MEMORANDUM
Comfort Lake-Forest Lake Watershed District

Date:	3/13/2023
To:	CLFLWD Board of Managers
From:	Mike Kinney, District Administrator
Subject:	2022 DIY and CAT Water Monitoring Report

District Wide

Background/Discussion

The purpose of this agenda item is to provide the Board with Draft 2022 Do-It-Yourself (DIY) and Citizen Assisted Tributary (CAT) Water Monitoring Report for review in advance of the **April 13th** Board Meeting.

Comments or other feedback are requested to be provided to staff by March 28th in order to finalize the report prior to the **April 13th** board meeting where it will be presented by District Staff for acceptance by the Board.

Attached

2022 DIY and CAT Water Monitoring

2022

Do-It-Yourself Diagnostic & Citizen Assisted Tributary Monitoring Programs

January 2023

Comfort Lake–Forest Lake Watershed District

Blayne Eineichner

Cover Image. *Staff collecting samples along the channel that connects Cranberry Lake to Forest Lake's third basin.*

Table of Contents

Table of Contents 2

1. **Introduction** 4

2. **Methods** 4

2.1 Monitoring Equipment 4

2.2 Monitoring Approach 5

2.3 Data Collection 5

2.4 Monitoring Sites 6

3.1 Sunrise River Subwatershed – DIY – 7

3.2 Forest Lake Subwatershed Citizen Assisted Tributary Monitoring 12

4. **Conclusion** 18

4.1 Plans for the 2022 Monitoring Year 19

4.2 Acknowledgments 19

List of Figures:

Figure	Text	Page Number
1.	Images of the Hach colorimeter and chemical reagents.	6
2	2022 precipitation summary.	8
3	Map of the Sunrise River subwatershed DIY Diagnostic monitoring effort for 2022.	9
4.	Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort.	11
5	Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort in the County Line (site #14) subwatershed.	
6.	Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort represented as box and whisker plots.	12
7.	Map showing all monitoring locations on the Second and Third Basin of Forest Lake.	13
8.	Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort.	14
9.	Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort represented as box and whisker plots.	15
10.	Duplicate Water Grab Sample Comparison Study results.	17

List of Tables:

Table	Text	Page Number
1.	Description of the 2022 Sunrise River sampling sites.	10
2.	Results from 2022 Sunrise River subwatershed diagnostic monitoring effort in numerical format.	11
3.	Description of the monitoring sites around Forest Lake Third Basin.	13
4.	Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort in numerical format.	15
5.	Results from 2022 Duplicate Water Grab Sample Comparison Study in numerical format.	17

1. Introduction

The Comfort Lake–Forest Lake Watershed District (CLFLWD) has a robust annual monitoring program with the purpose of evaluating the water quality conditions of its water resources. The program includes lake and stream water quality monitoring as well as project effectiveness and watershed-wide diagnostic monitoring. This data is used to establish baseline water quality trends, to evaluate the success of completed projects, as well as to identify waterbodies impaired and in need of restoration. The District uses an intensive and systematic diagnostic monitoring approach to identify sources of pollutants – whether that be an agricultural area, tributary, wetland sink releasing nutrients, or other source. This approach is effective but can be an expensive and a lengthy endeavor. The average annual monitoring budget for the District is in excess of $180,000, a substantial proportion of the District's total annual operational budget. In its never-ending quest for improvement and efficiency, CLFLWD is exploring new technologies and strategies to streamline and improve the diagnostic monitoring process, save taxpayer dollars, and reach similar conclusions to full-scale traditional diagnostic monitoring.

In 2022, the District continued its implementation and evaluation of two monitoring strategies developed in 2020 to supplement and inform its current diagnostic monitoring program:

- The staff-led Do-it-Yourself (DIY) diagnostic monitoring program, and
- The volunteer lead Citizen Scientist Assisted Tributary (CAT) monitoring program

2. Methods

2.1 Monitoring Equipment

A head-to-head comparison of diagnostic equipment in 2020 concluded that the HACH colorimeter (Figure 1) was the preferred option for the CLFLWD CAT and DIY efforts (2020 DIY and CAT Monitoring Report, 2-25-2020 Board Packet). The comparison concluded that this technology was user friendly, cost effective, and delivered consistent results. As such, the HACH colorimeter was again used in 2021 and 2022 for the DIY and CAT water quality analysis.

To further evaluate the HACH colorimeter, a duplicate water sample comparison study was conducted in 2021 and continued in 2022. This study compared results from duplicate water samples analyzed by both the HACH colorimeter and a commercial laboratory. This study was based on a similar 2020 study that compared water quality grab samples collected on the same day, but not at the same exact time of day. The 2021 and 2022 studies were designed to eliminate any variability due to timing (as seen in the 2020 study) by analyzing duplicate water quality samples - or those taken the same location and time.

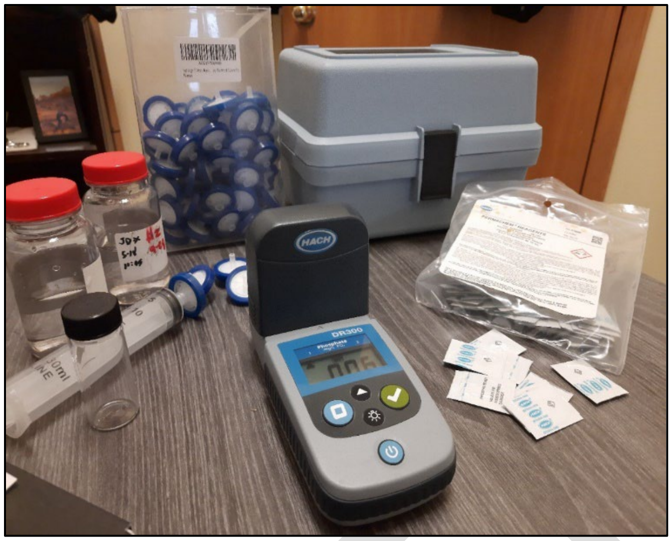

Figure 1. The Hach colorimeter and chemical reagents used by the CLFLWD in 2022.

2.2 Monitoring Approach

The same two monitoring approaches developed in 2020 were again used in 2021 and 2022: the staff lead “Do-it-Yourself” (DIY) diagnostic monitoring and the volunteer conducted “Citizen Assisted Tributary Monitoring” (CAT) effort. The monitoring procedure for both efforts was essentially the same (described below) with the only distinction being whether District staff or volunteers collected the water samples. The DIY diagnostic program was conducted fully with District staff, whereas the CAT program used volunteers to collect, preserve / store, and sometimes analyze the water samples.

Both approaches had advantages and disadvantages. The DIY program offers more control over the monitoring effort, though it is also constrained by staff workload, the work week, and business hours. The CAT program was set up to allow local volunteers to collect water samples in their neighborhood in their off time, allowing more flexibility to conceivably collect water samples during the peak of a precipitation event and/or on the weekend. The use of volunteers could allow the collection of a great deal of data at a rather low expense to the district. However, the tradeoff for this flexibility and cost savings is the data collection effort is less controlled and certain storm events could be missed when volunteers are out of town or otherwise predisposed.

