	32.98	7.07	83.30	16.70	33.40
Oct	mean	12.2	77.8	84.8	82.57	43.84	35.92	7.07	82.21	31.43	34.51
	max	13.5	82.0	88.0	86.30	68.50	38.53	7.22	85.80	65.00	38.30
	min	11.5	72.0	76.0	79.00	28.70	33.56	6.92	78.50	23.20	30.10
Nov	mean	11.5	71.2	79.4	74.91	49.43	36.48	7.02	74.63	43.67	36.63
	max	12.7	79.0	87.0	86.50	68.70	39.09	7.25	81.20	60.60	38.65
	min	10.8	53.0	64.0	66.90	32.80	34.29	6.84	67.50	27.90	30.79
Dec	mean	11.2	71.6	78.6	74.45	48.77	38.69	7.09	75.25	44.82	38.58
	max	12.2	77.0	84.0	79.50	66.50	39.98	7.37	80.00	55.30	40.00
	min	10.4	53.0	62.0	68.40	36.20	37.74	6.90	68.90	35.70	37.77

Table 2. Analysis of daily air temperature by month, recorded at KML Weather Station, with comparison to 2024 maximum daily temperatures. Note number of days maximum air temperatures were 90°F or greater each month, not accounting for ‘feels like’ heat index temperature.

Maximum Daily Air Temps (F)									
2025	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	81.0	86.6	87.1	88.9	90.5	88.2	84.8	79.4	78.6
Max	84.0	89.0	89.0	91.0	93.0	91.0	88.0	87.0	84.0
Min	76.0	82.0	80.0	86.0	85.0	84.0	76.0	64.0	62.0
days ≥90°	0	0	0	10	27	8	0	0	0

2024	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
mean	80.3	86.9	87.4	89.8	89.5	89.9	84.9	80.7	76.1
max	83.0	92.0	90.0	91.0	92.0	92.0	90.0	84.0	84.0
min	75.0	82.0	77.0	89.0	85.0	88.0	79.0	70.0	68.0
days ≥90°	0	6	6	20	11	16	1	0	0

Table 3. 2025 Summary of monthly rainfall in Layton, with comparison to 2020 – 2024 and 5-year monthly means. Data from Keys Marine Laboratory (KML) Weather Station.

Monthly Rainfall (inches)	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			Annual total rainfall
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2025	1.03	1.65	0.08	0.93	3.80	9.13	4.51	4.70	8.60	7.31	1.11	1.19	44.04
2024	1.46	3.34	6.65	2.50	1.57	5.15	1.24	9.61	9.21	9.19	1.24	7.42	58.58
2023	2.02	1.53	1.09	2.59	3.69	1.72	3.85	2.42	6.75	2.54	7.03	7.94	43.17
2022	2.70	1.03	1.33	1.44	4.10	13.48	3.81	3.17	11.52	1.41	4.23	1.73	49.95
2021	1.90	1.80	0.60	3.10	1.30	6.50	3.90	2.90	5.40	3.60	5.00	1.30	37.30
2020									13.70	13.10	4.10	1.10	na
5-yr monthly mean	1.82	1.87	1.95	2.11	2.89	7.20	3.46	4.56	8.30	4.81	3.72	3.92	46.61

Table 3. Summary of monthly tidal ranges for 2025 at site #2 (western finger canal) with comparison to 2020-2024. Tide pole measurements are relative to top of canal seawall (13.2) and top of dock (14.0). King Tides are the most prominent Sept-Nov and may be exacerbated by tropical storms, hurricanes causing oceanside storm surge, and strong east winds pushing into the Long Key Bight.

Tides		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2025	max	11.4	11.6	12.1	11.8	11.9	12.1	11.9	12.6	12.9	13.5	12.7	12.2
	min	10.6	10.3	10.5	10.6	10.5	10.8	10.7	10.9	11.2	11.5	10.8	10.4
2024	max	11.9	11.8	11.6	11.6	12.6	12.3	12.1	12.3	13.1	13.0	13.3	11.7
	min	10.6	10.6	10.4	10.5	10.8	11.0	10.8	10.6	11.3	11.4	11.2	10.7
2023	max	11.6	11.4	11.9	11.8	12.1	12.3	12.2	12.7	12.9	12.9	12.7	12.1
	min	10.4	10.1	10.7	11.0	10.9	10.7	10.6	10.9	10.9	11.3	11.1	11.0
2022	max	12.0	12.4	11.5	11.8	12.50	12.2	12.0	12.3	13.0	12.9	12.6	12.3
	min	10.8	10.7	10.7	10.8	11.00	10.8	10.7	11.0	11.0	11.2	11.3	11.1
2021	max	11.4	11.5	11.6	11.9	11.80	11.8	12.0	12.4	12.4	12.5	12.4	11.9
	min	10.3	10.3	10.5	10.4	10.50	10.5	10.7	11.0	10.9	10.9	11.1	10.9
2020	max									12.6	12.8	12.6	11.7
	min									11.3	11.3	11.0	10.5



