

City of Sanibel Clean Canals Program

Year Five Monitoring Report

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Submitted by:

Mark Thompson, M.S., Research Associate

Eric Milbrandt, Ph.D., Director

900A Tarpon Bay Rd, Sanibel, FL 33957



SCCF
SANIBEL-CAPTIVA
CONSERVATION FOUNDATION

Description of the Project

Prior to the incorporation of the City of Sanibel, canals were dug to provide water access and fill for residential developments. These man-made canals on Sanibel Island often experience dense algae blooms, low oxygen concentrations and fish kills. The low flow and minimal flushing in canals increases water residence times and can promote the formation of phytoplankton blooms. Recent algae blooms in southwest Florida are a health concern as well as an aesthetic problem for residential areas located on canals. Factors such as rainfall, tides, stormwater and irrigation runoff, Sanibel Slough discharges and freshwater releases from the Caloosahatchee River system can be factors producing poor water quality within these canals. Groundwater quality and flow may also affect the conditions found in canals. A more thorough knowledge of the spatial and temporal variability in canal water quality can benefit management decisions aimed at improving water quality.

The Sanibel Communities for Clean Water initiative was created to provide water quality data and recommendations to homeowners surrounding ponds and lakes on the island's interior. That program has now been extended to include homeowners located on canals. This report summarizes the results of wet and dry season sampling at 11 sites (Figure 1a and 1b) within Sanibel's canal systems for the 2025 calendar year with reference to previous results analyzed in 2019, 2021 and 2023. This year's effort was scaled back from 36 canal sites due to being combined with the Sanibel community lakes monitoring effort. Resources originally planned to be allocated to this project are also being used to sample and evaluate a subset of Sanibel lakes. These projects will provide information related to recovery from impacts of hurricanes Ian (2022), Helene (2024) and Milton (2024) on local waterbodies.

The data obtained from sampling Sanibel Canals is entered into the Florida DEP WIN database which is used to evaluate waterbodies for impairment. The two waterbody segments in which the canals reside (2065H1-San Carlos Bay and 2092G-Sanibel Bayous, Figure 2) were listed as impaired due to exceedance of nitrogen criteria for the first time in 2020 after the data collected during this project was evaluated by Florida DEP. The State will now plan to develop a framework for improving water quality in these waterbodies by establishing a Total Maximum Daily Load (TMDL) quantity for nitrogen in each of these segments. The data collected by this project will continue to be shared with DEP to better track any changes in water quality conditions over time.

Methods

Surface water samples were taken at 11 individual sites chosen by the City of Sanibel Department of Natural Resources staff (Table 1, Figure 1a and 1b). Samples were collected from each site once during wet season and once during dry season. Dry season samples were collected in April 2025. Wet season sampling was done in August 2025, during the annual fertilizer ban period. Samples were analyzed by Benchmark Laboratories for orthophosphate (OP), total

phosphate (TP), nitrate-nitrite (NO_x), ammonia (NH₃), and total nitrogen (TN). A calibrated YSI data sonde was deployed at each site to measure DO, turbidity, CDOM, chlorophyll *a*, pH, salinity, and temperature in the field. Results were entered into the SCCF Water Quality Database and will be uploaded into the DEP central water quality data storage system (WIN) to allow evaluation under the impaired waters rule.

Data was plotted and mapped, and inferences were made between sample years, sites, and areas of Sanibel. The 11 sampling sites were ranked from most impaired to least impaired in terms of water quality based upon results of chlorophyll *a*, total phosphorus, inorganic nitrogen, and turbidity. The values for each parameter were ranked from 1 to 11 with 1 being the most impaired water quality and 11 having the least impaired water quality. After ranking for each parameter, the ranked values were added, and the sum of ranks was then ordered for overall site rank (lowest sum rank = most impaired water quality rank). This exercise allows an overall comparison between sites on Sanibel but doesn't give context to each site's fundamental water quality. To remedy this, a grade was also given to each site based upon mean water quality parameter values for each site. The mean TN, TP, and chlorophyll *a* values at each site were compared to state criteria and percentile distribution of values from throughout the state (Hand FLDEP, 2008) to come up with a score for each of these three parameters based upon values in Table 2. A score of 4 is the least impaired water quality while a score of 0 is the most impaired. At each site, scores for TN, TP and Chl_a were added up and then divided by 3 to come up with an average overall water quality score. A grade was then assigned to the site based upon the score: 4 = A, 3 = B, 2 = C, 1 = D, 0 = F. The grade reflects the site's overall success in meeting water quality criteria for all three parameters.

The results of all water quality monitoring are provided in an excel workbook containing raw data, and comparison analyses. This spreadsheet can be the source of data for the Communities for Clean Water interactive website.

Results

Of the 11 sites sampled in 2025, 10 sites (90%) had mean chlorophyll *a* concentrations above the Florida DEP criteria for Pine Island Sound of 6.5 ug/l, 11 sites (100%) had mean TN concentrations greater than the 0.57 mg/l criteria and 3 (27%) had mean phosphorus concentrations greater than the 0.06 mg/l criteria (Table 2, Figures 3,4,5). The ranges and mean values for dissolved oxygen, turbidity, water temperature, salinity and ammonia are shown in Figures 6 through 10 and Table 2.

Dissolved oxygen concentration in a waterbody follows a diurnal cycle with greatest oxygen concentrations usually occurring late during the sunniest part of the day while lowest concentrations occur early in the morning. Our sampling effort provides only a snapshot of one point in this daily cycle at any sampling location. This reality should be considered when considering any evaluation of DO data which occurs at one time during the day. A statistical

comparison of mean DO (mg/l) between sites found significantly lower DO (Kruskal Wallis, $p < 0.01$) at site SCC05 which is the furthest site upstream at a dead end in the eastern canal system (Figure 6 and Table 2). This would be a poorly flushed area, and lower DO would be expected there. No other significant differences in DO were found. A weak but significant increasing trend in dissolved oxygen was found over all 11 sites from 2019 through this most recent monitoring year (Spearman's, $p = 0.03$, $c = 0.214$).

No significant difference (Spearman's, $p = 0.065$, $c = 0.204$) could be found in turbidity between sites in 2025 (Figure 7, Table 2) and no significant trend in the pooled data from these 11 sites from 2019 through 2025. Similarly, no significant difference between sites in 2025 and no trend could be found in salinity since 2019. Mean salinity within the canals fell between the mean salinity of the Gulf of Mexico and that of the lower Caloosahatchee River at shell point (Figure 9).

Statistical comparison of inorganic nitrogen between sites found no detectable differences, although site 31 off Dinkin's Bayou had a higher mean IN than the other sites (Figure 10). A significant increasing trend was found for IN between 2019 and the 2025 sampling period for the 11 sites pooled together.

Water quality grades for each site are shown in Table 2 and in Figures 11a and 11b. In general water quality grades in 2025 for these 11 sites were about the same as their grades for 2023. As in 2023, the least impaired water quality sites were located nearest to the mouth of a canal system where they received the best tidal flushing. Similarly, the most impaired water quality sites were located farthest from the mouth of canal systems in the more interior sections of canals (Figure 11).

Conclusions

Based upon comparison to Florida DEP water quality criteria, most of Sanibel's canals have serious water quality issues and may not support a natural, diverse flora and fauna. Total nitrogen concentrations exceed water quality criteria at all sites monitored in 2025, 2023 and 2021 and all but 1 site in 2019. The main source of nitrogen from Sanibel has been previously determined to be natural land; however, fertilizer and reclaimed water used for landscape irrigation are also major contributors (Thompson et al, 2018). The stormwater runoff loading is a combination of local sources and regional freshwater discharges from the Caloosahatchee River watershed (USGS 2015).