2.3 Data Collection

Water grab samples were taken at both baseflow and during highwater conditions, with the primary goal of sampling during or shortly after storm events. Staff and volunteers tried to collect water samples at each monitoring location after a rain event predicted to be around 0.75 inches or greater- as indicated on several websites (weather.com, Noaa.gov, CoCoRaHS.org). Staff or volunteers collected a 100 ml water grab sample at each monitoring location, labeled the sample, and then recorded the date, time, and any additional notes on a provided datasheet. No flow measurements were taken, but flow observations were noted (dry channel, trickle, swift flow) on the data sheet. Samples were kept on ice (DIY) or filtered and frozen (CAT) for future analysis. DIY diagnostic samples were analyzed within 2 hours of collection back at CLFLWD offices, and CAT samples were delivered in batches to the CLFLWD office for analysis by staff. All water samples were analyzed with the Hach colorimeter and PhosVer 3 reagent for orthophosphate. All data was entered into an Excel workbook and saved on the CLFLWD network.

While conducting the District's traditional diagnostic monitoring effort for Comfort Lake, EOR collected several duplicate water quality samples and delivered these samples to District staff for analysis with the HACH colorimeter. These same water samples were submitted to the laboratory that EOR uses for analysis. These duplicates allow for further evaluation of the HACH colorimeter equipment and may shed some light on the accuracy and utility of the DIY and CAT programs. Results from this comparison are shared below in section 3.3.

2.4 Monitoring Sites

During 2022, two subwatersheds were monitored, from May through September, by the DIY diagnostic and CAT monitoring efforts. The Sunrise River subwatershed between Forest and Comfort Lake through the DIY diagnostic effort and the Forest Lake Second and Third Basin subwatersheds through the CAT monitoring effort.

Thirty-six potential sites for these two subwatersheds were identified through a desktop effort (GIS), of those, 27 sites were field verified to be appropriate for the 2022 monitoring effort. Samples were collected at each of these 27 locations during five to six monitoring events throughout the field season. Sampling sites and events were limited in 2021 and again in 2022 by drought conditions, and it should be noted that it may be possible to sample more of the 36 identified locations during an average precipitation year.

Estimated staff hours needed to develop, coordinate, and implement these programs in 2022 was approximately 60 hours for the DIY diagnostic and 30 hours for the CAT program. This is a similar effort as seen during the 2021 monitoring year, though considerably less than in 2020 (~55% less staff hours). This decrease from the 2020 effort was partly due to the programs being full developed and implementation ready, as well as the lack of monitoring events and subsequent water quality samples collected during a drought year.

3. Results and Discussion

A total of 75 water grab samples were collected and analyzed in 2022 –47 samples through the DIY diagnostic program and 28 samples through the CAT program. This is a similar level to the effort of 2021, but a substantial departure from the number of samples collected in 2020 – approximately a 60% decline. This can be attributed to the below average precipitation totals or drought conditions during the 2021 and 2022 monitoring season (Figure 2). Few precipitation events neared the 0.75-inch precipitation amount that is generally needed to flow water through the entire drainage network. As such, staff collected samples where they could during lesser rain events and the results of the 2022 monitoring effort should be considered in this light as they may not be fully representative of nutrient loads seen in "normal" years.

The results from these monitoring efforts, as well as interpretation and discussion of the results are presented below by subwatershed. In addition, there are comparisons of data between duplicate samples collected by Emmons and Olivier Resources, Inc (EOR) in their diagnostic effort for the Comfort Lake watershed. These duplicate samples were evaluated with both the DIY technology and a commercial laboratory to better understand the precision and accuracy of the DIY technology.

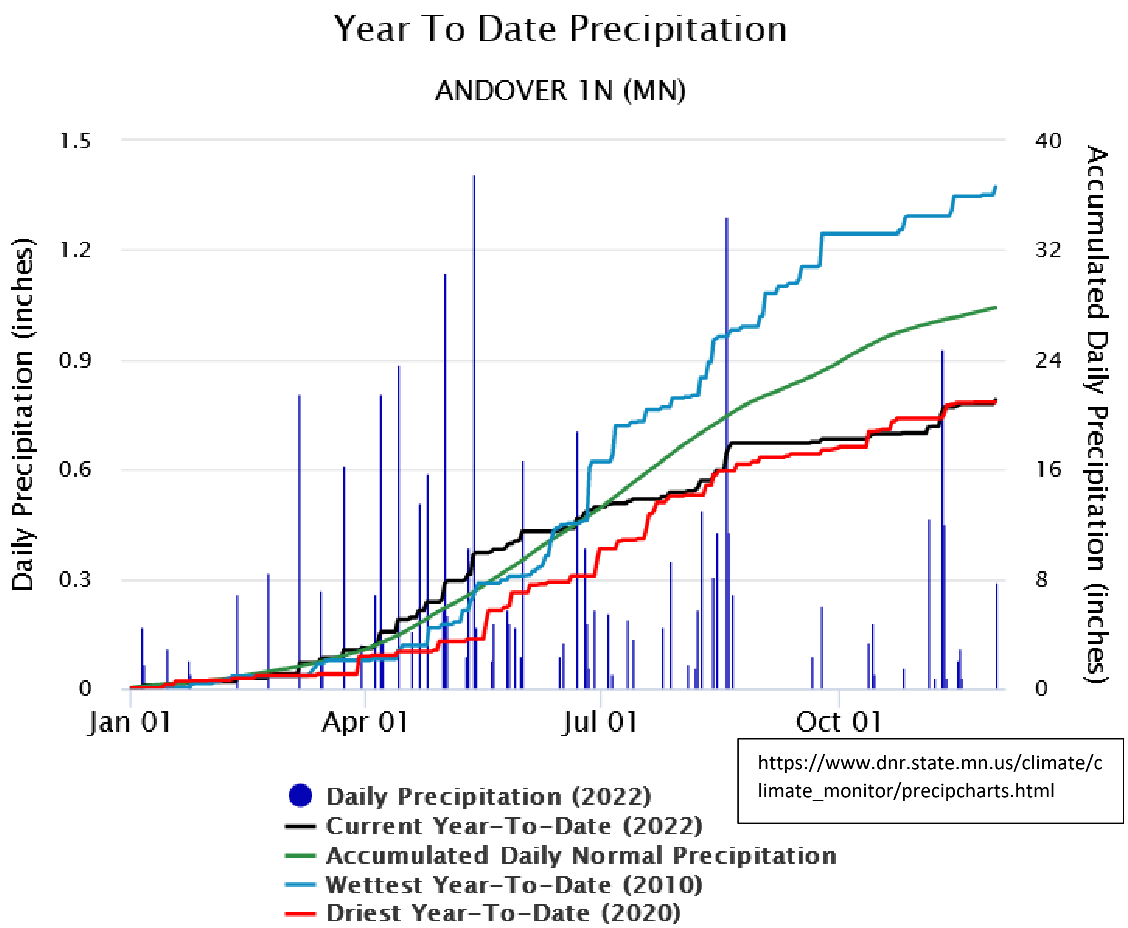

Figure 2. 2022 precipitation summary for the closest MNDNR monitoring station to the CLFLWD.