South Layton Drive (left) and South Layton Causeway (right) during October 2025 King Tides

Continuous canal temperature profile

An underwater pendant-style data logger (Onset HOBO Inc., Bourne, MA, United States) remained submerged dockside at site #2 and was set to continuously record canal water temperature every 30 minutes (figure 1. Layton canal map). The data logger was downloaded monthly, and a temperature profile was created for 2023 (figure 2). Canal water temperatures were influenced by winter cold fronts, heavy rainfall events, and tropical storms or hurricanes. Water temperatures in the canal consistently exceeded the *thermal stress threshold* (85.30°F or 29.60°C) from early May through mid-October and the *coral bleaching threshold* (87.08°F or 30.60°C) mid-May through early October (fig 2). While coral typically does not occur within the Layton canal system, other marine organisms, including fish and other

invertebrates, also experienced thermal stress (e.g., paling and bleaching was observed in ‘upside-down jellyfish’ (*Cassiopeia xamachana* or *C. frondosa*)).

Most tropical reef-building corals do not tolerate temperatures below 65°F (18°C) for extended periods of time and temperatures below 60°F (15°C) can be lethal. Corals experience heat stress and bleaching when water temperatures exceed the *maximum mean monthly sea surface temperature* (MMM SST) by 1°C. August is typically our warmest month in the Keys and MMM SST for August in the Florida Keys is calculated as 29.6°C (85.3°F), therefore the established *threshold for coral bleaching* conditions on the Florida Reef Tract is 30.6°C (87.08°F). Observations of coral bleaching is dependent on duration of time above this threshold. More information can be found at the NOAA Satellite Coral Bleaching Monitoring <https://coralreefwatch.noaa.gov/product/vs/map.php>.

See **Glossary of Terms** at the end of this report.