The Florida DEP has determined that the waters of Pine Island Sound, San Carlos Bay and the Bayous of eastern Sanibel are all "impaired" due to exceedance of nitrogen criteria. These impaired waterbodies include all the canals which were sampled during this study. The data from the 2019, 2021 and 2023 sampling events were entered into the Florida WIN database and used during impaired waters evaluations by DEP. The data from the 2025 sampling events

will also be entered into the WIN database by SCCF marine laboratory for use in evaluating these waterbodies in the future.

The poorest water quality was found in sections of canals farthest away from the mouth of the canal systems. Poor flushing (water exchange) and circulation is known to be associated with higher chlorophyll *a* and nutrient concentrations, and these results support that association. Water quality “grades” were poor overall but water quality at the monitored sites did not seem to change drastically after hurricane Ian, Helene or Milton.

In general, Sanibel’s canals are typical of estuarine canals throughout Florida. Water quality conditions are greatly influenced by the amount of flushing a canal receives and land use in the watershed, On Sanibel, the proximity to golf course runoff and groundwater flow have been shown to have significant impacts on water quality as well as regional freshwater flows from the Caloosahatchee watersheds.

Attachment: Excel spreadsheet: Sanibel_Clean_Canals_2025

Table 1. Sites monitored for this study in 2025.

Station	Description	Approximate Address	Region	Latitude	Longitude
SCC02	East End Sanibel Canal	Midway down sextant drive at boatramp entrance	East	26.451618	-82.033434
SCC05	East End Canal under bike path bridge	Beside 425 East Gulf Drive at curve - bike path bridge	East	26.448592	-82.025105
SCC09	East End Canal south side of Periwinkle	Behind tennis court Mackenzie Island	East	26.446391	-82.028791
SCC10	East End Canal south side of Periwinkle	Behind 1057 Yachtsman Dr.	East	26.447613	-82.031009
SCC11	East End Canal south side of Periwinkle	740 Windlass off Anchor Dr.	East	26.447952	-82.033444
SCC20	East End Canal south side of Periwinkle	Behind 812 Sand Dollar Dr off Lundgren	East	26.442111	-82.036950
SCC21	East End Canal south side of Periwinkle	Behind 890 Beach Rd.	East	26.443023	-82.039200
SCC22	Northern Canal off Bay Drive	Behind 1246 Bay Drive	D North	26.460229	-82.046119
SCC27	Northern Canal off Dixie Beach Rd	Behind 1689 Sabal Palm off Royal Poinciana	D North	26.462456	-82.055476
SCC31	Canal off Dinkins Bayou west end	Behind house 5830 San Cap Rd	Bayous	26.474490	-82.168722
SCC35	Canal off Dinkins Bayou west end	Open Lot on East Side (2469) Coconut Drive	Bayous	26.480705	-82.178596

Table 2. Summary of water quality conditions in 11 canal sites tested during this project year. Sites are listed from worst (rank1) to best water quality (rank11). A water quality grade is also shown to better characterize the overall water quality of each site regardless of its rank among Sanibel canals. Poor water quality dominates the project area.

Site	2025 Grade	2023 Grade	2021 Grade	2019 Grade	TP Grade	Chla Grade	TN Grade	Overall Grade Score	Mean TP mg/l	Mean Chla ug/l	Mean TN mg/l	Mean Turb NTU	Mean IN mg/l	IN Rank	TP Rank	Chla Rank	Turb Rank	Sum Rank	2025 Rank	2023 Rank
SCC35	D-	D-	D+	D-	1	0	1	0.67	0.077	17.4	1.130	10.8	0.147	2	2	3	6	13	1	1
SCC31	D+	D-	D+	D-	4	0	0	1.33	0.036	14.0	1.442	23.3	0.285	1	6	5	2	14	2	3
SCC10	D+	C-	C-	B	4	0	0	1.33	0.084	20.2	1.782	6.2	0.124	3	1	1	9	14	2	9
SCC21	D	D-	F+	C-	3	0	0	1.00	0.051	17.8	1.383	18.8	0.082	8	4	2	3	17	4	2
SCC11	D	D+	C-	C-	2	0	1	1.00	0.033	17.3	0.922	13.1	0.117	4	7	4	5	20	5	6
SCC05	D-	D-	D+	D-	1	0	1	0.67	0.065	13.0	0.855	15.0	0.072	10	3	6	4	23	6	3
SCC09	D	D+	D+	C-	2	0	1	1.00	0.038	12.5	0.658	5.2	0.088	7	5	7	10	29	7	5
SCC02	C-	B	B-	B	3	1	1	1.67	0.025	9.7	1.260	8.1	0.102	6	9	9	8	32	8	11
SCC22	C+	C+	C+	C+	4	3	0	2.33	0.019	4.4	1.414	50.0	0.066	11	10	11	1	33	9	10
SCC27	C+	C-	C+	B-	4	2	1	2.33	0.015	7.0	0.739	10.5	0.107	5	11	10	7	33	9	8
SCC20	D+	D+	D-	C-	3	1	0	1.33	0.030	10.6	1.281	3.9	0.081	9	8	8	11	36	11	6