3.1 Sunrise River Subwatershed – DIY –

Similar to 2021, the 2022 Sunrise River subwatershed monitoring effort focused on the drainage area between Forest Lake and Comfort Lake. Twenty-one locations were included in the monitored effort, but due to drought, only ten of the sampling locations were able to be monitored on multiple occasions (Figure 3, Table 1.). Water quality samples were collected from another five monitoring locations sporadically. A total of five sampling events took place during the 2022 diagnostic effort with a total of 47 samples collected and analyzed – with the majority of the samples coming from the ten locations mentioned above. It is possible that during an average precipitation year that more of the 21 sites could be continuously monitored throughout the field season.

The 2022 monitoring effort included additional effort in the County Line sub-shed (Figure 3). This area was identified in 2021 as a potential nutrient source for the Sunrise River. Four additional sites were added to the Highway 8 ditch, adjacent wetland, and neighborhood ditch system in this sub-shed in an attempt to pinpoint the source of the nutrient.

2021 Sunrise River Monitoring Locations

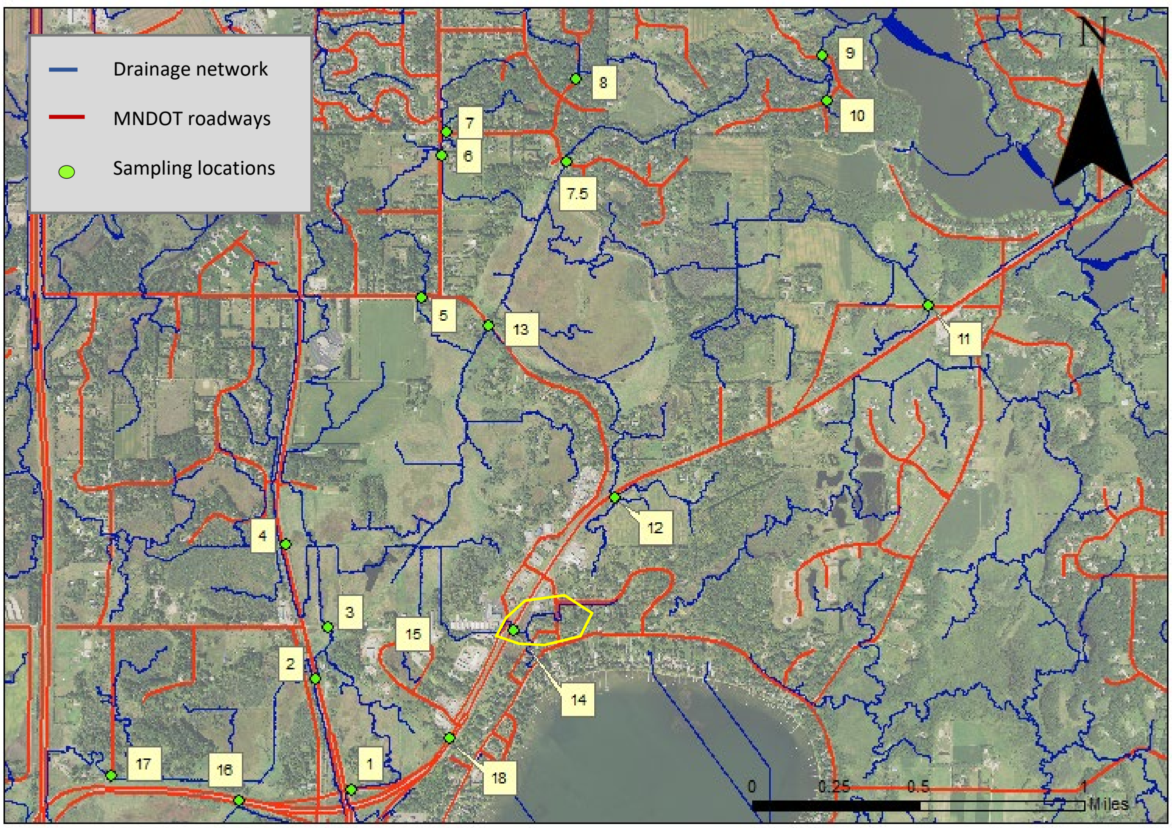

Figure 3. Map of the Sunrise River subwatershed DIY Diagnostic monitoring effort for 2022. The Green dots indicate potential monitoring locations identified in GIS. The blue lines indicate GIS derived flow paths. The County line sub-shed (site 14b-e) is indicated on the map as a yellow polygon due to constraints associated with scale.

Table 1. Description of the 2022 Sunrise River sampling sites.

Monitoring location	Description
S1	Ditch North of Hwy 61 / 8 junction near old building for sale signs
S2	Decommissioned Judicial Ditch 2 – off 61 by Ducharme driveway
S4	Heims Lake Drainage at the bike trail crossing
S5	250th St N manhole between field edge and Goodview Ave
S6	Goodview Culvert ~ 350 ft south of the 255th junction
S7	Culvert near east corner of Goodview and 255th St
S7.5	Sunrise River @ the 256th crossing – ISCO Site
S8	Gramford Rd culvert
S9	Sunrise River @ the Comfort Lake inlet - ISCO site
S10	Culvert at corner of 256th St and Heritage Ln
S11	Ditch / culvert on 250th St
S12	Hwy 8 culvert by the agriculture field and political/for sale signs
S13	Sunrise River @ the Greenway crossing - ISCO site
S14 (a)	Drainage ditch @ the County line, west of Hwy 8 & Greenway Rd
S14 b	Roadside ditch entering into the County Line ditch (S14a)
S14 c	Drainage ditch @ the County line, east of Hwy 8
S14 d	Drainage ditch @ the County line, west Greenway Ave N
S14 e	Drainage ditch @ the County line, along Greenway Ln N
S15	Ditch @ NE side of Goodview Circle North Loop
S16	Decommissioned Judicial Ditch 2 @ Hwy 8 - Bixby Park outflow
S18	Sunrise River @ Forest Lake Outflow – ISCO site

The majority of the water quality grab samples collected in 2022 had orthophosphate levels around 0.20 mg/L (similar to past years). Several monitoring locations did have elevated orthophosphate levels in some of the samples, but these results are confounded by the drought conditions (little to no flow, standing water) and subsequent lack of data to fully evaluate these locations as a nutrient source. As such, these results (Figure 4, Figure 5, Table 2) may not be representative of the nutrient load during an average precipitation year.