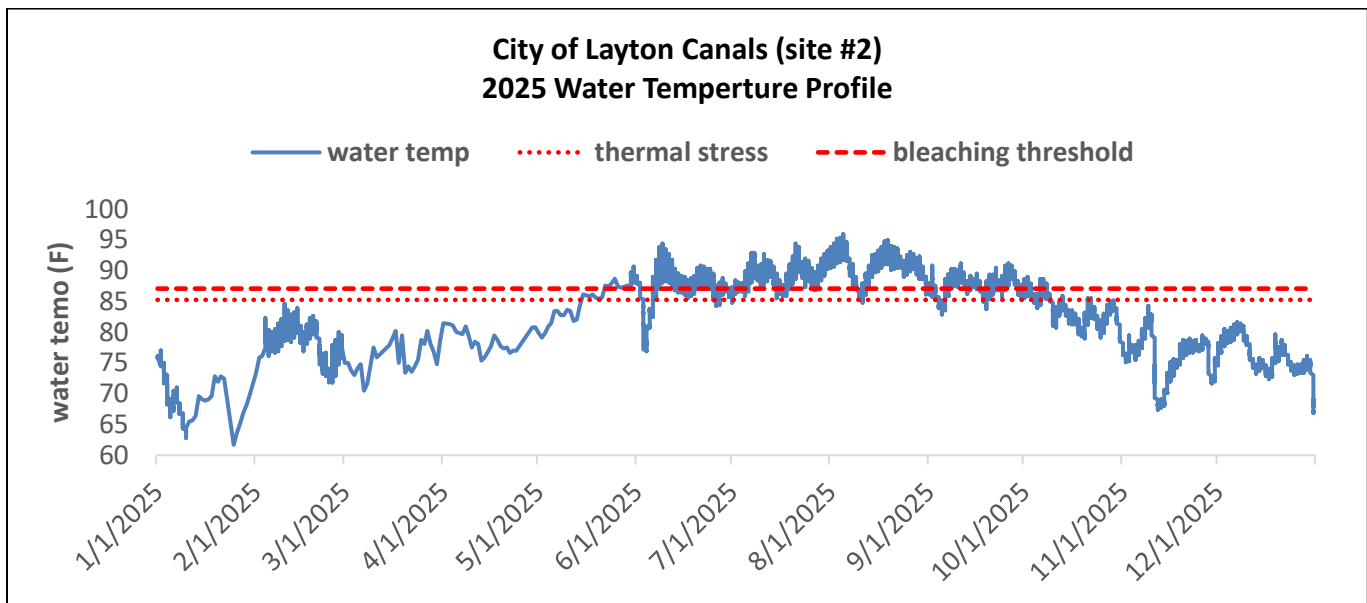


Figure 2. Continual Layton canal temperature profile **A)** Summary of 2025 annual profile from continual data logger for City of Layton Canal water temperature recorded every 30 minutes at Site-2 western finger canal. Dotted red line represents the *thermal stress threshold* (85.30°F or 29.60°C). Dashed red line represents the *coral bleaching threshold* for the Florida’s Coral Reef (87.08°F or 30.60°C).

Table 4. 2025 Summary of annual continual data logger canal water temperatures recorded at Site-2 dockside with comparison to 2024 data. Mean and median water temperatures were higher in 2025 than 2024.

A. Annual Summary of HOBO Canal Water Temperatures 2025

Annual Canal Temps	2025		2024	
	water temp (°F)	water temp (°C)	water temp (°F)	water temp (°C)
mean	83.13	28.92	81.76	27.65
maximum	95.98	35.54	95.78	35.44
minimum	61.70	16.50	64.14	17.86
median	85.01	30.15	81.80	27.67
thermal stress	85.30	29.60		
bleach threshold	87.08	30.60		

B. Summary of Monthly HOBO Canal Water Temperatures 2025

Q-1 2025	Jan-25		Feb-25		Mar-25	
	°F	°C	°F	°C	°F	°C
mean	69.30	20.72	78.11	25.62	75.88	24.38
maximum	77.05	25.03	84.65	29.25	80.24	26.80
minimum	61.70	16.50	71.86	22.14	70.52	21.40
median	68.93	20.52	78.62	25.90	75.02	23.90
Q-2 2025	Apr-25		May-25		Jun-25	
	°F	°C	°F	°C	°F	°C
mean	78.68	25.94	87.74	30.97	87.25	30.69
maximum	81.50	27.50	90.68	32.60	94.44	34.69
minimum	75.38	24.10	79.16	26.20	76.88	24.93
median	78.44	25.80	89.02	31.68	87.55	30.86
Q-3 2025	Jul-25		Aug-25		Sep-25	
	°F	°C	°F	°C	°F	°C
mean	88.97	31.65	90.69	32.60	87.43	30.79
maximum	94.44	34.69	95.98	35.54	91.24	32.91
minimum	84.83	29.35	84.83	29.35	82.86	28.26
median	88.83	31.57	90.87	32.70	87.55	30.86
Q-4 2025	Oct-25		Nov-25		Dec-25	
	°F	°C	°F	°C	°F	°C
mean	83.43	28.57	75.88	24.38	76.16	25.07
maximum	89.02	31.68	84.30	29.05	81.62	26.29
minimum	78.45	25.81	67.39	19.66	66.88	23.68
median	83.40	28.56	76.79	24.88	75.48	25.13

Comparisons of Layton Canal System monitoring at additional sites

Five additional sites within the canal system (1: mouth of Long Key Lake, 3: City Hall dock, 4: Causeway canal end by ‘the Pipes’, 6: natural Zane Grey Creek, 7: Long Key Bight) were monitored weekly by noon to track fluctuations within the Layton Canal System (figures 3 – 6 and tables 5 - 8; see figure 1 for map of sites). Some fluctuation in weekly readings may be attributed to tidal stage in the canal system (rising or falling tides) at the time of monitoring. At the Long Key Bight site, salinity and pH were typically more similar to normal seasonal reef values than at sites within the Layton Canal System (figures 7 & 8). Salinity within the canal system appeared to be influenced by seasonal rainfall during the year, sharply declining following heavy rains while steadily becoming more saline during periods of low rainfall (table 7, figure 5). Values for pH within the Layton Canal System were consistently more acidic than the Long Key Bight or reef waters, likely influenced by natural tannins and detritus in the canals and incomplete daily tidal flushing which would bring in reef quality water (table 8 & figure 6).