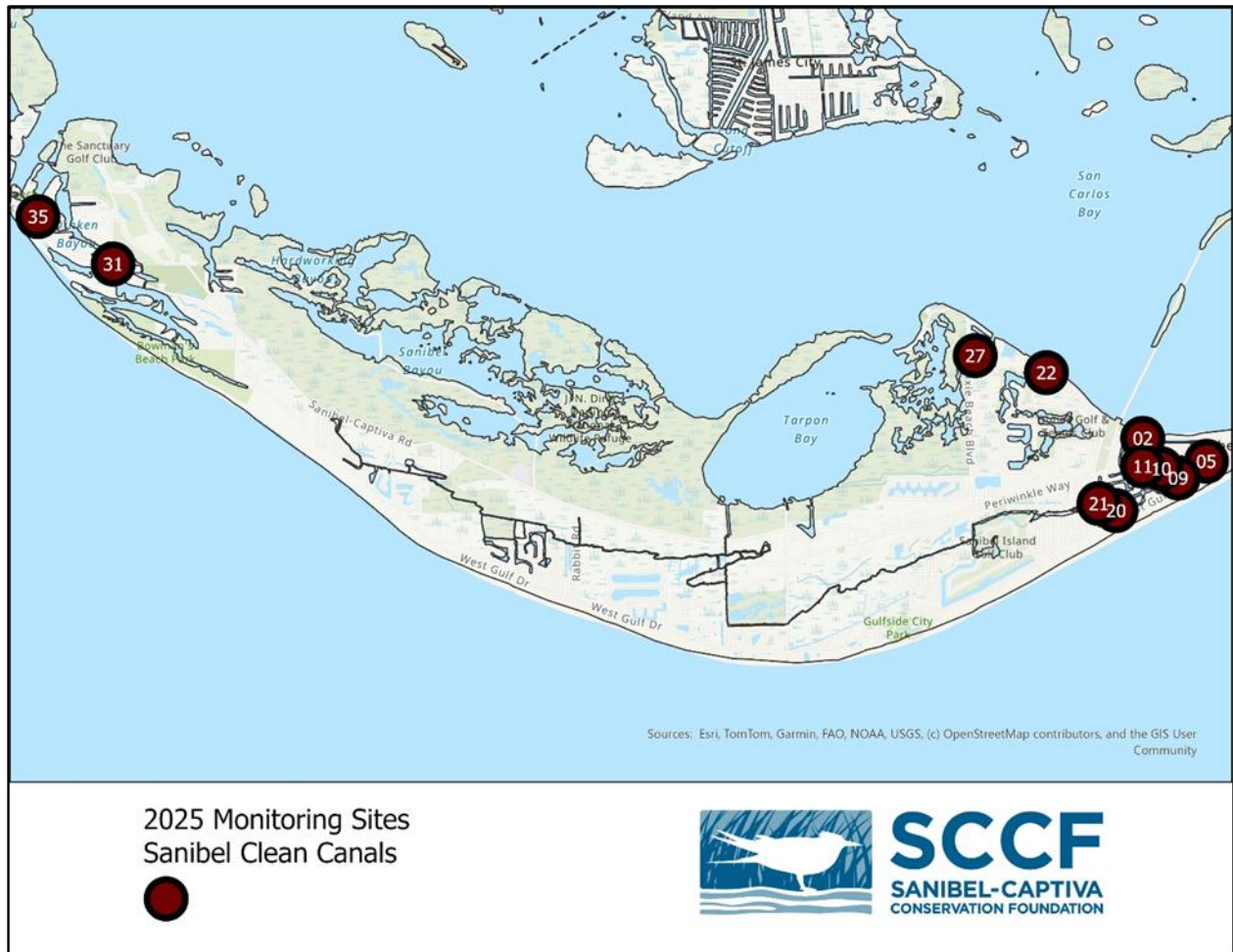


Figure 1a. Location of the 11 sampling sites for collection of water quality data from Sanibel’s canals in 2025.

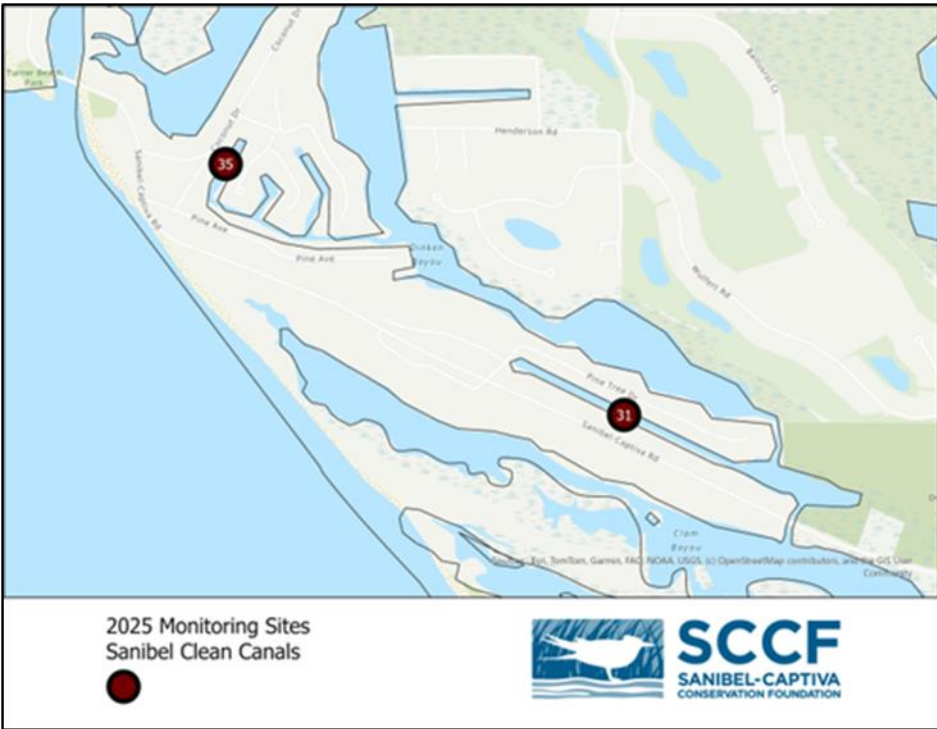
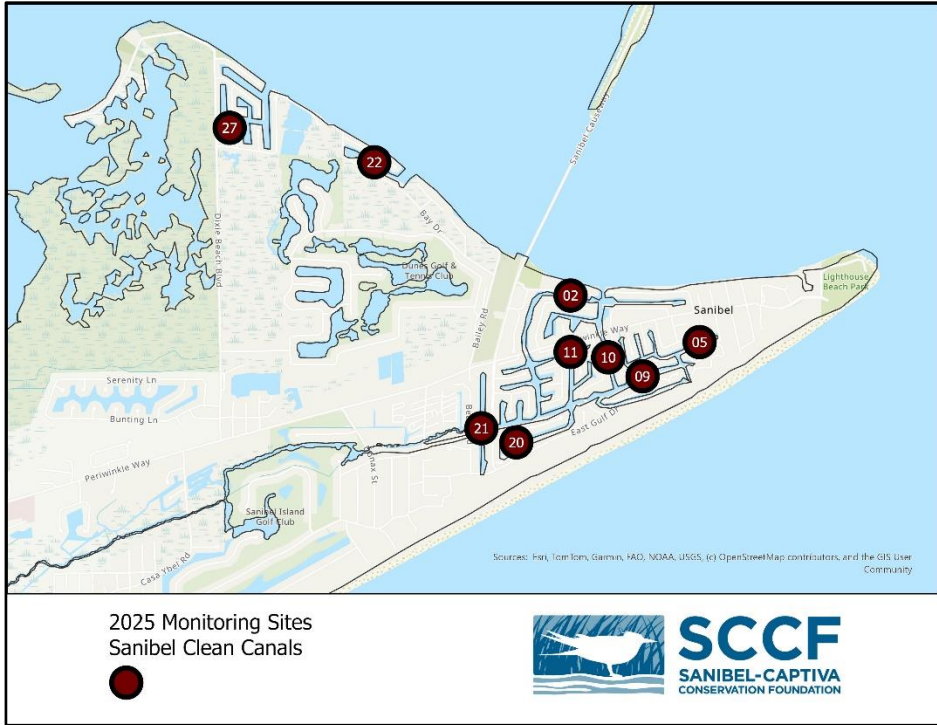


Figure 1b. Location of sampling sites for collection of water quality data from Sanibel’s canals separated into eastern (top) and western sites.