The sites mentioned above with elevated orthophosphate levels included most notably S5 (a roadside manhole), sites S10 (culvert), S12 (culvert near agriculture field), and S14 and S15 (both roadside ditches). It is not surprising that these sites had elevated orthophosphate levels as they are closely associated with roadways and all lack natural treatment. Stormwater sheets directly off the road surfaces into this stormwater infrastructure with little to no vegetation filtering or soil infiltration. Furthermore, few samples were taken at any of these sites (excluding S14) and any conclusions gathered from this data should be viewed in this context. These findings give credence to the District's enhanced street sweeping program as a key nutrient reduction strategy as road surface runoff is a substantial source / conveyance of orthophosphate for the district.

Samples collected from the County Line sub-shed (S14a-e, located near the Washington / Chisago County line) had consistently elevated orthophosphate levels. Unfortunately, drought conditions limited sample collection, and as such, no specific source of nutrient was identified in this area. Further investigation at this location is warranted to pinpoint the main source of nutrient.

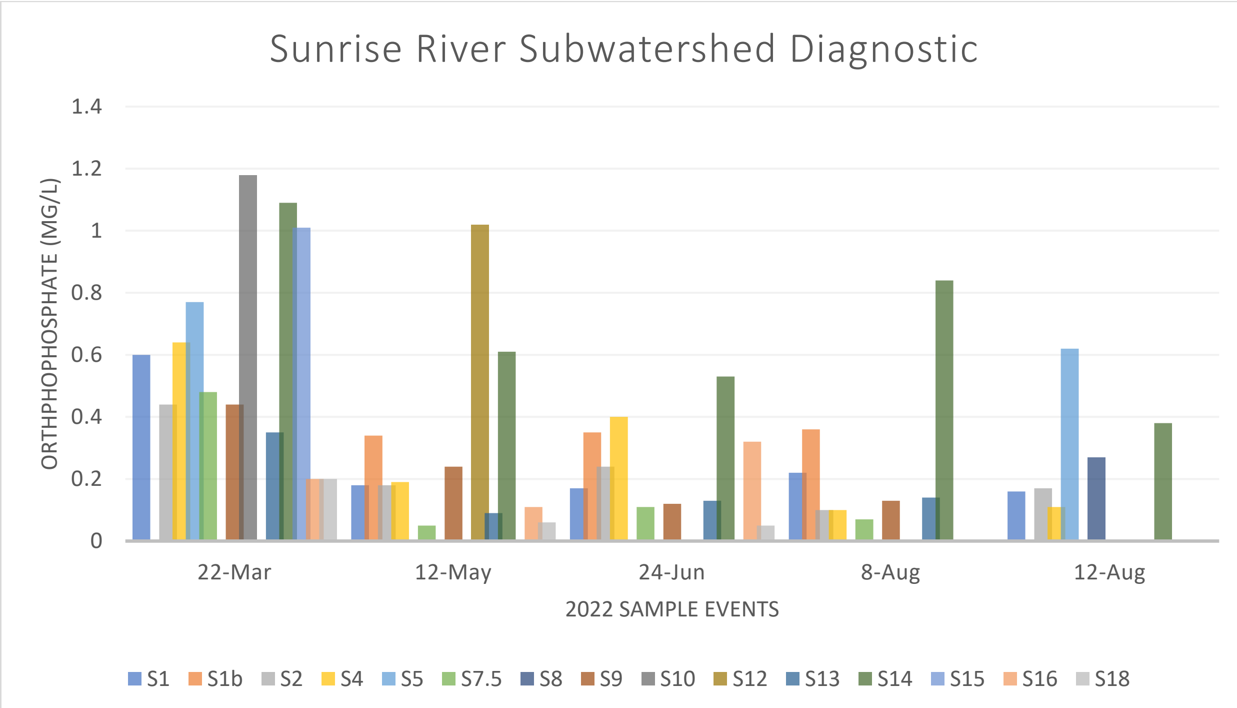

Figure 4. Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort. All results are in mg/l of orthophosphate. S5, S10, S12, S15 are roadside ditch/culvert sites. S14 is the County Line site.

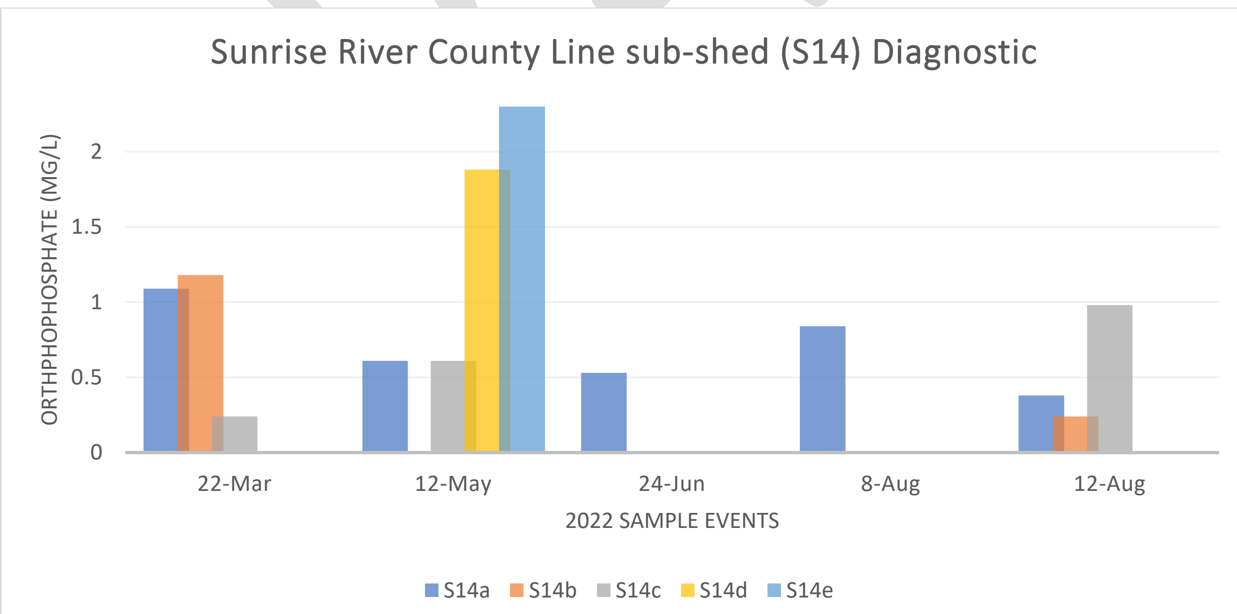

Figure 5. Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort at the County Line monitoring location subwatershed. All results are in mg/l of orthophosphate.

Table 2. Results from 2022 Sunrise River subwatershed diagnostic monitoring effort in numerical format. All results are in mg/l of orthophosphate. Cells with dots indicate no sample was collected. Data from the County Line (site 14 sub-shed) are excluded from this table as to save space and aid in the display of the data.