Water temperature (°C)

Table 5. Summary of 2025 water temperature (°C) monitored within the Layton Canal System. Sites 1, 3, 4, 6, & 7 were monitored weekly. See map in figure 1 for site locations within the canal system.

2025 water temp (°C)	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 Bight
mean	26.17	27.18	26.48	26.46	26.61
max	30.40	31.90	31.20	31.70	31.50
min	17.80	20.30	17.80	19.80	19.70

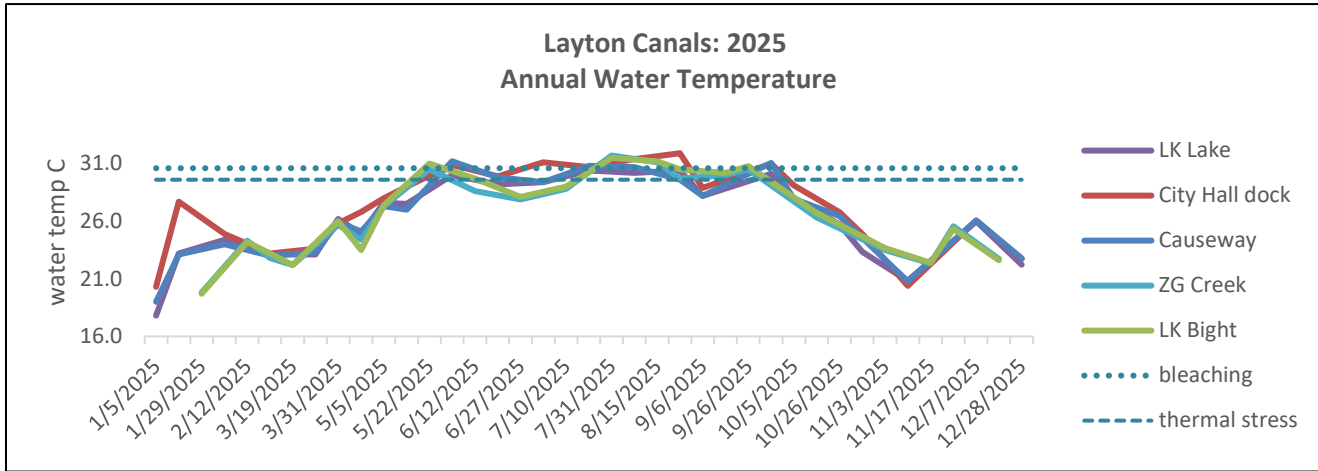


Figure 3. 2025 Layton Canal System water temperatures (°C) monitored weekly at five sites. Grey dashed line is coral bleaching threshold for the Florida Reef Tract is 30.6°C/87.08°F). Grey dotted line is thermal stress threshold (85.30°F or 29.60°C).

Dissolved oxygen (% DO)

Table 6. Summary of 2025 dissolved oxygen (% DO) monitored within the Layton Canal System.

2025 % DO	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	42.85	44.77	50.33	42.48	64.29
max	76.50	67.30	68.00	67.20	94.40
min	24.40	25.70	26.50	18.70	34.00

