

Final

Post-Treatment Assessment for Aquatic Plant Control ERDC Demonstration Project Stewart Park, Cayuga Lake Ithaca, New York

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**US Army Corps
of Engineers®**
Buffalo District
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CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION.....	1-1
1.1 Background.....	1-1
1.2 Purpose and Scope.....	1-2
2 OVERVIEW OF HERBICIDE TREATMENT AND MONITORING.....	2-1
2.1 Public Notification.....	2-1
2.2 Herbicide Treatment Methodology.....	2-1
2.2.1 Herbicide Transfer.....	2-2
2.2.2 Herbicide Application.....	2-2
2.3 Quantity of Herbicide Used and Total Area Treated.....	2-2
2.3.1 Fall Creek.....	2-2
2.3.2 Cayuga Lake East.....	2-7
2.3.3 Cayuga Lake West.....	2-8
2.3.4 Cayuga Inlet.....	2-9
2.4 Water Quality Sampling Methodology.....	2-9
2.4.1 JV Sampling.....	2-10
2.4.2 USACE Sampling.....	2-13
2.5 Results 2-13	
2.5.1 Fall Creek Sampling.....	2-14
2.5.2 Cayuga Lake East In-Lake Sampling.....	2-15
2.5.3 Cayuga Lake West Sampling.....	2-18
2.5.4 Cayuga Inlet Sampling.....	2-20
2.6 Vegetative Monitoring and Treatment Summary.....	2-22
3 STUDY IMPROVEMENTS.....	3-1
3.1 Herbicide Application and Analysis.....	3-1
3.1.1 Herbicide Application.....	3-1
3.1.2 Analysis.....	3-1
3.2 2022 Lessons Learned.....	3-1
3.2.1 Herbicide Application.....	3-1
3.2.2 Communication.....	3-1
3.2.3 Sampling and Monitoring.....	3-1
4 REFERENCES.....	4-1

LIST OF TABLES

Table 2-1 Fluridone (Sonar® Genesis) In-Line Injector Application Summary by Treatment Date for Fall Creek 2-4

Table 2-2 Fluridone (Sonar® H4C) Herbicide Application Summary by Treatment Date for Fall Creek 2-7

Table 2-3 In-lake Fluridone Herbicide Application Summary by Treatment Date for Cayuga Lake East 2-7

Table 2-4 In-lake Fluridone Herbicide Application Summary by Treatment Date for Cayuga Lake West..... 2-8

Table 2-5 In-lake Fluridone Herbicide Application Summary for Cayuga Inlet..... 2-9

Table 2-6 In-lake Chelated Copper Herbicide Application Summary for Cayuga Inlet..... 2-9

Table 2-7 In-Lake Water Fluridone Sample Collection Sites Stewart Park, Cayuga Lake Hydrilla Demonstration Project..... 2-10

Table 2-8 Water Fluridone Sample Collection Sites Grouped by Treatment Area, Stewart Park, Cayuga Lake Hydrilla Demonstration Project 2-13

Table 2-9 Fall Creek Treatment Area – JV Water Sampling Results for Fluridone..... 2-14

Table 2-10 Fall Creek - USACE Water Sampling Results for Fluridone^a..... 2-15

Table 2-11 Cayuga Lake East — JV Water Sampling Results for Fluridone^a 2-16

Table 2-12 Cayuga Lake East — USACE Water Sampling Results for Fluridone^a 2-17

Table 2-13 Cayuga Lake West — JV Water Sampling Results for Fluridone^a 2-19

Table 2-14 Cayuga Lake West - USACE In-Lake Water Sampling Results for Fluridone..... 2-20

Table 2-15 Cayuga Lake Inlet — JV In-Lake Water Sampling Results for Fluridone^a 2-21

Table 2-16 Cayuga Lake Inlet - USACE Water Sampling Results for Fluridone^a 2-22

Table 2-17 Summary of Dominant Species Percent Occurrence in Point Intercept Surveys 2-23

LIST OF FIGURES

Figure 1-1 Fluridone Treatment Areas – Summer 2022 1-3

Figure 1-2 2022 Fluridone Treatment Areas at Fall Creek 1-4

Figure 1-3 2022 Fluridone Treatment Areas at Cayuga Lake East..... 1-5

Figure 1-4 2022 Fluridone Treatment Areas at Cayuga Lake West..... 1-6

Figure 1-5 2022 Fluridone Treatment Areas at Cayuga Inlet 1-7

Figure 1-6 Copper Spot Treatment Area – Summer 2022 1-8

Figure 2-1 In-Lake Water Sample Locations..... 2-12

Figure 2-2 Point Intercept Surveys Locations for 2022 in Cayuga Lake at Ithaca, NY..... 2-25

Figure 2-3 Hydrilla Locations from Point Intercept Surveys during June-August 2022 in Cayuga Lake at Ithaca, NY..... 2-26

ACRONYMS AND ABBREVIATIONS

cfs	cubic feet per second
ERDC	Engineer Research and Development Center
HPLC	high-performance liquid chromatography
Hydrilla	Hydrilla verticillata
JV	Environmental Assessment Services, LLC and Ecology and Environment, Inc. Joint Venture
µg/L	micrograms per liter
NYSDEC	New York State Department of Environmental Conservation
PIS	point intercept survey
ppb	parts per billion
Project	Stewart Park, Cayuga Lake Hydrilla Demonstration Project
SePRO	SePRO Corporation
SLM	SOLitude Lake Management, LLC
TAT	turnaround time
TSMP	Treman State Marine Park
USACE	United States Army Corps of Engineers (Buffalo District)
USGS	United States Geological Survey

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1 INTRODUCTION

The Stewart Park, Cayuga Lake Hydrilla Demonstration Project (the Project) is a field-scale demonstration of a technology developed under the United States Army Corps of Engineers – Buffalo District’s (USACE’s) Aquatic Plant Control Research Program to manage monoecious hydrilla (*Hydrilla verticillata*; Hydrilla) in a high-water exchange environment.