Date	S1	S1b	S2	S4	S5	S7.5	S8	S9	S10	S12	S13	S14	S15	S16	S18
22-Mar	0.6	.	0.44	0.64	0.77	0.48	.	0.44	1.18	.	0.35	1.09	1.01	0.2	0.2
12-May	0.18	0.34	0.18	0.19	.	0.05	.	0.24	.	1.02	0.09	0.61	.	0.11	0.06
24-Jun	0.17	0.35	0.24	0.4	.	0.11	.	0.12	.	.	0.13	0.53	.	0.32	0.05
8-Aug	0.22	0.36	0.1	0.1	.	0.07	.	0.13	.	.	0.14	0.84	.	.	.
12-Aug	0.16	.	0.17	0.11	0.62	.	0.27	.	.	.	.	0.38	.	.	.

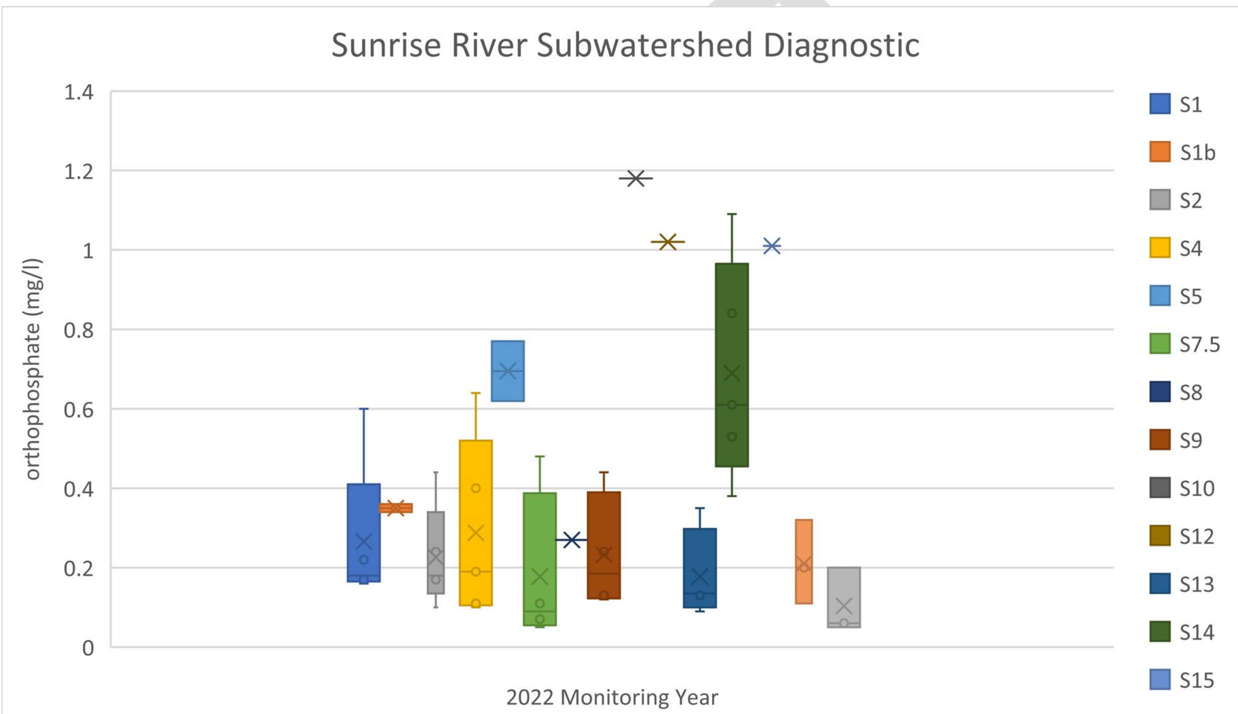

Figure 6. Results from 2022 Sunrise River Subwatershed DIY diagnostic monitoring effort represented as box and whisker plots. The box represents the interquartile range (25% on each side of the median), the line in the box is the median, the X is the mean, and the whiskers represent the lower and upper extremes or maximum values. Any circles/dots beyond the whisker ends indicate data outliers.

3.2 Forest Lake Subwatershed Citizen Assisted Tributary Monitoring

The 2022 Forest Lake subwatershed Citizen Assisted Tributary (CAT) monitoring effort focused on the Forest Lake Second and Third basins. Fourteen locations were included in the monitored effort, but due to drought, only nine of the sampling locations were monitored in 2022. Of these nine sites, only six locations allowed repeated sample collection throughout the monitoring season (Figure 7, Table 3.). A total of six sampling events were attempted during the 2022 CAT effort with only 28 total samples collected and analyzed.

Due to the drought, the Forest Lake drainage network remained very dry and frequently infiltrated precipitation instead of conveying much of the stormwater. As such, many of the monitoring locations remained dry or were very flashy during even the largest rain events and few samples were able to be collected. It is possible that during an average precipitation year more of the 14 sites could be continuously monitored.