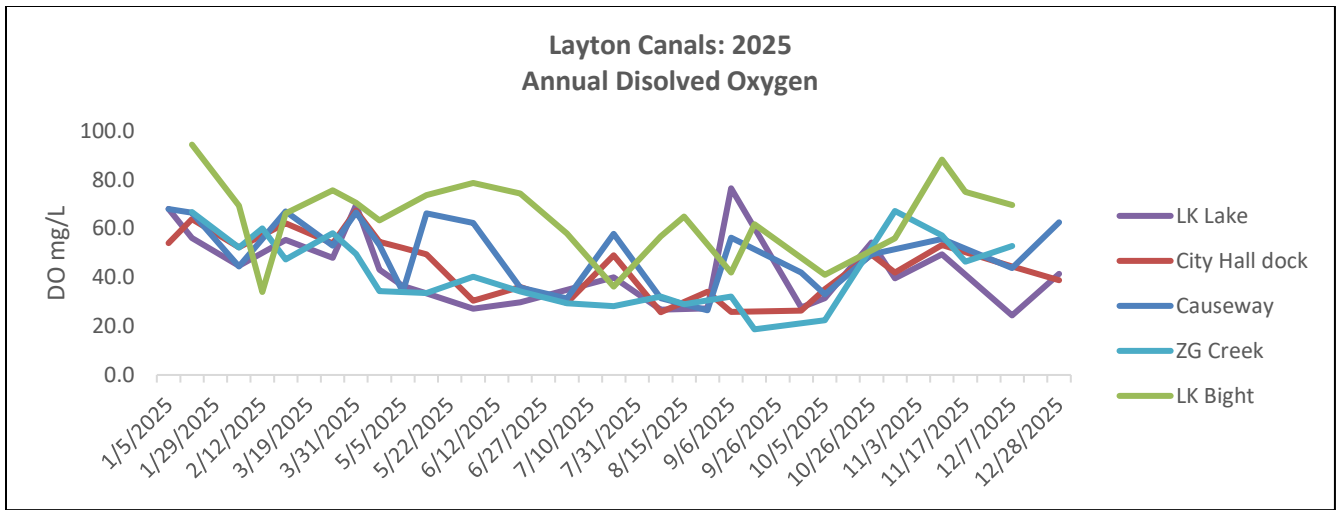


Figure 4. 2025 Layton Canal System dissolved oxygen (% DO) monitored weekly at five sites. Fluctuations in DO% are likely also influenced by tidal stage at the time of monitoring (incoming, outgoing).

Salinity – parts per thousand (ppt)

Table 7. Summary of 2025 salinity (ppt) within the Layton Canal System. Typical Florida Keys reef salinity is 34-35ppt.

2025 salinity ppt	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	39.46	40.09	40.45	40.05	39.25
max	45.29	45.56	45.33	44.47	44.10
min	30.53	34.66	34.78	34.79	29.16

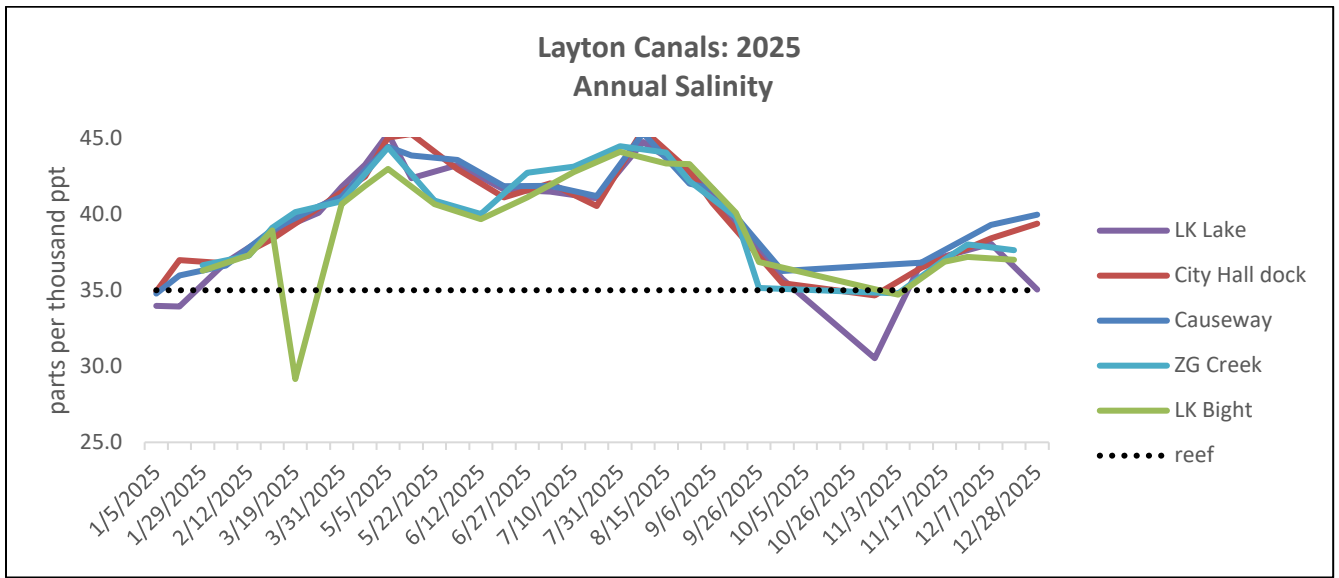


Figure 5. 2025 Layton canal system salinity (parts per thousand, ppt) monitored at five sites. Typical Florida Keys reef salinity is 34-35ppt.

Canal System - pH

Table 8. Summary of 2025 pH within the Layton Canal System. Typical Florida Keys reef pH is 7.9-8.2).

