City of Layton Water Monitoring Report
2024 Third Quarter (July-September)

Water quality is a critical concern for the Florida Keys and its surrounding unique marine ecosystems. It remains a high priority in the City of Layton to monitor and characterize water conditions within its canal system.

Canal water monitoring was performed dockside at site #2 western finger canal and site #5 main canal (Figure 1 map) using a YSI Professional Plus multiparameter instrument for water data (YSI Incorporated, Yellow Springs, Ohio, USA). Data was usually recorded daily by 9:00 am. At site #2 three canal aerators, purchased by the City of Layton, are 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 by 'the Pipes') were monitored weekly by 10:00 am to track fluctuations withing 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. 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).

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 main Layton canal, #6 undeveloped Zane Grey Creek, #7 Long Key Bight.

Daily monitoring:

Daily water quality was monitored at two canal-side sites (site 2 and site 5, Figure 1 monitoring sites) using a hand-held YSI Professional Plus multiparameter instrument. Morning air temperature and tide

level were recorded, along with water temperature, percent dissolved oxygen, salinity (parts per thousand) and pH. A summary of 2024 Third Quarter daily canal monitoring data at sites #2 and #5 can be found in Table 1A-C.

Table 1. Third Quarter Summary (Jul-Sep) of daily dockside canal water monitoring for 2024. Site #2 western finger canal. Site #5 main Layton canal (see figure 1 map of locations). Typical Florida Keys reef salinity: 34-35ppt; reef pH: 8.0-8.3. Coral bleaching threshold for the Florida Reef tract: 87.08°F/30.60°C.

A.

Jul	morning		Site #2				Site #5			
		air	water		salinity		water		salinity	
2024	tide	(F)	(F)	DO %	ppt	pH	(F)	DO %	ppt	pH
mean	11.5	82.7	88.26	30.20	42.18	7.57	88.29	26.47	42.24	7.59
max	12.1	85.0	90.68	40.00	43.95	7.73	90.50	43.10	44.66	7.80
min	10.8	76.0	85.28	17.80	40.38	7.34	85.46	14.90	40.42	7.47

B.

Aug	morning		Site #2				Site #5			
		air	water		salinity		water		salinity	
2024	tide	(F)	(F)	DO %	ppt	pH	(F)	DO %	ppt	pH
mean	11.4	81.1	87.34	28.90	39.80	7.53	87.00	24.74	39.65	7.51
max	12.3	84.0	90.50	42.90	43.37	7.66	90.50	35.40	42.94	7.65
min	10.6	77.0	82.76	15.80	35.89	7.34	78.08	11.90	30.07	7.37

C.

Sep	morning		Site #2				Site #5			
			water		salinity		water		salinity	
2024	tide	air (F)	(F)	DO %	ppt	pH	(F)	DO %	ppt	pH
mean	12.1	81.1	87.09	43.07	35.38	7.42	87.01	30.49	35.22	7.38
max	13.1	85.0	89.96	78.10	38.44	7.63	89.78	44.80	36.90	7.62
min	11.3	75.0	83.30	26.20	32.27	7.21	83.84	17.40	30.07	7.18

Table 2. Analysis of daily maximum air temperatures recorded at KML Weather Station for July-August 2024, with comparison to July-August 2023.

Max Daily Air Temps (F)	**2024**				**2023**		
	Jul	**Aug**	**Sep**		**Jul**	**Aug**	**Sep**
mean	89.8	89.5	89.9		91.4	91.4	89.0
max	91.0	92.0	92.0		93.0	94.0	91.0
min	89.0	85.0	88.0		88.0	89.0	85.0
days ≥90°	*20*	*11*	*16*		*27*	*28*	*15*

Rainfall monitoring

Daily rainfall data in Layton was acquired from the Keys Marine Laboratory (KML) Weather Station (Vantage Vue Pro weather station, Davis Instruments). Monthly total rainfall and third quarter (Jul-Sep) total rainfall is presented in Table 3. Rainfall data is also compared here with data from 2021-2023 with calculated mean (average) rainfall for each month and for Q-3. Using historic rainfall data in Layton since 2020, the four-year mean was calculated for each month and for the total Third Quarter rainfall.