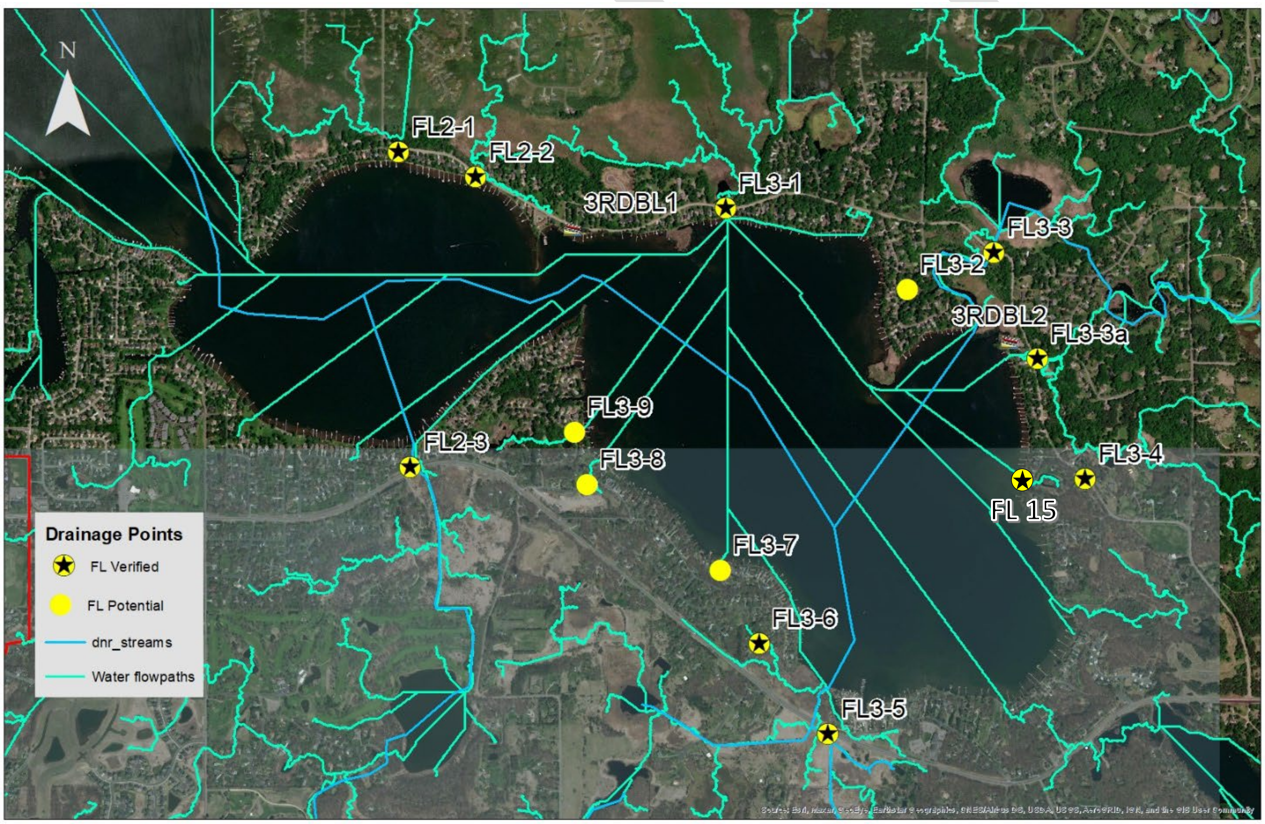

Figure 7. Map showing all monitoring locations on the Second and Third Basin of Forest Lake. The yellow dots represent potential monitoring locations, and the yellow dots with black stars represent verified locations appropriate for the monitoring effort. The blue lines indicate active stream channels, and the green/blue lines indicate GIS derived flow paths.

Table 3. Description of the monitoring sites around Forest Lake Third Basin.

Monitoring location	Description
FL3 -1	Culvert on North Shore Trail east of the boat launch.
FL3 -3	Culvert on the NE corner of the third basin, drains from Cranberry Lake.
FL3 -3a	Culvert located on the corner of N Shore Trail and 219th St. N
FL3 -4	East side of the third basin, located just North of Juniper Ave. N
FL3 -5	Southernmost site- channel located along Scandia Trail N.
FL3 -6	Small culvert located on Iverson Ave. N
FL2-1	Ditch on North Shore Trail, just East of N Shore Circle N.
FL2-3	Culvert located under Scandia Trail N, Just East of 217th St. N
FL15	Third Lake Pond discharge

The results from the 2022 Forest Lake CAT effort were limited by the drought conditions and therefore, may not be representative of the nutrient loading during an average precipitation year. The majority of the water quality samples that were collected had orthophosphate levels near or less than 0.20 mg/L (similar to past years) but the data set is not robust enough to confirm these results (Figure 8, Figure 9, Table 4). Several grab samples collected did show highly elevated levels, but these samples were collected at extremely low flow or from stagnant water. It is likely that these samples contained some ditch sediments and thus are not representative of the actual nutrient load at these locations. As such, the results from the 2022 monitoring effort should be viewed in this context and repetition of this effort during an average precipitation year should be considered.

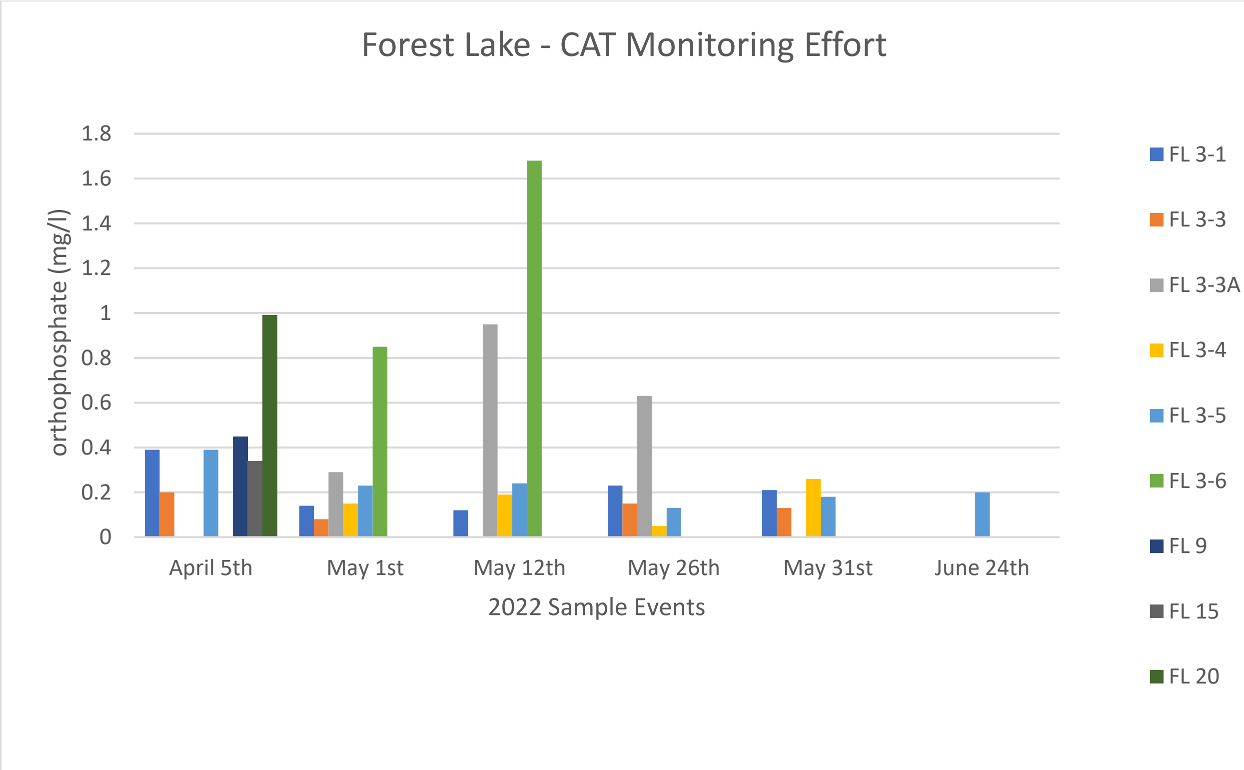

Figure 8. Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort. All results are in mg/l of orthophosphate.

*Table 4. Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort in numerical format. All results are in mg/l of orthophosphate. Cells with dots indicate no sample was collected. Cells with an asterisk * indicate the sample was taken at low flow or in stagnant conditions.*

Date	FL3-1	FL3-3	FL3-3a	FL3-4	FL3-5	FL3-6	FL-9	FL-15	FL - 20
5 - April	0.38*	0.2*	.	.	.0.39	.	0.45*	0.34	0.99
1 –May	0.14	0.08*	0.29*	0.15	0.23	0.85	.	.	.
12-May	0.12	0	0.95	0.19	0.24	1.68	.	.	.
26-May	0.23*	0.15*	0.63*	0.05	0.13	.	.	.	.
31-May	0.21*	0.13*	.	0.26*	0.18	.	.	.	.
24 - June	.	.	.	.	0.2	.	.	.	.