2025 pH	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	7.46	7.46	7.53	7.44	7.62
max	7.82	7.79	7.86	7.89	8.14
min	7.04	6.98	7.06	6.65	6.93

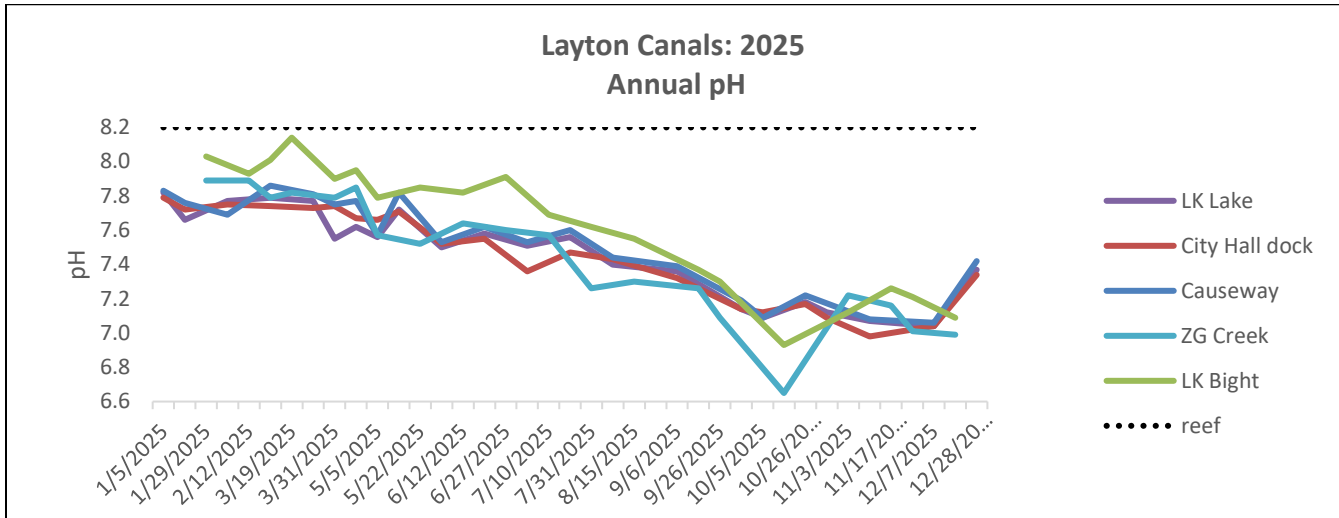


Figure 6. 2025 Layton Canal System pH weekly monitoring at five sites. Typical Florida Keys reef pH is 7.9 to 8.2.

Water quality sampling

Key indicators of water quality often include nutrient levels (nitrogen & phosphorus), chlorophyll *a* (as a marker for algae concentrations), and heavy metals (mercury, lead, arsenic, copper, etc.). To establish a baseline for water quality parameters in the Layton canal system, regular sampling is scheduled to occur in spring and fall at three strategic locations within the Layton canal system: Site 2 west finger canal, site 6 undeveloped Zane Grey Creek, and site 7 Long Key Bight (map figure 1).

Four sampling periods have been tested since Spring 2022 (Appendix 1). Fall sampling was not done in 2023 or 2024. No sampling was done in 2025. Nutrients, heavy metals, and chlorophyll were consistently within acceptable ranges or below practical detection limits (l, U). Coliform counts were within acceptable limits (*E. coli* <410 mpn/100mL).

Monitoring the City of Layton canal system will continue in 2026 as outlined in protocols above.

Submitted by Cynthia Lewis, PhD
January 2026

Glossary of Terms

Salinity on Florida Keys Reef is typically 34-35ppt (parts per thousand)

pH on Florida Keys Reef is currently 7.9 pH - 8.2 pH; pH is measured on a logarithmic scale of 1.0 pH (acid) to 14.0 pH (base); 7.0 pH neutral. *Ocean acidification* causes calcium carbonate structures (e.g., coral skeleton, lobster & crab exoskeletons, mollusks, bivalves, etc.) to accrete (grow) more slowly and/or dissolve more quickly.

Coral bleaching refers to the snow-white or 'bleached' appearance of coral. This often occurs when seawater temperatures exceed the *coral bleaching threshold* (87.08°F or 30.60°C) causing the coral animal to lose its golden-brown photosynthetic algae living in its tissues. The partial or nearly complete loss of this symbiotic algae reveals the snow-white coral skeleton under the translucent coral tissue hence the term 'bleached'.