This report contributes to the Year 5 post-treatment monitoring and assessment of herbicide efficacy on Hydrilla by summarizing herbicide treatment methodology and contact time, and identifying lessons learned to benefit future work.

1.1 Background

Hydrilla is a very aggressive, invasive submerged aquatic plant. Treatment of Hydrilla at the southern end of Cayuga Lake began in 2013, and USACE began leading herbicide application efforts in 2018, as discussed below. Given the ease with which this plant spreads by fragments, its proximity to the Erie Canal, and the heavy use of the waterway, this infestation has caused urgent concern regarding spread to other areas of Cayuga Lake, the Finger Lakes, the Erie Canal system, and, potentially, the Great Lakes. These concerns provided the impetus for implementing this Project.

The majority of the Hydrilla treated as a part of the first year (2018) of the Project occurred along the shoreline of Stewart Park, and it was treated with fluridone and spot treatments with chelated copper. In subsequent years, additional areas have been identified for treatment. In 2019, in addition to a treatment area along Stewart Park, an area near the Cornell Community Sailing Center was also treated with fluridone and chelated copper. During the third year (2020), an area within Cayuga Inlet east of Cass Park was added to the treatment plan for fluridone treatment, and an area within Fall Creek was added and spot treated only with chelated copper. In 2021, four general treatment areas were established in Fall Creek, Cayuga Lake East, Cayuga Lake West, and Cayuga Inlet for fluridone application. These general treatment areas were subdivided into additional treatment areas.

Based on observations made in the fall of 2021, a treatment plan was developed with the Hydrilla Task Force to control monoecious Hydrilla beds in the southern end of Cayuga Lake, Cayuga Inlet, Cascadilla Creek, and Fall Creek (see **Figure 1-1**). Four general treatment areas were established for treatment with fluridone (Sonar® H4C and/or Sonar® Genesis):

- **Fall Creek:** 22.5 acres starting at Fall Creek from the State Route 13 bridge to the confluence with Cayuga Lake including the lagoons at Stewart Park and the golf course (see **Figure 1-2**).
- **Cayuga Lake East:** 55 acres at the southern end of Cayuga Lake offshore of Stewart Park and the Cornell Community Sailing Center; three total areas – Stewart Park 1, Stewart Park 2, and the Cornell Community Sailing Center (see **Figure 1-3**).
- **Cayuga Lake West:** 12.5 acres comprising two different areas near Treman State Marine Park west of the confluence with Cayuga Inlet – Treman State Marine Park 1 and Treman State Marine Park 2 (see **Figure 1-4**).
- **Cayuga Inlet:** 9.8 acres comprising four different areas within the Cayuga Inlet – Treman State Marine Park Boat Launch, Cass Park, Cornell Crew Bay, and Cascadilla Creek (see **Figure 1-5**).

All treatment areas were treated with Sonar® H4C. The Fall Creek treatment area was treated with both Sonar® H4C and Sonar® Genesis. Additionally, spot treatment with copper ethylene diamine complex (chelated copper; Harpoon®) occurred in the Cornell Crew Bay (see **Figure 1-6**). USACE delineated these treatment areas using aquatic plant survey data from 2021 and 2022.

Implementation of the Project has been a collaborative effort between the USACE Engineer Research and Development Center (ERDC); the USACE Buffalo District; Environmental Assessment Services, LLC—Ecology and Environment, Inc. (member of WSP) Joint Venture (JV); the New York State Department of Environmental Conservation (NYSDEC); the City of Ithaca; the Tompkins County Soil and Water Conservation District; the Tompkins County Health Department; the Finger Lakes Partnership for Regional Invasive Species Management; the Cayuga Lake Watershed Network; and the applicator, SOLitude Lake Management, LLC (SLM). Although USACE was not required to obtain an Article 15, New York Code of Rules and Regulations, Part 327, aquatic pesticide permit for the Project, reasonable and appropriate measures were taken to meet the intent and conditions that would be associated with such a permit.

1.2 Purpose and Scope

The purpose of the Project is to perform a field-scale demonstration of a technology developed under the Aquatic Plant Control Research Program to evaluate the effectiveness of aquatic herbicides to manage monoecious Hydrilla in high-water exchange environments. USACE is also funding a separate research project titled “Improving Chemical Control in High Water Exchange Environments in Northern Waters”; this research has been ongoing since 2010. This method and the underlying concepts are being tested against monoecious Hydrilla for the Tonawanda Creek/Erie Canal Demonstration Project in Western New York and the Wells College Bay Demonstration Project, as well as for this Project.

The findings in this program will provide valuable information for developing future guidance for managing this invasive aquatic plant that is expanding in high-water exchange systems throughout the northeastern United States.

This post-treatment report includes a summary of the herbicide treatment methodology, including quantity of herbicide used and total acreage treated; a discussion of herbicide contact time and dispersion through the system; and a discussion of the monitoring that accompanied the herbicide application. Lastly, the report provides conclusions, in the form of lessons learned, to help inform future treatment projects.