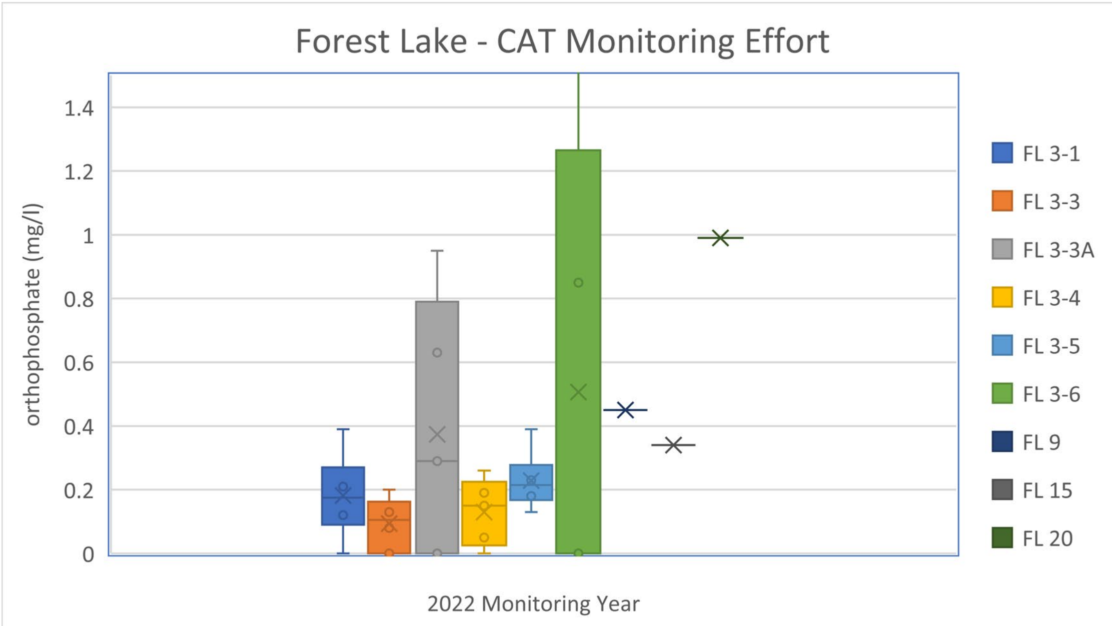

Figure 9. Results from 2022 Forest Lake Second and Third Basin CAT monitoring effort represented as box and whisker plots. The box represents the interquartile range (25% on each side of the median), the line in the box is the median, the X is the mean, and the whiskers represent the lower and upper extremes or maximum values. Any circles/dots beyond the whisker ends indicate data outliers.

3.3 Duplicate Water Quality Sample Comparison

The District's engineering firm, Emmons and Olivier Resources, Inc (EOR), conducted sequential diagnostic monitoring in the Forest Lake subwatershed during 2021 and in the Comfort Lake subwatershed in 2022. As part of this effort, EOR staff collected two duplicate water quality grab samples at several location throughout the field season(s) and delivered one of the samples to District staff for analysis with the HACH colorimeter. The duplicates of these samples were analyzed at the commercial laboratory contracted by EOR, Instrumental Lab in Fridley. The EOR laboratory analyzed the samples for: Total Phosphorus, Orthophosphate, and Total Suspended Solids. The HACH colorimeter is only capable of testing for Orthophosphate concentration. Consequently, only orthophosphate concentration results were compared between water quality analysis equipment in this study.

Duplicate sampling and analysis allow for direct comparison of results and thus allows for further evaluation of the HACH technology. A similar comparison was attempted in 2020, however WQ samples compared were not true duplicate as they were taken at the same sampling site, but often hours apart and potentially on different limbs or stages of the of the hydrograph. This can introduce variability into the study resulting in a degree of "noise" in the results. The use of exact duplicates in 2021 and 2022 offers a true comparison of the technologies – commercial laboratory vs the HACH pocket colorimeter – and may shed some additional light on the utility and/or limitations of the DIY monitoring technology and methods.

Results from the 2021 duplicate water sample comparison study were not as conclusive as was anticipated during the planning phase of this study due to drought conditions and few samples were collected/analyzed. As such, additional samples were collected in 2022 to continue the evaluation of this technology. Unfortunately, drought conditions persisted into 2022 which greatly reduced the amount of data that was gathered and thus available for this study. A total of 33 water quality grab samples were evaluated in the study in 2021 and 2022 (Figure 9, Table 5) - a smaller sample size than is ideal for a study of this nature.

Due the small sample size and the non-normal distribution of the data set, a Wilcoxon Signed Ranked test was utilized to analyze the data. This test compared the difference between the means (average difference between values for HACH vs commercial laboratory) of the data set. Results of the analysis indicated that, with a 95% probability level, there was a statistical difference between the mean values of the results from the HACH colorimeter as compared to the commercial laboratory. In other words, the two data sets are not statistically similar and the HACH colorimeter results cannot be substituted for those analyzed by the commercial laboratory. This result is in contrast to the findings of the of the 2021 study that indicated there was no statistical difference between the data from the HACH vs Lab data. The discrepancy here is likely due to the very small sample size of the data set in 2021 (n=9) and the misuse of a paired T-Test on this dataset. As the data did not have a normal distribution, it violated a core assumption of this test. This combined with the small sample size skewed the data and gave a misleading result.

Despite the lack of statistical validation, the 2022 results do suggest that the HACH colorimeter can be used to determine the relative concentration of the pollutant – in other words, gives a ballpark value that can indicate high or low concentration. Though the results lack the accuracy of the commercial lab analysis, they could be useful as a screening tool in a diagnostic program to direct future “traditional” diagnostic monitoring efforts that utilize a commercial laboratory.