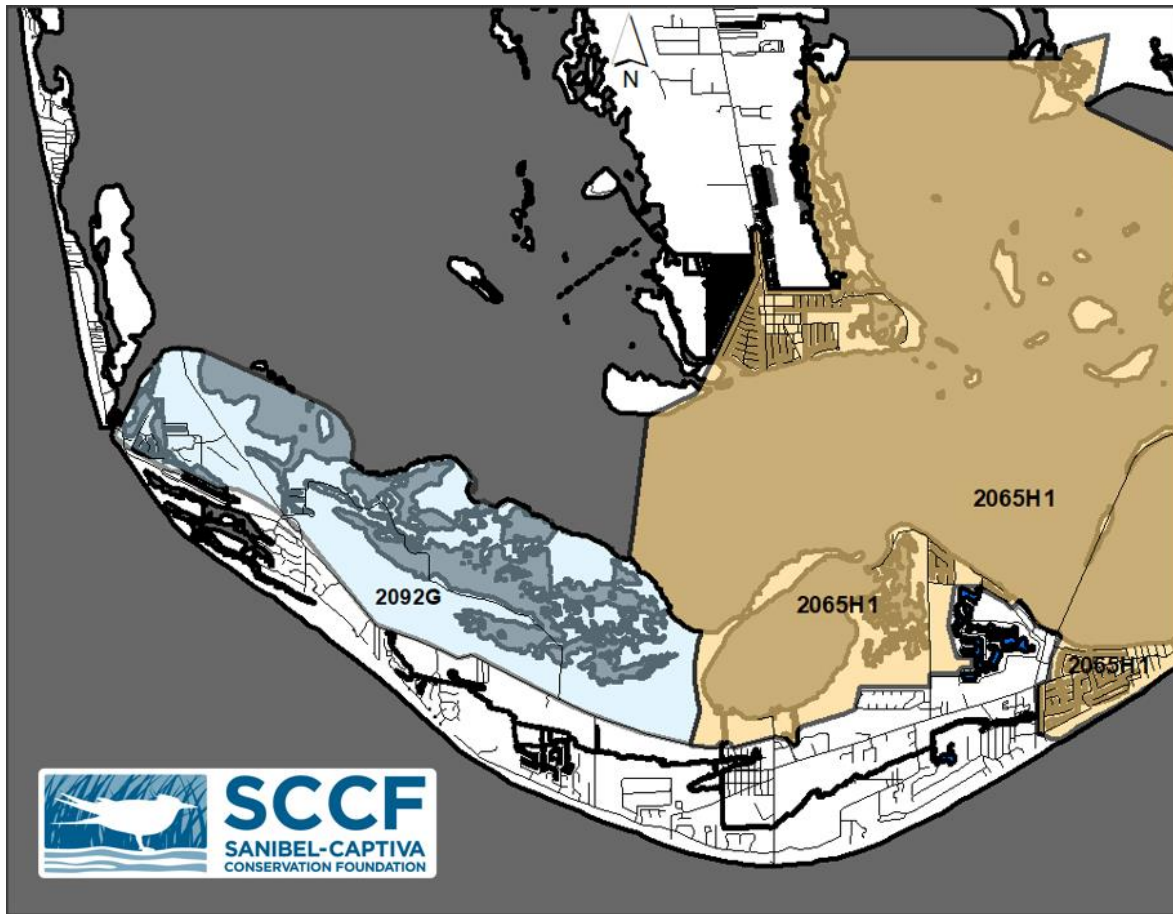


Figure 2. The Florida DEP waterbody identification numbers (WBIDs) for the canals on Sanibel. Sanibel canals fall within two WBIDs as shown on map.

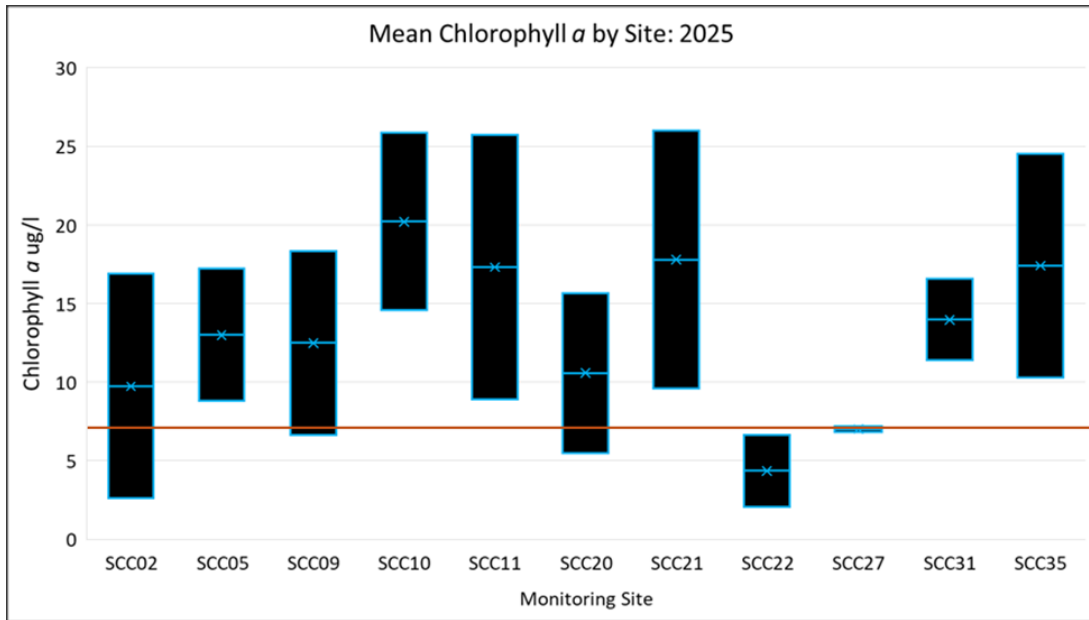


Figure 3. Boxplot showing range and mean (midline) values of chlorophyll *a* ug/l concentrations for the 11 sites sampled during this project. The red line indicates the value of Pine Island Sound water quality criteria for this parameter.

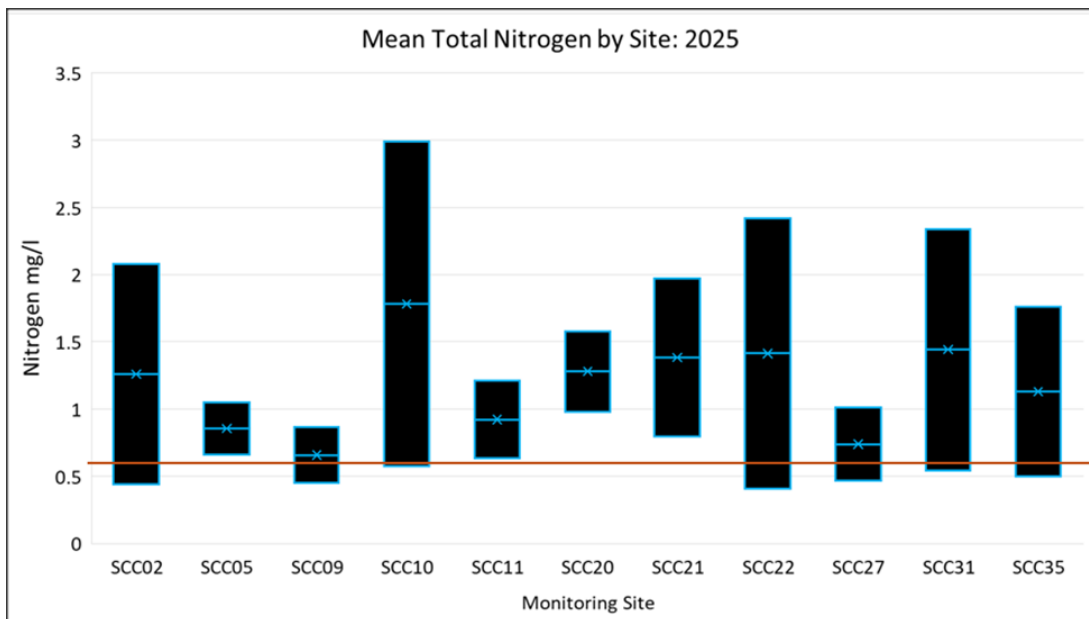


Figure 4. Boxplot showing range and mean (midline) values of total nitrogen (mg/l) concentrations for the 11 sites sampled during this project. The red line indicates the value of Pine Island Sound water quality criteria for this parameter.