Figure 1-1 Fluridone Treatment Areas - Summer 2022
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

-  Cayuga Inlet
-  Cayuga Lake East
-  Cayuga Lake West
-  Fall Creek

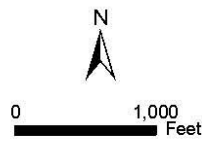


Figure 1-1 Fluridone Treatment Areas – Summer 2022

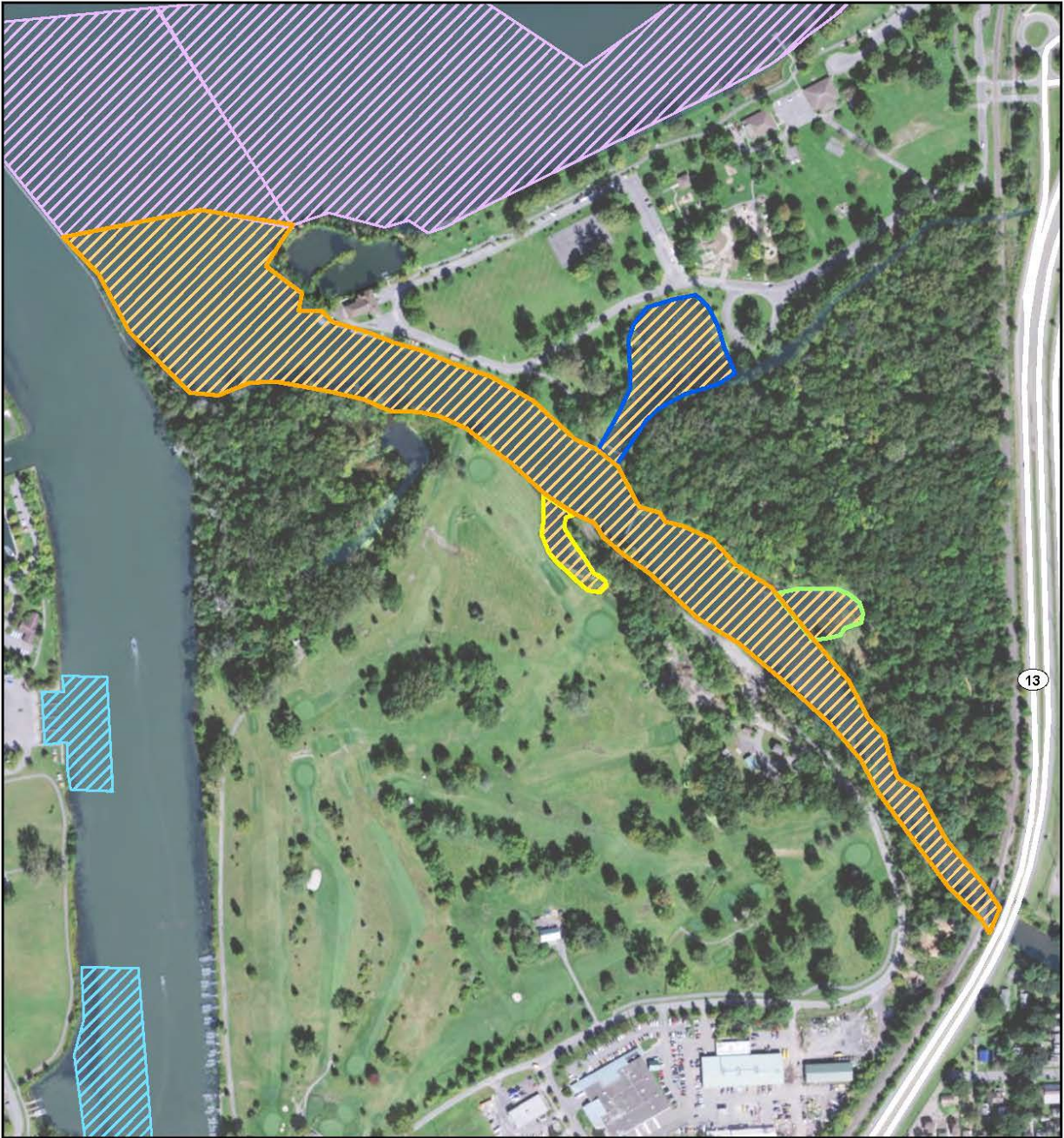


Figure 1-2 2022 Fluridone Treatment Areas at Fall Creek
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

- | | |
|---|--|
|  Fall Creek (18.7 acres) |  Fall Creek |
|  Fall Creek Lagoon (0.7 acres) |  Cayuga Inlet |
|  Golf Course Lagoon (0.6 acres) |  Cayuga Lake East |
|  Stewart Park Lagoon (2.5 acres) | |

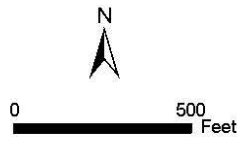







Figure 1-2 2022 Fluridone Treatment Areas at Fall Creek



Figure 1-3 2022 Fluridone Treatment Areas at Cayuga Lake East
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

-  Cornell Community Sailing Club (3.4 acres)
-  Stewart Park 1 (27.5 acres)
-  Stewart Park 2 (12.5 acres)
-  Cayuga Lake East
-  Fall Creek

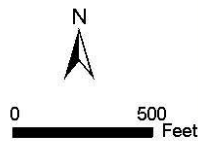





Figure 1-3 2022 Fluridone Treatment Areas at Cayuga Lake East



Figure 1-4 2022 Fluridone Treatment Areas at Cayuga Lake West
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

-  Treman State Marine Park 1 (11.6 acres)
-  Cayuga Lake West
-  Treman State Marine Park 2 (2.0 acres)