Table 3. Monthly inches of rainfall in Layton during 2024 Third Quarter, with comparison to 2021, 2022, and 2023. No data reported for Jul & Aug 2020.

Q-3 Rainfall inches	**Jul**	**Aug**	**Sep**	**Q-3 mean**	**Q-3 total**
2024	1.24	9.61	9.21	6.69	20.06
2023	3.85	2.42	6.75	4.34	13.02
2022	3.81	3.17	11.52	6.17	18.50
2021	3.90	2.90	5.40	4.07	12.20
2020			13.70		
Mean Rainfall	3.85	2.83	7.89	*5.32*	*15.95*

Continuous dockside water temperature

An underwater pendant-style data logger (Onset HOBO Inc., Bourne, MA, United States) remained submerged dockside at site #2 (Figure 1. Layton canal map) and was set to continually record canal water temperature every 30 minutes. The data logger was downloaded monthly, and a temperature profile was created for 2024 Third Quarter (Jul-Sep; Figure 2).

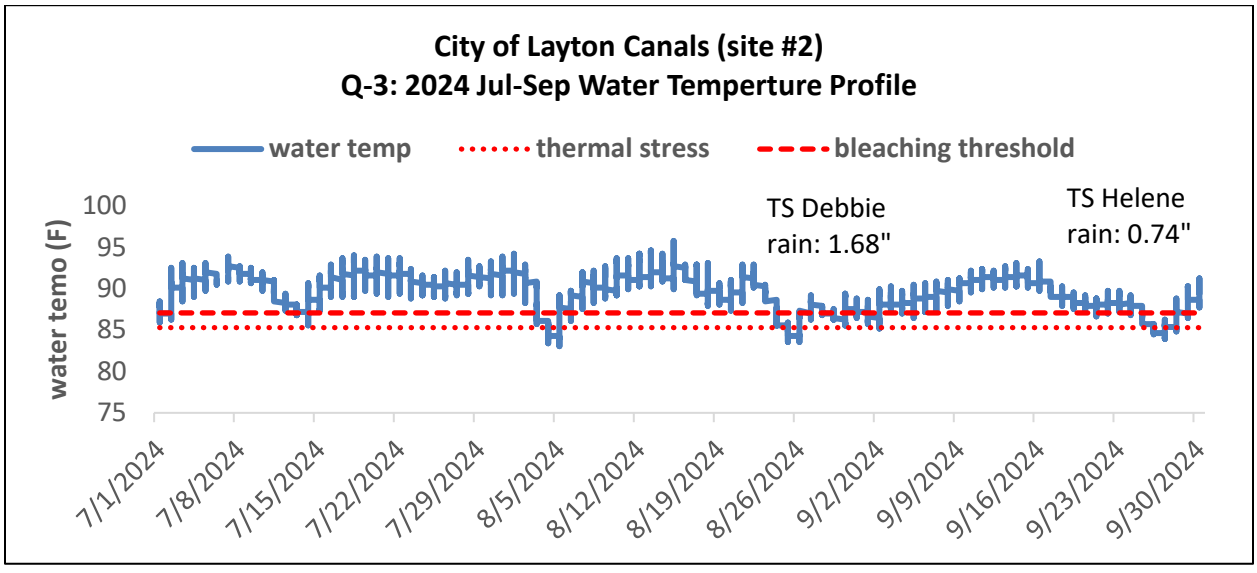

Figure 2. 2024 Third Quarter City of Layton Canal water temperature profile, recorded every 30 minutes at Site #2 western finger canal. Dotted red line represents the 'thermal stress for coral' (85.3°F/29.6°C),

1°C above maximum mean monthly sea surface temperature. Dashed red line represents the 'coral bleaching threshold' for the Florida's Coral Reef (87.08°F/30.60°C).