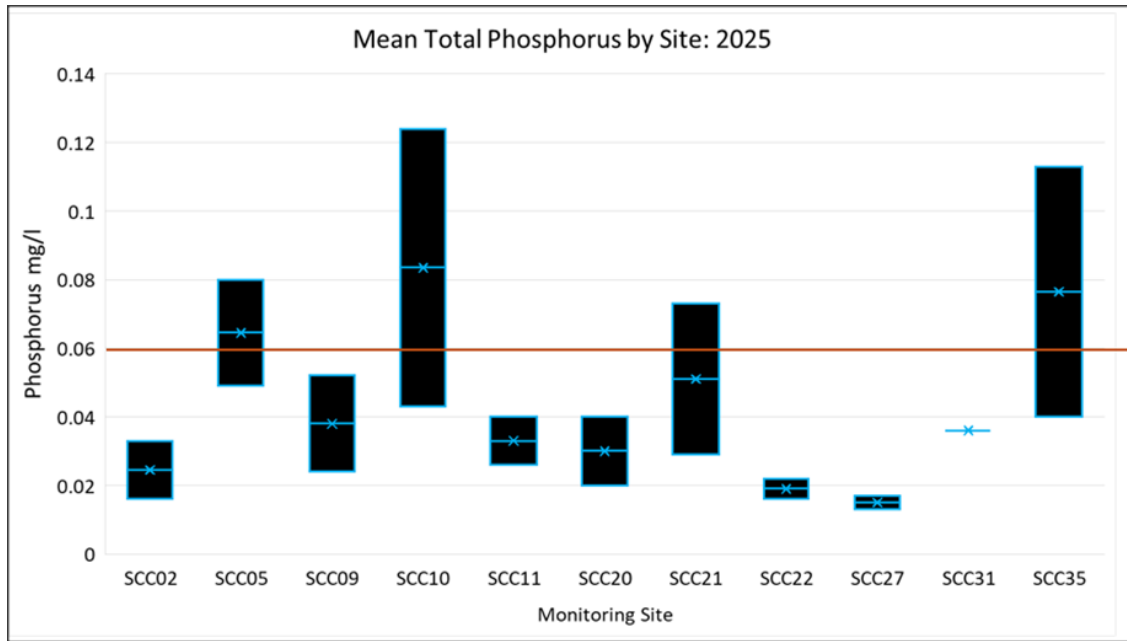


Figure 5. Boxplot showing range and mean (midline) values of total phosphorus (mg/l) concentrations for the 11 sites sampled during this project. The red line indicates the value of Pine Island Sound water quality criteria for this parameter.

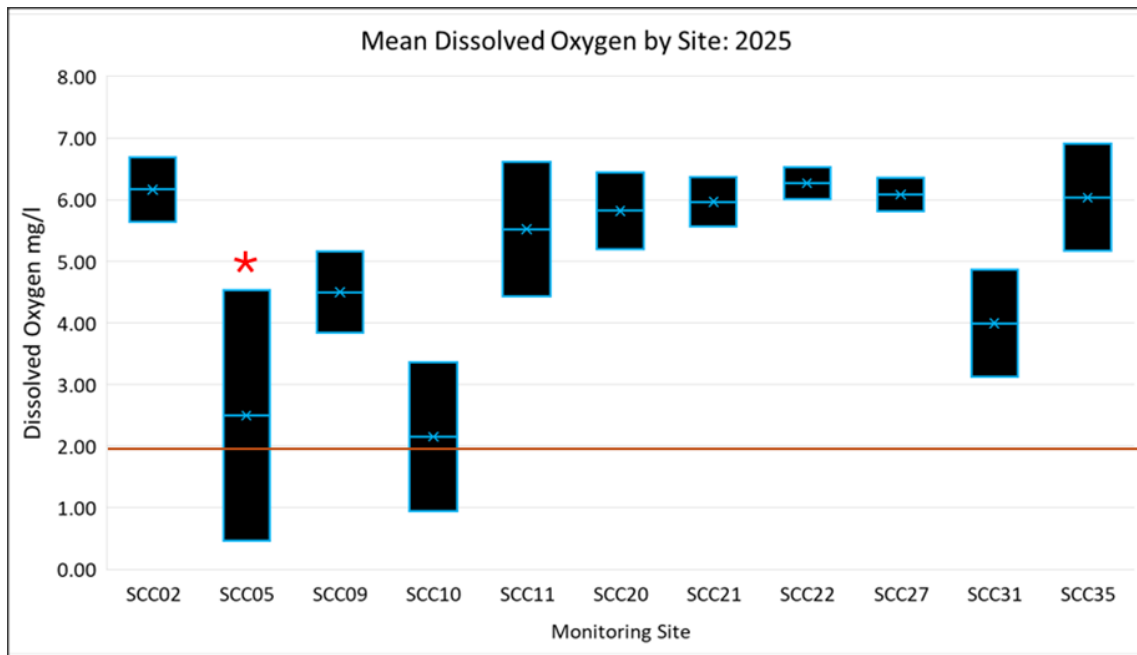


Figure 6. Boxplot showing range and mean (midline) values of dissolved oxygen (mg/l) concentrations for the 11 sites sampled during this project. The red line indicates level at which anoxic conditions prevail. DO at site SCC05 was significantly lower than the other sites.

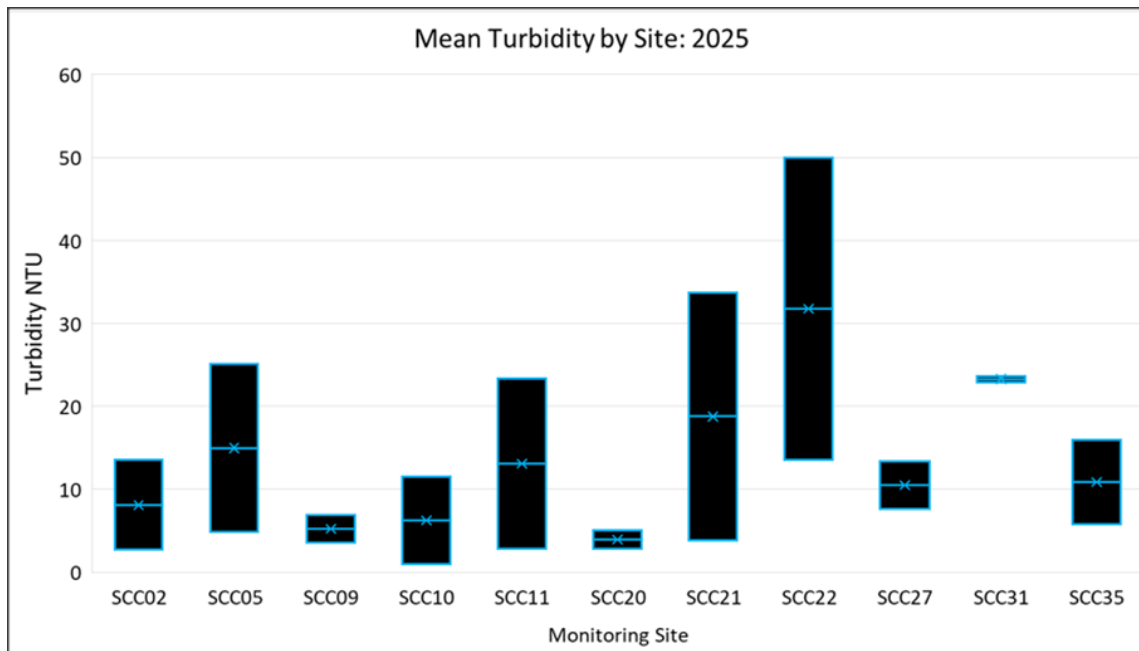


Figure 7. Boxplot showing range and mean (midline) values of turbidity (NTU) concentrations for the 11 sites sampled during this project.