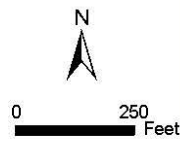


Figure 1-4 2022 Fluridone Treatment Areas at Cayuga Lake West

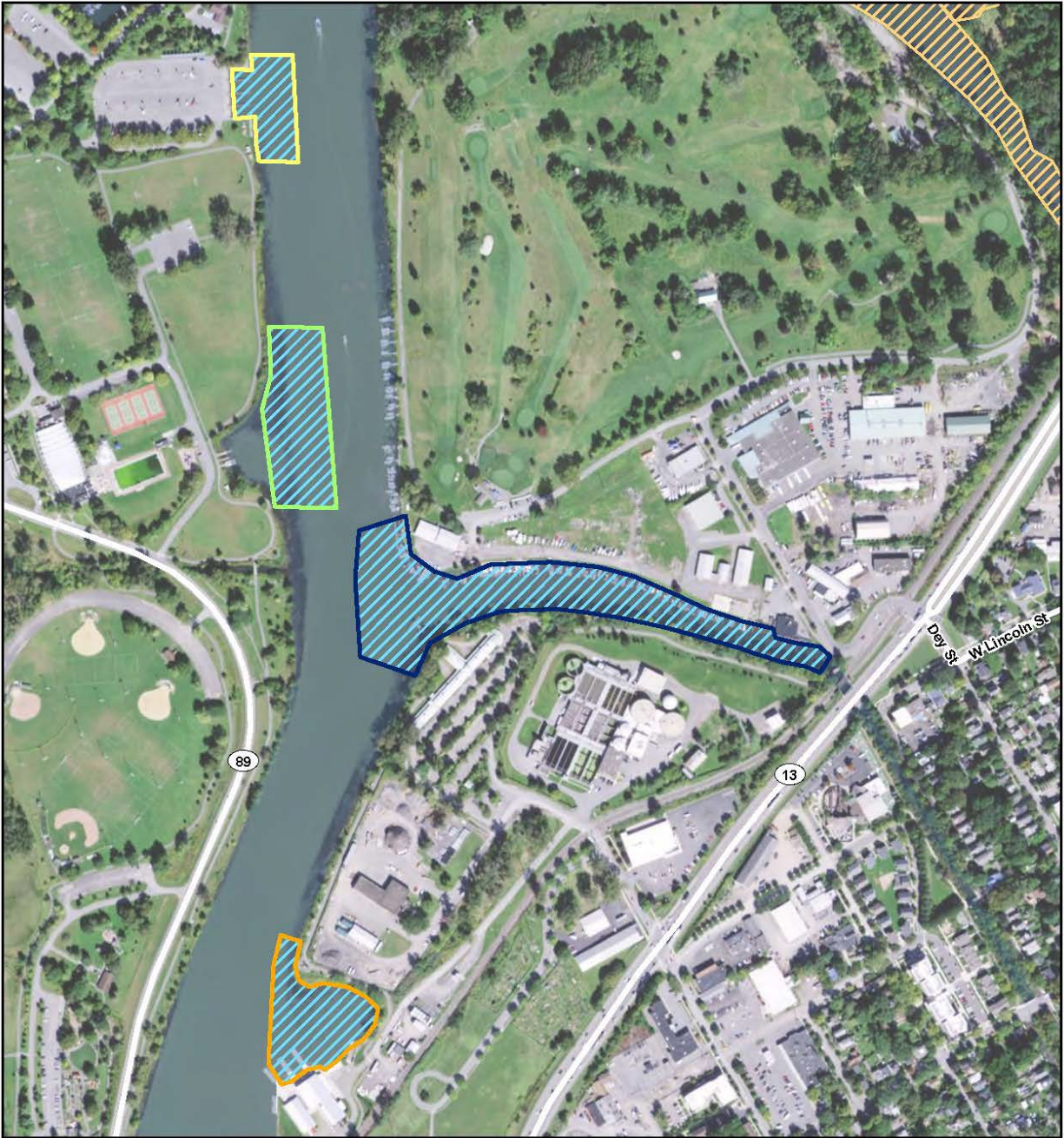


Figure 1-5 2022 Fluridone Treatment Areas at Cayuga Inlet
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

- | | |
|---|--------------|
| Cascadilla Creek (6.7 acres) | Cayuga Inlet |
| Cayuga Inlet Cass Park (3.1 acres) | Fall Creek |
| Cornell Crew Bay (2.5 acres) | |
| Treman State Marine Park Launch (1.5 acres) | |