Many marine organisms found in the canal system are adapted to seasonal fluctuations in water conditions. Cold water stress is a concern when water temperatures reach 65°F (18°C) for extended periods of time and temperatures below 60°F (15°C) can be lethal. Coral experience heat stress when water temperatures exceed the *maximum mean monthly sea surface temperature* (MMM SST) by 1°C. August is typically our warmest month and MMM SST for August on Florida's Coral Reef is calculated as 29.6°C/85.3°F, therefore the established threshold for coral bleaching conditions on Florida's Coral Reef is 30.6°C/87.08°F. Observations of coral bleaching is dependent on duration of time above this threshold.

A glossary of terms can be found at the end of this report. More information can be found at the NOAA Satellite Coral Bleaching Monitoring https://coralreefwatch.noaa.gov/product/vs/map.php.

Table 4. 2024 Third Quarter summary of continual data logger canal water temperatures recorded at Site #2 dockside (3A) with comparison to continual data logger data from 2023 Q-3 (4B).

4A

Q-3 2024	Jul-24		Aug-24		Sep-24	
	°F	°C	°F	°C	°F	°C
Mean	90.30	32.39	89.06	31.70	88.68	31.49
Maximum	94.06	34.48	95.78	35.44	93.30	34.06
Minimum	85.55	29.75	83.04	28.36	83.94	28.85
Median	90.50	32.50	89.38	31.88	88.65	31.47
thermal stress	85.30	29.60				
bleach threshold	87.08	30.60				

4B

Q-3 2023	Jul-23		Aug-23		Sep-23	
	°F	°C	°F	°C	°F	°C
Mean	91.60	33.11	90.01	32.23	88.51	31.39
Maximum	95.59	35.33	96.56	35.86	93.30	34.06
Minimum	84.12	28.95	82.69	28.16	84.30	29.05
Median	92.17	33.43	90.31	32.39	88.28	31.27

Comparisons of other Layton Canal System monitoring sites:

Five additional sites within the Layton Canal System (1: mouth of Long Key Lake, 3: City Hall dock, 4: Causeway by 'the Pipes', 6: natural Zane Grey Creek, 7: Long Key Bight) were monitored with the hand-held YSI unit weekly to track fluctuations withing the Layton Canal System (Tables 4-7; see fig. 1 for map of site locations). 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 consistently more similar to normal seasonal reef values than at sites within the Layton canal system

(table 6 & 7). Salinity within the canal system is influenced by rainfall, becoming more saline during periods with low rainfall but slowly returning to more normal ocean salinity (35-36 ppt). 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 5. Summary of Layton Canals weekly water temperatures (°C) at five sites for 2024 Jul-Sep. Florida Reef Tract coral bleaching threshold is 30.6°C. Coral thermal stress is 29.6°C, 1°C above *maximum mean monthly sea surface temperature*.

2024 Temp C	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	30.02	31.23	30.83	30.70	30.70
max	31.60	32.40	31.60	32.20	31.80
min	29.10	29.80	29.10	29.90	30.20

Table 5. Summary of Layton Canals weekly dissolved oxygen (% DO) at five sites 2024 Jul-Sep. DO is typically lowest in the early morning before photosynthetic activity enhances DO but can also be influenced by rising or falling tides and water temperatures.

2024 DO %	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	26.08	30.79	35.96	30.24	49.96
max	32.00	48.60	53.20	53.10	77.90
min	18.27	16.80	23.10	16.70	30.20

Table 6. Summary of Layton Canals weekly salinity (parts per thousand, ppt) at five sites for 2024 Jul-Sep. Typical Florida Keys reef salinity is 34-35ppt.