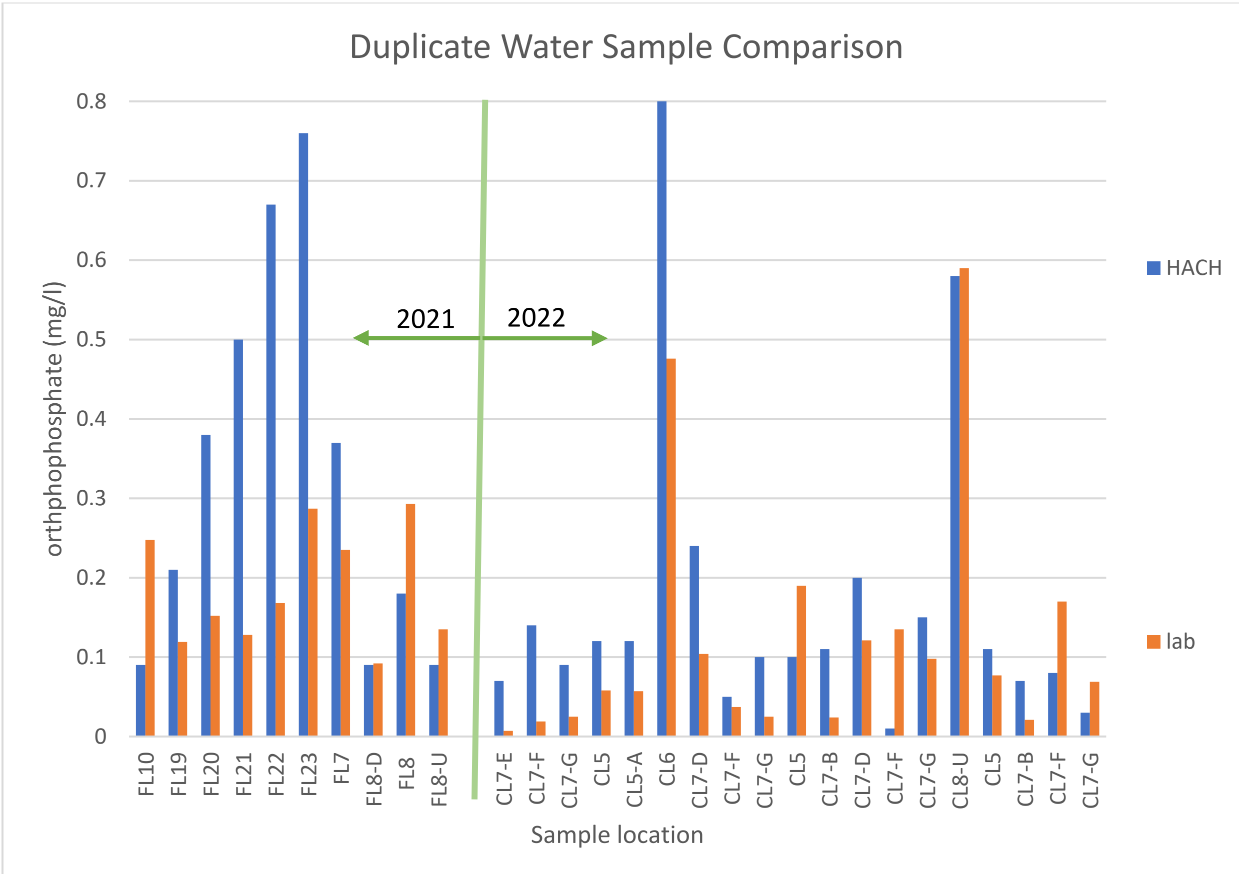

Figure 10. Comparison of data between duplicate sites samples and analyzed by both a commercial laboratory and the HACH colorimeter in 2021 and 2022. T-test statistics indicate with a 95% probability that there is a statistical difference between mean values of the data analyzed by the HACH and commercial laboratory.

Table 5. Results from the Duplicate Water Grab Sample Comparison Study in numerical format. All results are in mg/l of orthophosphate.

Sample Location	Date	HACH	lab
FL10	2021-05-27	0.09	0.25
FL19	2021-05-27	0.21	0.12
FL20	2021-05-27	0.38	0.15
FL21	2021-05-27	0.5	0.13
FL22	2021-05-27	0.67	0.17
FL23	2021-05-27	0.76	0.29
FL7	2021-05-27	0.37	0.24
FL8-D	2021-05-27	0.09	0.09
FL8	2021-08-09	0.18	0.29
FL8-U	2021-05-27	0.17	0.02
CL5	2022-05-02	0.17	0.02
CL5-A	2022-05-02	0.07	0.03
CL6	2022-05-02	0.36	0.05

CL7-D	2022-05-02	0.13	0.05
CL7-E	2022-05-02	0.07	0.01
CL7-F	2022-05-02	0.14	0.02
CL7-G	2022-05-02	0.09	0.03
CL5	2022-05-12	0.12	0.06
CL5-A	2022-05-12	0.12	0.06
CL6	2022-05-12	0.24	0.10
CL7-D	2022-05-12	0.05	0.04
CL7-F	2022-05-12	0.10	0.03
CL7-G	2022-08-08	0.10	0.19
CL5	2022-08-08	0.11	0.02
CL7-B	2022-08-08	0.20	0.12
CL7-D	2022-08-08	0.01	0.14
CL7-F	2022-08-08	0.15	0.10
CL7-G	2022-08-08	0.58	0.59
CL8-U	2022-08-19	0.11	0.08
CL5	2022-08-19	0.07	0.02
CL7-B	2022-08-19	0.08	0.17
CL7-F	2022-08-19	0.03	0.07
CL7-G	2022-08-19	0.09	0.14

4. Conclusion

Similar to 2021, the 2022 monitoring season proved to be somewhat challenging due to region-wide drought conditions. Minnesota DNR precipitation data indicates that 2022 had below average precipitation with few large rain events recorded during the typical water quality monitoring season. This limited the number of sampling events resulted in fewer water quality data points than anticipated. To compensate, staff sampled precipitation events with less than the recommended 0.75 inches of rainfall. This allowed additional sampling events but lead to many data gaps as these smaller precipitation events did not fully activate the entire drainage network. As such, the DIY and CAT data sets for 2022 are incomplete and the results from these efforts are not as conclusive as anticipated.

One of the secondary goals of the 2022 monitoring effort was to further evaluate the DIY/CAT HACH colorimeter technology. This was attempted through the Duplicate Water Quality Sample Comparison Study (section 3.3). Though the study indicated that the results from the HACH colorimeter were statistically different than those from the commercial laboratory, the data does show promise for the HACH colorimeter as at least a screening tool for a traditional diagnostic monitoring program that utilizes a commercial laboratory for its analysis.

There are several other relatively inexpensive colorimeters ($500-$1,200) on the market that may provide more accurate results than the HACH colorimeter tested in this study. As such, it is recommended that the evaluation of these technologies be continued in future years as this low-cost diagnostic monitoring could be an important tool for future watershed monitoring and management in the District, and in the region.

4.1 Plans for the 2023 Monitoring Year

Based on recent drought related challenges, the CLFLWD plans to repeat the Forest Lake CAT monitoring effort. Focus will again be on Second and Third basins, with the hope of expanding into First basin with the recruitment of additional volunteers.

The 2023 DIY effort will move into the Comfort Lake direct drainage while continuing to investigate the Sunrise River County Line (S14) sub-watershed. Staff are optimistic that another year of DIY and CAT monitoring will fill in existing data gaps and allow for identification of sources of phosphorus loading within these watersheds.

The 2023 effort will also include a Duplicate Water Quality Sample Comparison Study to further evaluate the HACH or another brand/model of "pocket" colorimeter technology. As there is no scheduled traditional diagnostic monitoring for this year, staff will utilize water quality sampling from the District's long-term stream monitoring program.

4.2 Acknowledgments

The Comfort Lake-Forest Lake Watershed District would like to thank the volunteers who assisted in the implementation of the Citizen Assisted Tributary Monitoring program. Randy Schumacher was a big part of the program's success in 2022. His time and effort are very much appreciated!