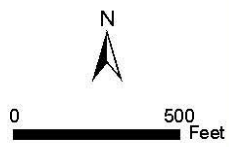


Figure 1-5 2022 Fluridone Treatment Areas at Cayuga Inlet

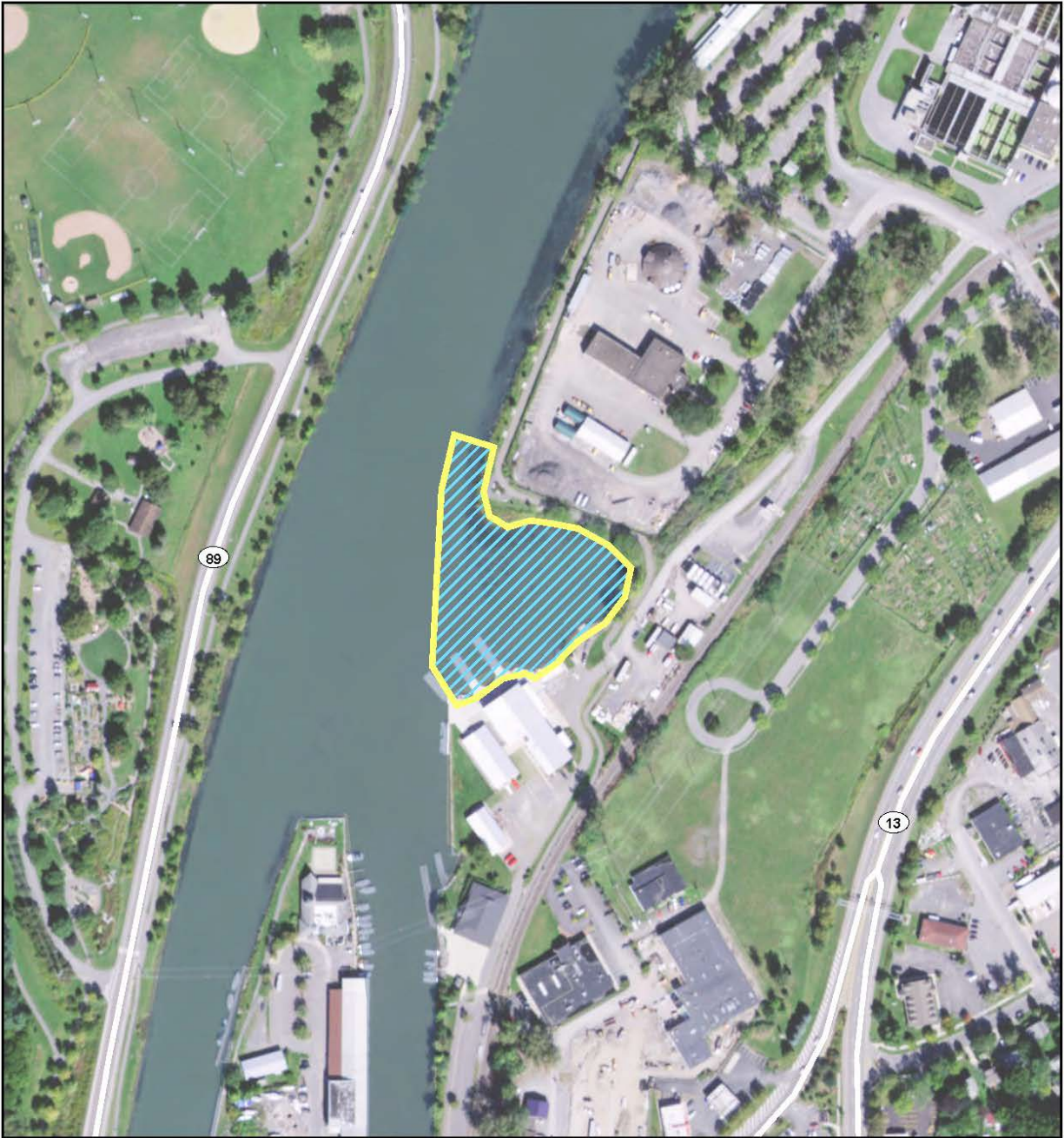


Figure 1-6 Copper Spot Treatment Area - Summer 2022
Cayuga Lake, Tompkins County, New York

- 2022 Hydrilla Treatment Areas
-  Cayuga Inlet
-  Copper Spot Treatment Areas

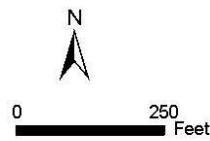


Figure 1-6 Copper Spot Treatment Area – Summer 2022

2 OVERVIEW OF HERBICIDE TREATMENT AND MONITORING

Treatment of Hydrilla for the Project focused on the application of the aquatic herbicides fluridone (Sonar® 4HC and Sonar® Genesis) and chelated copper (Harpoon®) within Cayuga Lake near Stewart Park and the Cornell Community Sailing Center in Ithaca, within Cayuga Lake near Treman State Marine Park, two areas within and two areas adjacent to the Cayuga Inlet, and within a portion of Fall Creek. The following sections outline the public notification that preceded treatment, herbicide treatment methodology, and quantity of herbicide used.

2.1 Public Notification

Public awareness and understanding of the Project were important to successful implementation. USACE and its interagency partners conducted outreach activities to potentially affected users in advance of treatment. Outreach and notification activities associated with treatment near Ithaca included:

- Collaboration was conducted with stakeholders regarding the development of treatment plans for 2022 by conference call and virtual meetings.
- Dates for the initial treatments were provided to NYSDEC, the Tompkins County Health Department, the City of Ithaca, the Bolton Point Water Treatment Plant, and the Cayuga Lake Watershed Network; and email reminder notifications were sent out 24 hours prior to each treatment.
- Written notifications were sent by certified mail approximately 28 days prior to the first fluridone treatment to all riparian owners/users within the 0.5-mile buffer (north and south) of the treatment areas.
- Agency notification letters were distributed approximately 21 days prior to the first fluridone treatment.
- Yellow warning signs were deployed and maintained at public access points along the lakeshore at the commencement of each treatment. The signs indicated applicable water use restrictions regarding irrigation and drinking, culinary, or food processing purposes. The signs also displayed water use restrictions that were in effect for the duration of the treatment or until testing determined that the threshold concentrations had been met. Additionally, signage was posted prior to the chelated copper spot treatment in Cornell Crew Bay.

The Tompkins County Soil and Water Conservation District posted and maintained the yellow warning signs (as described above) to meet the intent of permit requirements. Application dates and times were updated on the signs prior to each of the fluridone treatments. As in all previous years of the Project, NYSDEC did not require any newspaper notifications of the treatment activities.

2.2 Herbicide Treatment Methodology

The aquatic herbicide fluridone (Sonar® H4C) was applied in designated sections of Cayuga Lake and the Cayuga Inlet during 10 treatment events that occurred between June 20 and September 1, 2022 (see **Table 2-1**). Fluridone (Sonar® H4C) was applied in Fall Creek during 10 treatment events, beginning 2 weeks earlier than treatment in the lake; treatment events occurred between June 16 and August 18, 2022. Fall Creek was also treated with a second type of fluridone (Sonar® Genesis) via an injection system. Treatments via the injection system started on June 21, 2022 and concluded on September 1, 2022. Lastly, chelated copper (Harpoon®) was applied to one of the areas within the Cayuga Lake East treatment area on September 1, 2022. SLM conducted the herbicide applications in accordance with the *Performance Work Statement or Contract Aquatic Plant Control ERDC Demonstration Project Stewart Park, Cayuga Lake, Ithaca, NY*, dated April 2022 (USACE 2022).