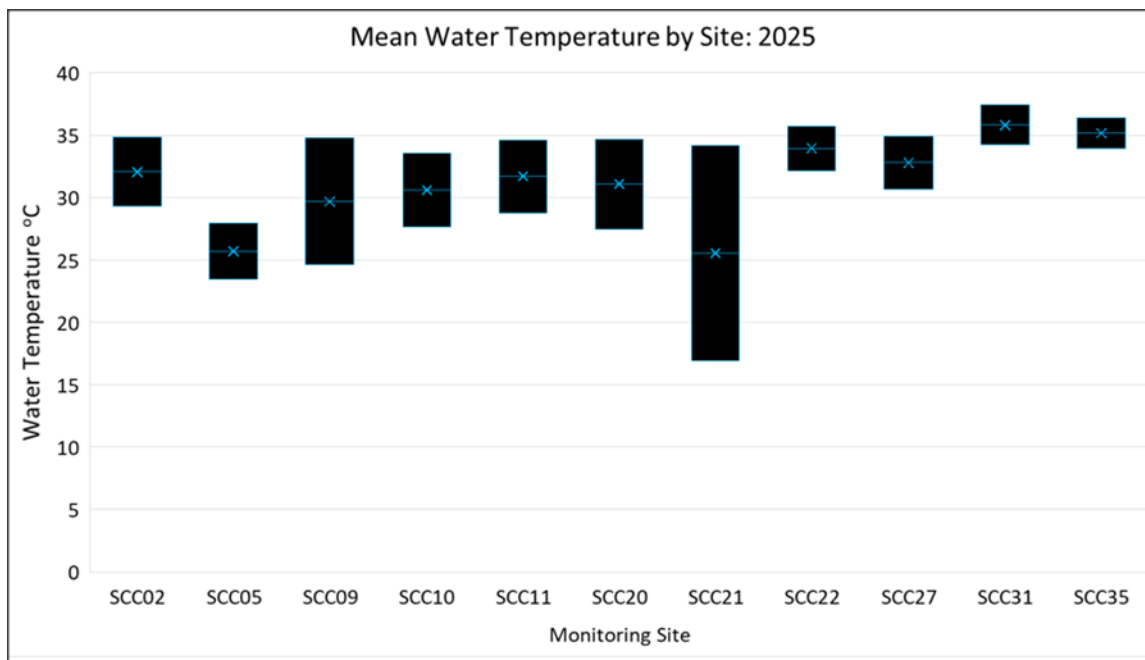


Figure 8. Boxplot showing range and mean (midline) values of water temperature (C) concentrations for the 11 sites sampled during this project.

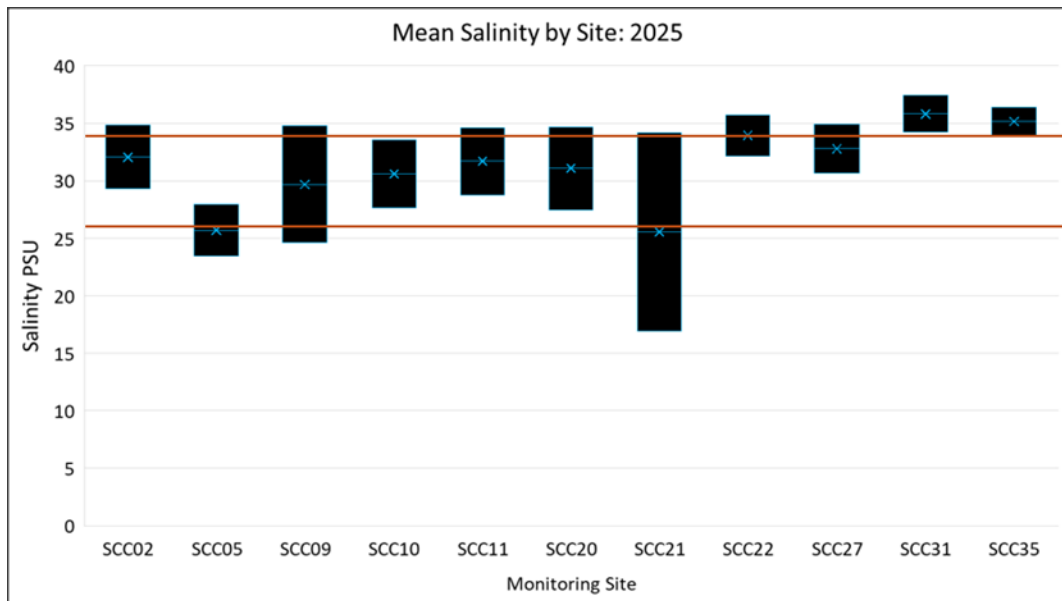


Figure 9. Boxplot showing range and mean (midline) values of salinity (PSU) concentrations for the 11 sites sampled during this project. The lower red line is the mean salinity at Shell Point on the Caloosahatchee, while the upper line is the mean salinity in the Gulf of Mexico near Fort Myers Beach.

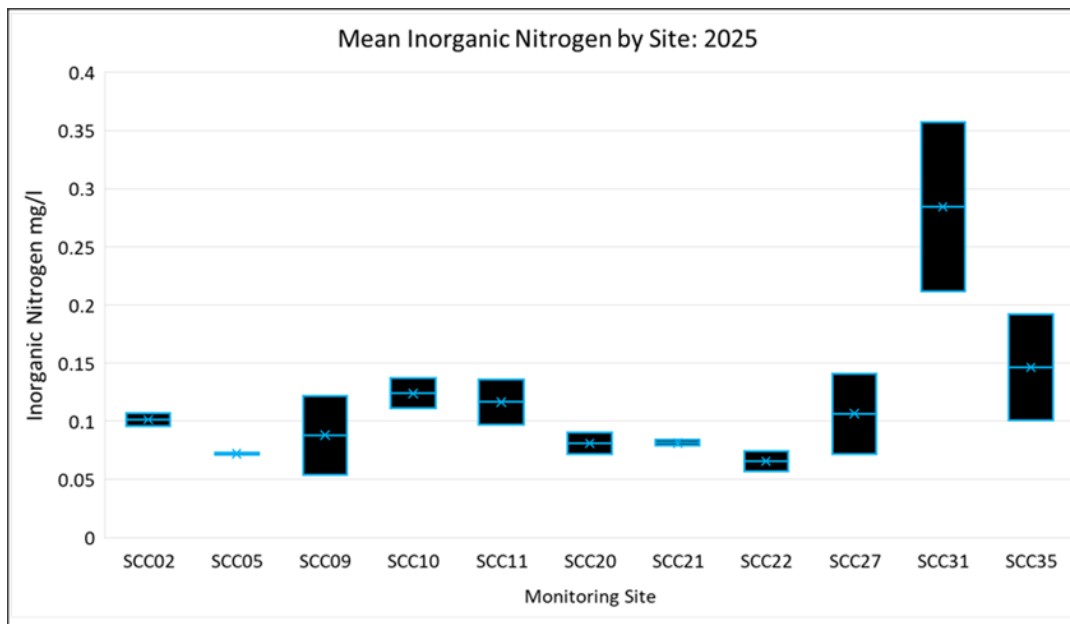


Figure 10. Boxplot showing range and mean (midline) values of inorganic nitrogen (mg/l) concentrations for the 11 sites sampled during this project.