Maximum Mean Monthly Sea Surface Temperature (MMM-SST) is calculated to be 85.30°F/29.60°C for August in the Florida Keys. Coral experience heat stress and bleaching when water temperatures exceed the *maximum mean monthly sea surface temperature* (MMM-SST) by 1°C (or 1.8°F).

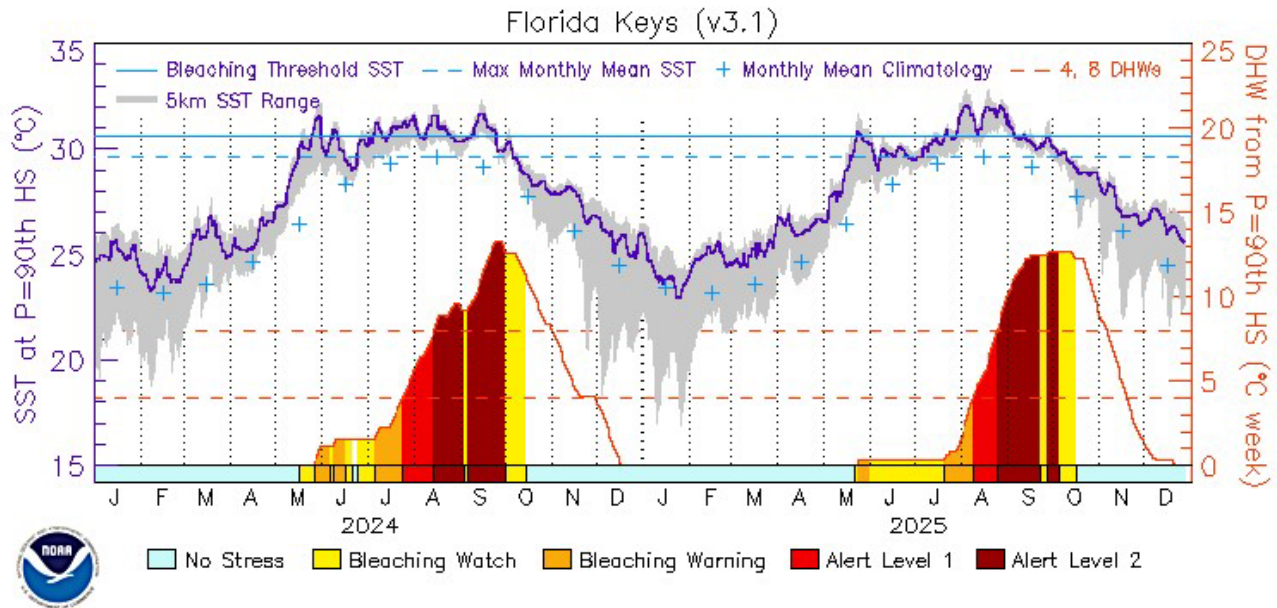
Thermal (heat) stress for coral begins to occur at 85.30°F/29.60°C in the Florida Keys (or the calculated MMM-SST for August)

The threshold for coral bleaching is 87.08°F/30.6°C in the Florida Keys. Coral experience heat stress and bleaching when water temperatures exceed the *maximum mean monthly sea surface temperature* (MMM-SST) by 1°C. Observations of coral bleaching is dependent on duration of time above this threshold.

Cold water stress: Most tropical reef-building corals do not tolerate temperatures below 65°F (18°C) for extended periods of time and temperatures below 60°F (15°C) can be lethal.

NOAA Sea Surface Temperatures (SST) and Coral Bleaching Forecast for the Florida Keys 2024 & 2025

NOAA Satellite Coral Bleaching Monitoring <https://coralreefwatch.noaa.gov/product/vs/map.php>.



Bleach Watch low level heat stress is present

Bleach Warning heat stress is accumulating, coral bleaching possible

Alert Level 1 degree heating weeks (DHW) above 4; risk of reef-wide coral bleaching

Alert Level 2 DHW above 8; risk of reef-wide coral bleaching with mortality

Alert Level 5 (new) DHW equal to or greater than 20; risk of near complete mortality (>80%)

2022 Florida Keys: max DHW 9

2023 Florida Keys: max DHW 23

2024 Florida Keys: max DHW 13

2025 Florida Keys: max DHW 12