2.2.1 Herbicide Transfer

SLM used a Kasco granular spreader and backpack blowers for the fluridone (Sonar® H4C) and chelated copper (Harpoon®) treatments. Backpack blowers were used in the Fall Creek treatment areas. The boats used for the treatments were either a jon boat or airboat. Herbicide transfer occurred at the Allen H. Treman State Park launch, where the chemical delivery truck was able to park so that access was maintained to the launch for other users during the herbicide transfer process. The fluridone was delivered in 40-pound buckets, and the chelated copper was delivered in 40-pound bags. The empty buckets and bags were triple rinsed on site and recycled at the SLM Cortland Office location through Casella Waste Management. SLM staff wore personal protective equipment during the transfer from the truck to the treatment system.

With respect to the injection system used in Fall Creek, herbicide transfer of Sonar® Genesis occurred at the injection system location off of Pier Road. Chemical delivery trucks parked adjacent to the injector, where SLM staff transferred the herbicide in boxes comprising four 1-gallon containers. SLM staff filled the injection system on five separate occasions, depending on the herbicide level within the holding tank. The injection system was loaded by pouring one-gallon jugs of Sonar® Genesis into the top opening of the 30-gallon tank in the injection system enclosure. Containers were once again rinsed on site and recycled at the SLM Cortland Office location. See Section 2.3.1 for additional discussion regarding the injection system.

2.2.2 Herbicide Application

SLM used a Kasco granular spreader throughout the treatment season. The boats had a global positioning system navigation system, with all the treatment areas preloaded. Treatment passes were made parallel to the shoreline. The quantity of herbicide needed for each section was determined by the total acreage and volume of the treatment areas. All predetermined product was applied to each section before moving to the next adjacent section. Section 2.3 details the herbicide used in each treatment area.

For all fluridone treatments, the boat was launched at the Allen H. Treman State Park launch. The staff included a lead applicator and an assistant/technician who assembled the treatment systems before going out for treatment. Treatment started generally started between 9:00 and 10:00 am, and applications were completed in approximately 3 to 4 hours each week.

2.3 Quantity of Herbicide Used and Total Area Treated

As indicated in Section 1.1, the Project was divided into four general treatment areas: Fall Creek, Cayuga Lake East, Cayuga Lake West, and the Cayuga Inlet (see **Figure 1-1**). Within each of these general areas, individual treatment plots were established. Each area is discussed separately below, with respect to the quantity of herbicide used and the total area treated. To develop the treatment plan for each treatment area, USACE and partners monitored the sprouting dynamics of Hydrilla tubers and condition of plants prior to and several weeks after treatment to determine optimal timing of treatment, length of exposure, and concentration of herbicide required for effective control of Hydrilla.

2.3.1 Fall Creek

The Fall Creek treatment area included Fall Creek from the State Route 13 bridge to the confluence with Cayuga Lake, including the Stewart Park, Fall Creek, and the golf course lagoons. Together, these areas made up 22.5 acres. Due to the average flow rate of the creek (75 cubic feet per second [cfs]), the main creek area was treated using two formulations of fluridone: (1) liquid fluridone (Sonar® Genesis) via an injection system, and (2) fluridone pellets (Sonar® H4C).

Injection System: Liquid Fluridone

A 24-volts-of-direct-current injection system was installed near the State Route 13 bridge to treat the creek to maintain a 2.5 parts per billion (ppb) daily rate. The injection unit contains a 30-gallon tank equipped with a tank level indicator, which was maintained between 6.7% and 105% capacity throughout the entire treatment. On a daily basis during operation of the injection system, flow rate was recorded using the United States Geological Survey (USGS) Station 04234000 Fall Creek, near Ithaca. Using the reported flow rate from the USGS station, a pump rate was calculated to deliver the appropriate application rate to each injector, with the goal of maintaining a target dose of 2 to 3 ppb for discharges that are 80 cfs or less. At flows above 80 cfs but less than 160 cfs, a pump rate was calculated to deliver the appropriate application rate to each injector for five consecutive days and then turned off for five consecutive days. Operation of the system will be temporarily suspended when discharge is above 160 cfs. This treatment schedule was established for the injection system, based on the herbicide budget for the system and the initial plan for treatment of the median summer discharge rate of 50 cfs for 75 days. Flow rates in 2022 were substantially less than what was seen in 2021 and more in line with the historical median flow rate. Flow rates in 2022 ranged from approximately 13.4 to 177 cfs between June and early September, compared with approximately 82 to 4,500 cfs in 2021 between June and October for the Fall Creek gage (USGS 2022). Based on historical data, the median flow rate for Fall Creek between July and October ranges between approximately 30 and 70 cfs. Thus, in 2022, the system operated for a total of 72 days, with only two dates above the 80 cfs threshold – one on July 25, 2022, at 100 cfs and one on August 23, 2022, at 80.5 cfs. The system was shut off for approximately 13 hours between the evening of July 25 and the morning of July 26 (see **Table 2-1**). At the end of operation, there were approximately 2 gallons Sonar® Genesis remaining in the tank. The tank is stored at the SOLitude Cortland warehouse for the winter. Summary injection details are provided in **Table 2-1**.