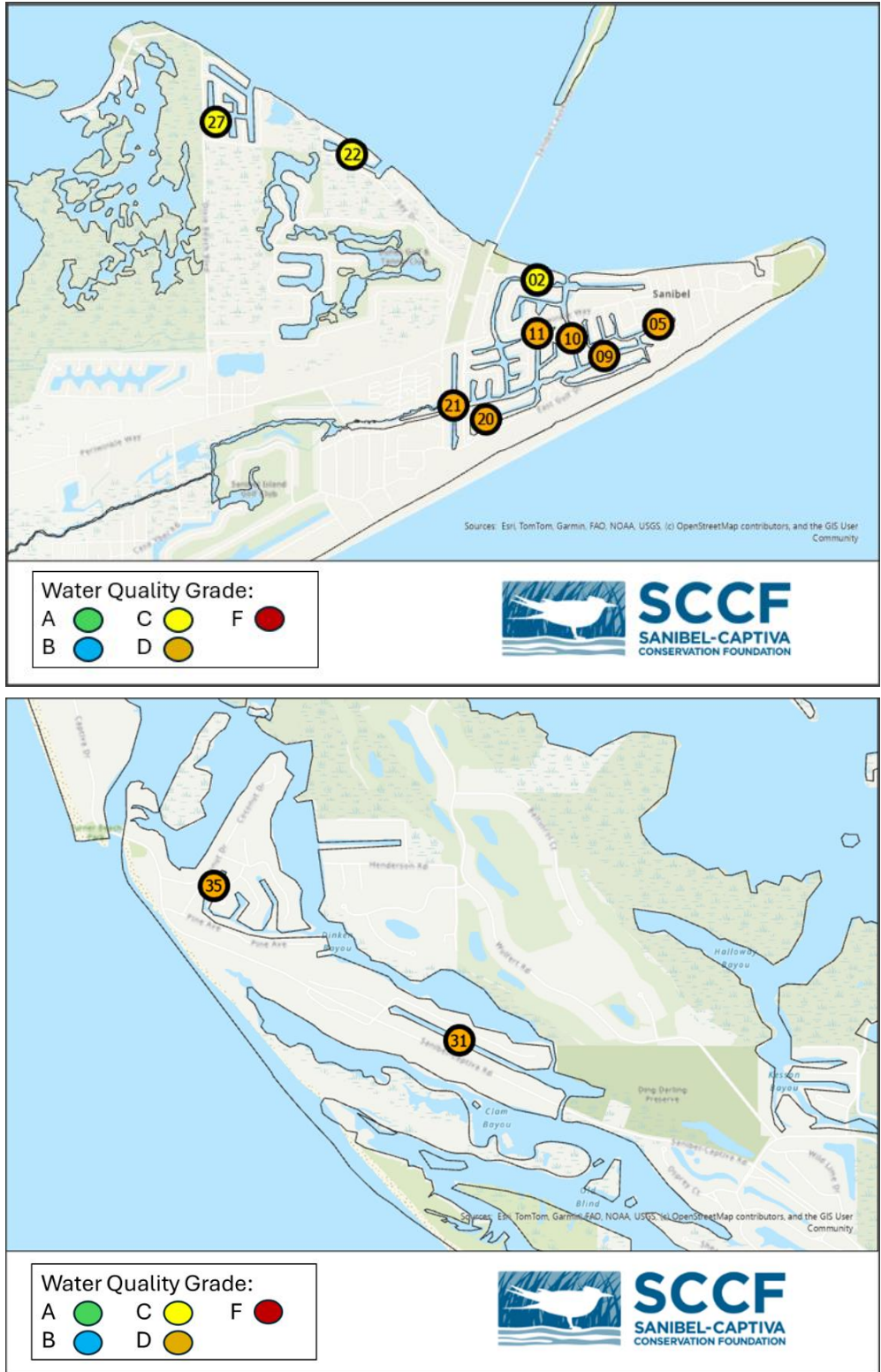


Figure 11a. Water quality grades for each site during this study period (top) and for the 2021 study period (bottom). For both study periods, better water quality occurred at sites nearest the mouth of each canal system while the most interior sites had the worst water quality.

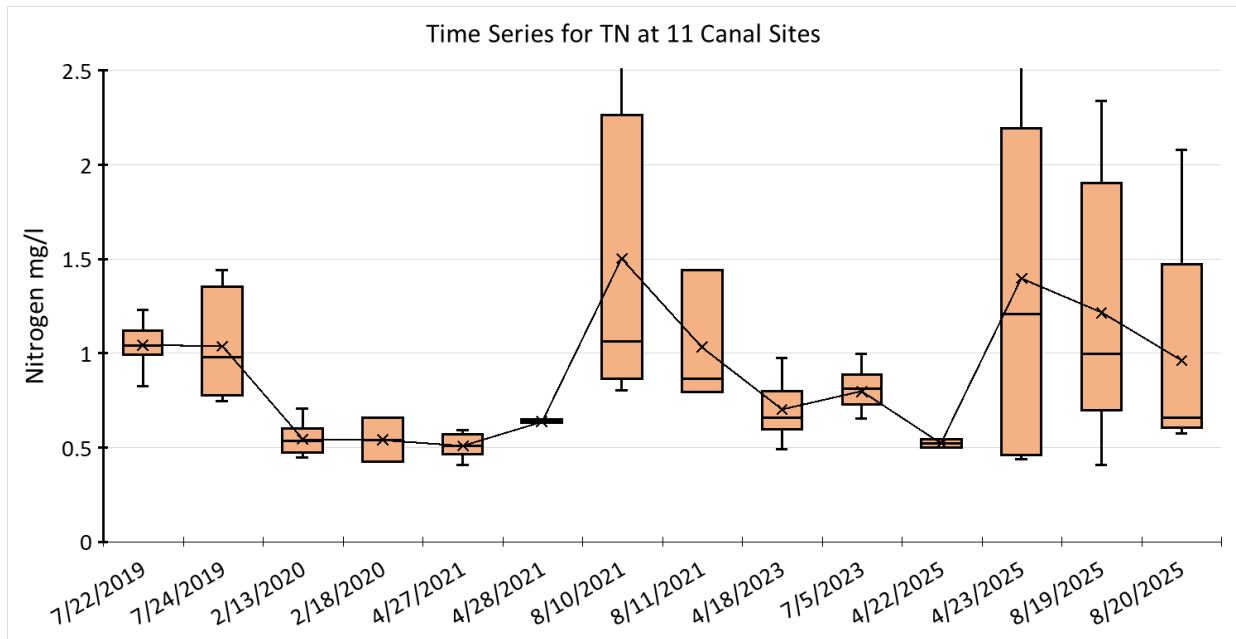


Figure 12. Time series of annual mean values for TN in 11 canals monitored in 2025 No significant trend in TN was decetctable using Kruskal Wallis nonparametric test.