2024 salinity ppt	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
Mean	40.05	39.58	39.63	39.69	39.72
Max	43.63	43.55	43.16	44.21	43.30
Min	35.76	35.75	36.20	32.29	35.76

Table 7. Summary of Layton Canals weekly pH readings at five sites for 2024 Jul-Sep. Typical Florida Keys reef pH is 7.9 to 8.2 and most similar to natural fluctuations in Long Key Bight.

2024 pH	Site 1 LK Lake	Site 3 City Hall	Site 4 Causeway	Site 6 ZG Creek	Site 7 LK Bight
mean	7.62	7.49	7.59	7.58	7.68
max	7.82	7.67	7.79	7.78	7.87
min	7.39	7.33	7.39	7.41	7.27

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.). Water samples were not collected during this quarter.

Submitted by Cynthia Lewis, PhD
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Glossary of terms

Salinity on Florida's Coral Reef is typically 34-35ppt (parts per thousand)

pH on Florida's Coral 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 or 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)

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.

Current Sea Surface Temperatures (SST) and Coral Bleaching Forecast for the Florida Keys 28 Dec 2024

NOAA Satellite Coral Bleaching Monitoring
https://coralreefwatch.noaa.gov/product/vs/timeseries/florida.php#florida_keys

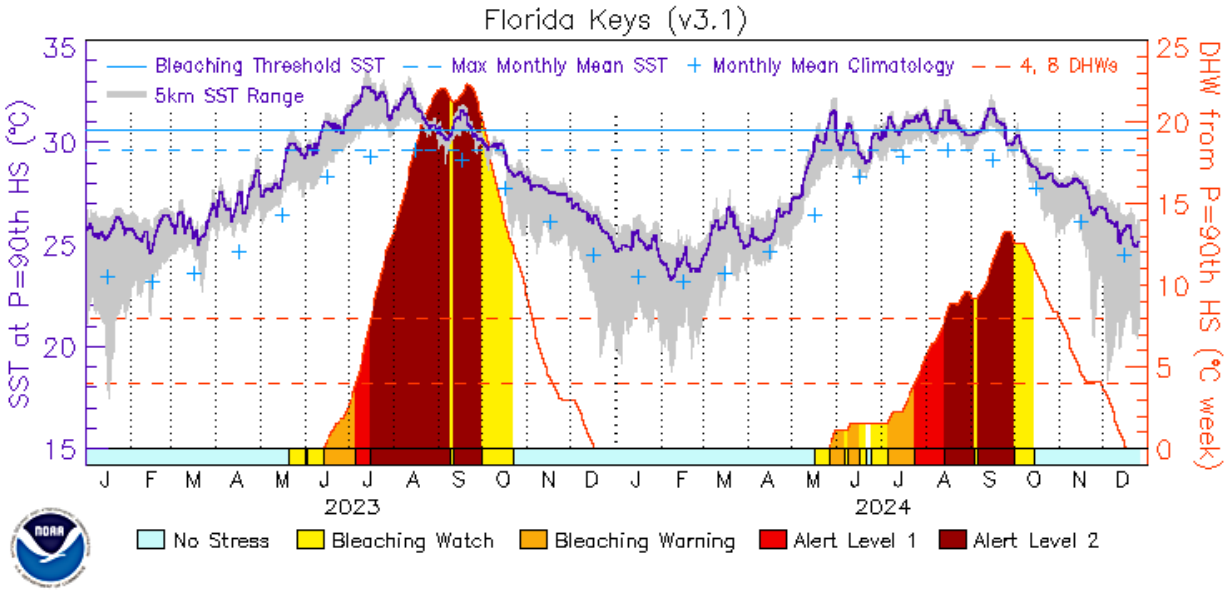

Figure 7. NOAA 2023 & 2024 Sea Surface Temperatures and coral bleaching forecasts for the Florida Keys as of 28 Dec 2024. The Keys were downgraded to 'no heat stress' in October 2024.