Pellet Fluridone Application

Ten fluridone treatments were scheduled for the Fall Creek treatment area during 2022. Because the water in Fall Creek becomes warmer earlier in the year than Cayuga Lake and Cayuga Inlet, the Fall Creek treatment area applications started 2 weeks earlier than those in the lake and inlet. The 2022 treatment plan specified that the first two treatments consist of applications of fluridone at a rate of 20ppb, and the third through tenth treatments at a rate of 9 ppb (see **Table 2-2**), which was consistent with the 2021 treatment plan. The reason for the decreased application rate for the third through tenth treatments was that the main channel of Fall Creek was to be treated with Sonar® Genesis and because of that, a slightly lower application rate could be used in the off-channel areas, as it was assumed that some of the herbicide from the main channel would assist in control of the off-channel areas. The general target application rate for the season was 2.5 ppb, with a goal of maintaining a target dose between 2 and 3 ppb. Sonar® H4C is a slow-release, pellet formulation of fluridone. Therefore, application rates are higher than the target concentration for the water column. All application rates are in accordance with approved herbicide product label. Treatments occurred approximately 7 days apart.

Stewart Park Post-Treatment Assessment Report

Table 2-1 Fluridone (Sonar® Genesis) In-Line Injector Application Summary by Treatment Date for Fall Creek

Date	Fall Creek Flow Rate (cfs)	Application Rate (ppb)	Total Volume Sonar® Genesis Added (gallons)	Tank Level (%)	PPH (pulse per hour)	Event Detail
6/21/22	40	2.5	22		750	Start up
6/22/22	40	2.5			750	
6/23/22	36.4	2.5		49.4	660	
6/24/22	50.2	2.5		43.8	916	
	40.5			37.4	733	
6/25/22	40.5	2.5			733	
6/26/22	31.6	2.5		22.4	587	
6/27/22	53.2	2.5	20	18.4	971	
6/28/22	44.8	2.5		66.3	806	
6/29/22	38.8	2.5		56.2	696	
6/30/22	35.5	2.5		47.2	641	
7/1/22	32.7	2.5			641	
7/2/22	30.8	2.5		34.2	550	
7/3/22	32.3	2.5		29.2	587	
7/4/22	27.0	2.5		19.2	495	
7/5/22	26.2	2.5		14.3	477	
7/6/22	29.2	2.5		8.1	477	Left on lower setting due to tank level
7/7/22	29.2	2.5			477	
7/8/22	25.5	2.5		98.5	468	
7/9/22	24.7	2.5			468	
7/10/22	23.3	2.5		105.3	422	
7/11/22	19.1	2.5		90.3	348	
7/12/22	18.5	2.5			348	
7/13/22	23.3	2.5		83.5	422	
7/14/22	19.8	2.5		78.4	367	
7/15/22	19.1	2.5			367	
7/16/22	19.1	2.5			367	
7/17/22	17.2	2.5		64.3	312	
7/18/22	19.8	2.5		61.7	367	
7/19/22	26.2	2.5		58.0	477	
7/20/22	19.8	2.5		50.0	367	
7/21/22	16.5	2.5		45.9	293	
7/22/22	15.2	2.5		42.8	275	

Stewart Park Post-Treatment Assessment Report

Date	Fall Creek Flow Rate (cfs)	Application Rate (ppb)	Total Volume Sonar® Genesis Added (gallons)	Tank Level (%)	PPH (pulse per hour)	Event Detail
7/23/22	19.1	2.5		39.0	310	
7/24/22	20.5	2.5		35.1	367	
7/25/22	39.7	2.5			733	
	100			29.0	1833	Turned off 6:04 pm
7/26/22	59.9	2.5		18.3	1100	Turned on 7:15 am
	48.4			13.7	825	
	44.8			11.1	805	
7/27/22	39.7	2.5		7.7	715	
	32.3			6.7	587	
7/28/22	26.2	2.5	28	95.4	477	
7/29/22	26.8	2.5			477	
7/30/22	29.2	2.5		95.5	532	
7/31/22	23.2	2.5		95.5	422	
8/1/22	20.5	2.5		96.4	422	
8/2/22	17.8	2.5		95.4	330	
8/3/22	17.2	2.5			330	
8/4/22	19.8	2.5		95.4	367	
	60.6			93.9	1118	
8/5/22	43.1	2.5		78.9	848	
8/6/22	30.8	2.5		74.9	550	
8/7/22	22.6	2.5		65.8	412	
8/8/22	19.1	2.5		60.5	348	
8/9/22	19.6	2.5			348	
8/10/22	23.3	2.5		51.4	422	
8/11/22	20.5	2.5		47.7	367	
8/12/22	19.1	2.5			348	
8/13/22	17.2	2.5		39.3	312	
8/14/22	16.5	2.5		36.5	303	
8/15/22	14.6	2.5		32.4	266	
8/16/22	13.8	2.5			266	
8/17/22	16.5	2.5		26.3	312	
8/18/22	30.2	2.5	24		550	
8/19/22	24.7	2.5		96.6	440	
8/20/22	20.5	2.5		91.6	367	
8/21/22	18.5	2.5		85.5	330	
8/22/22	33.9	2.5		82.1	623	

Stewart Park Post-Treatment Assessment Report

Date	Fall Creek Flow Rate (cfs)	Application Rate (ppb)	Total Volume Sonar® Genesis Added (gallons)	Tank Level (%)	PPH (pulse per hour)	Event Detail
8/23/22	80.5	2.5		74.3	1466	
8/24/22	68.6	2.5		58.5	1246	
8/25/22	42.2	2.5		43.8	770	
8/26/22	33.9	2.5			623	
8/27/22	38.0	2.5			696	
8/28/22	31.6	2.5		24.5	568	
8/29/22	30.0	2.5		15.7	550	
8/30/22	24.7	2.5		8.8	449	
8/31/22	33.9	2.5		7.3	623	
8/31/22	37.2	2.5		6.8	678	Injection ended; unit off

cfs = cubic feet per second; ppb = parts per billion

Table 2-2 Fluridone (Sonar® H4C) Herbicide Application Summary by Treatment Date for Fall Creek