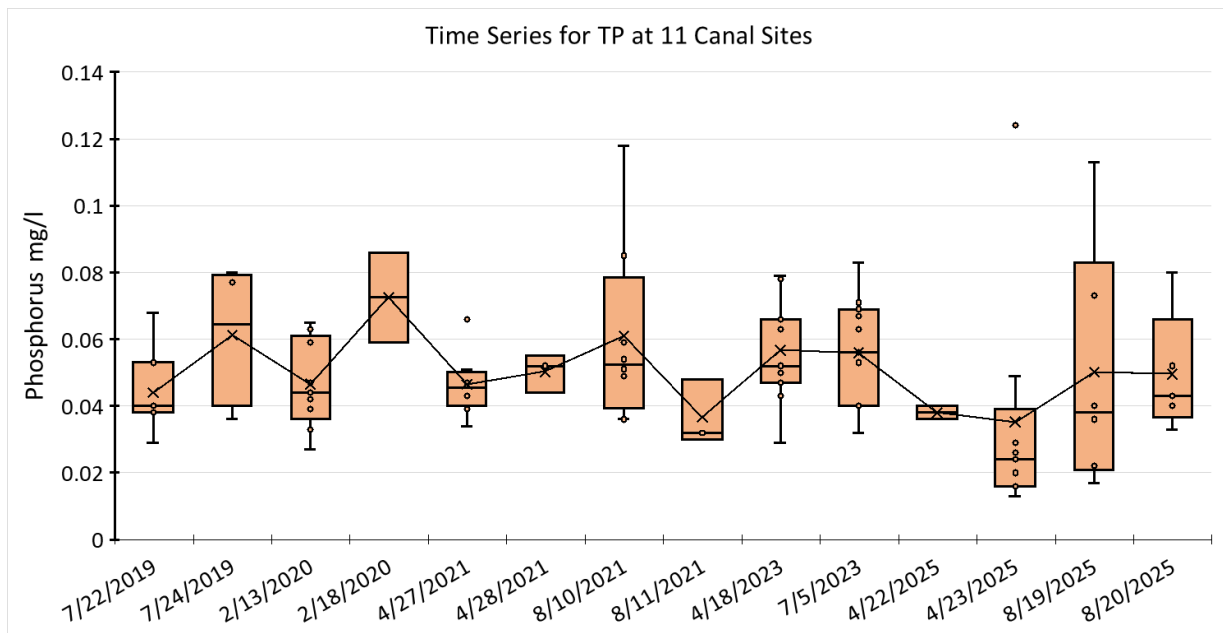


Figure 13. Time series of annual mean values for TP in 11 canals monitored in 2025 No significant trend in TP was decetctable using Kruskal Wallis nonparametric test.

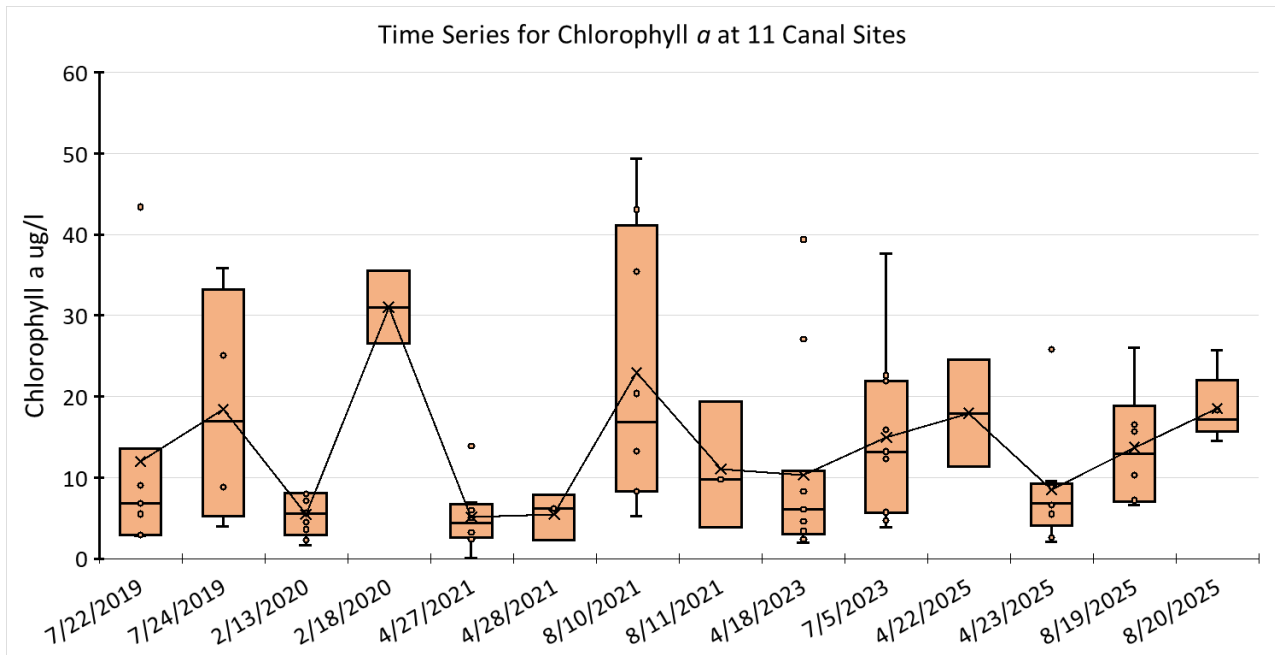


Figure 14. Time series of annual mean values for chlorophyll *a* in 11 canals monitored in 2025. No significant trend in chlorophyll *a* was detectable using Kruskal Wallis nonparametric test.

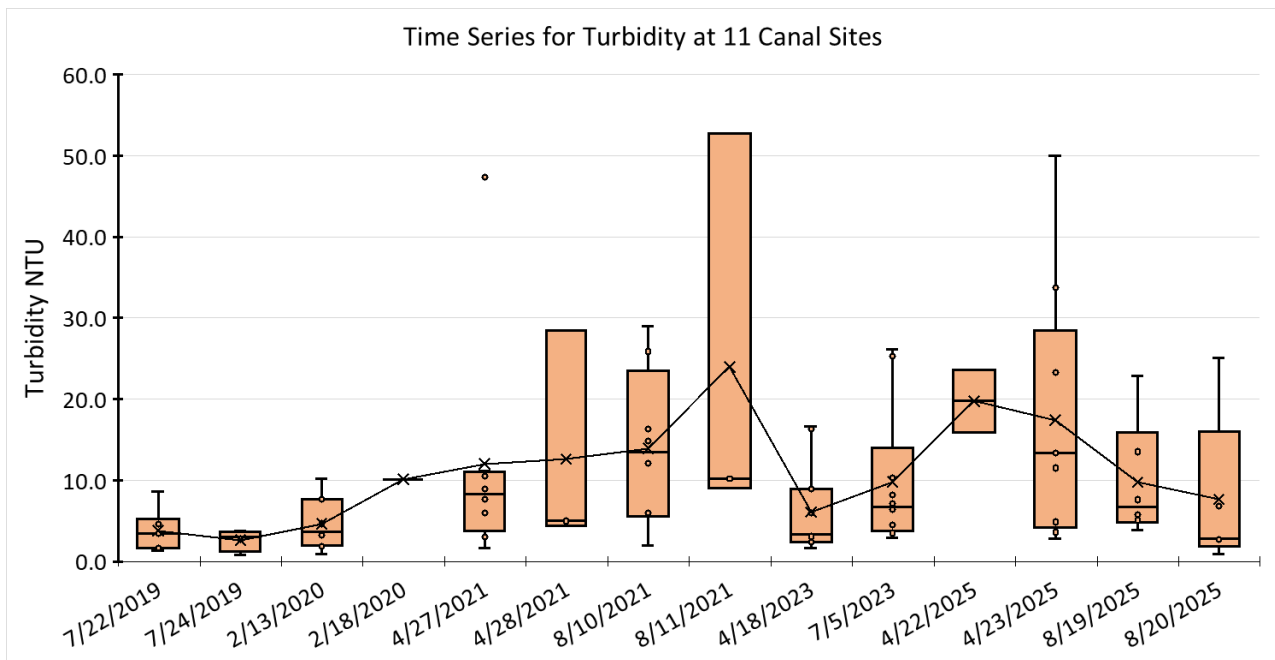


Figure 15. Time series of annual mean values for turbidity in 11 canals monitored in 2025. No significant trend in chlorophyll *a* was detectable using Kruskal Wallis nonparametric test.