Date	Application Rate (ppb)	Total Pounds of Sonar® H4C		
		Golf Course Lagoon	Stewart Park Lagoon	Fall Creek Lagoon
6/16/2022	20	3	12	3
6/23/2022	20	3	12	3
6/30/2022	9	1	5	1
7/7/2022	9	1	5	1
7/14/2022	9	1	5	1
7/21/2022	9	1	5	1
7/28/2022	9	1	5	1
8/4/2022	9	1	5	1
8/11/2022	9	1	5	1
8/25/2022	9	1	5	1
Total Pounds		14	64	14

ppb = parts per billion

2.3.2 Cayuga Lake East

The Cayuga Lake East treatment area included a total of 43.4 acres at the southern end of Cayuga Lake offshore of Stewart Park and the Cornell Community Sailing Center. Three areas—Stewart Park 1, Stewart Park 2, and the Cornell Community Sailing Center—made up this general treatment area.

Ten fluridone treatments were scheduled for the Cayuga Lake East treatment area during summer 2022. Analysis of water monitoring data from 2019 and 2021 indicates that concentrations of fluridone in the water column necessary to control Hydrilla can be achieved with slightly lower application rates; this is an indication of lower water exchange or better retention time. Fluridone inputs from the Fall Creek treatment plot were also factored into determining appropriate application rates for the Cayuga Lake East treatment area. The Cayuga Lake West and Cayuga Lake Inlet treatment areas do not exhibit the same beneficial retention periods and therefore have higher application rates compared to the Cayuga Lake East treatment area. The treatment plan specified that the first two treatments would consist of fluridone applications at a rate of 20 ppb each, and the third through tenth treatments would be applied at a rate of 9 ppb (see **Table 2-3**). As indicated in Section 2.3.1, the goal was to maintain a concentration of 1 to 3 ppb over the course of the treatment, as the target concentration of fluridone in the water column for effective control of Hydrilla is 1 to 3 ppb. Sonar H4C is a slow-release, pellet formulation of fluridone. Therefore, application rates are higher than the target concentration for the water column. All application rates are in accordance with approved label. Treatments occurred approximately 7 days apart.

Table 2-3 In-lake Fluridone Herbicide Application Summary by Treatment Date for Cayuga Lake East

Date	Application Rate (ppb)	Total Pounds of Sonar® H4C		
		Stewart Park 1	Stewart Park 2	Cornell Community Sailing Center
6/30/2022	20	188	104	43
7/7/2022	20	188	104	43
7/14/2022	9	85	47	19
7/21/2022	9	85	47	19

Stewart Park Post-Treatment Assessment Report

Date	Application Rate (ppb)	Total Pounds of Sonar® H4C		
		Stewart Park 1	Stewart Park 2	Cornell Community Sailing Center
7/28/2022	9	85	47	19
8/4/2022	9	85	47	19
8/11/2022	9	85	47	19
8/18/2022	9	85	47	19
8/25/2022	9	85	47	19
9/1/2022	9	85	47	19
Total Pounds		1,056	584	195

ppb = parts per billion

2.3.3 Cayuga Lake West

The Cayuga Lake West treatment area included a total of 13.6 acres at the southern end of Cayuga Lake west of the confluence with Cayuga Inlet. Two areas—Tremans State Marine Park 1 and Tremans State Marine Park 2—made up this general treatment area.

Ten fluridone treatments were scheduled for the Cayuga Lake West treatment area during summer 2022. The treatment plan specified that the first two treatments would consist of application of fluridone at a rate of 20 ppb, and the third through tenth treatments at a rate of 13.75 ppb (see **Table 2-4**). As indicated in Section 2.3.1, the goal was to maintain a concentration of 1 to 3 ppb over the course of the treatment. Sonar H4C is a slow-release, pellet formulation of fluridone resulting in higher application rates than the target concentration for the water column. All application rates are in accordance with approved label. Treatments occurred approximately 7 days apart. As indicated in **Table 2-4**, on three dates (August 4, August 18, and September 1, 2022) the Tremans Marine State Park 1 treatment area was not treated due to high fluridone concentrations.

Table 2-4 In-lake Fluridone Herbicide Application Summary by Treatment Date for Cayuga Lake West

Date	Application Rate (ppb)	Total Pounds of Sonar® H4C	
		Tremans State Marine Park 1	Tremans State Marine Park 2
6/30/2022	20	135	30
7/7/2022	20	135	30
7/14/2022	13.75	93	21
7/21/2022	13.75	93	21
7/28/2022	13.75	93	21
8/4/2022	13.75	Not treated*	21
8/11/2022	13.75	93	21
8/18/2022	13.75	Not treated*	21
8/25/2022	13.75	93	21
9/1/2022	13.75	Not treated*	21
Total Pounds		828	228

Notes:

a Tremans State Marine Park was not treated on 8/4/2022, 8/18/2022 and 9/1/2022 due to higher fluridone concentrations present per water sampling results.

ppb = parts per billion

2.3.4 Cayuga Inlet

The Cayuga Lake Inlet treatment area consisted of 14.1 acres comprising four different areas within the Cayuga Inlet—Tremans State Marine Park Boat Launch, Cass Park, Cornell Crew Bay, and Cascadilla Creek. Ten herbicide applications were scheduled for the Cayuga Lake Inlet treatment area during summer 2022. The treatment plan specified that the first two treatments would consist of application of fluridone at a rate of 20 ppb, and the third through tenth treatments at a rate of 13.75 ppb (see **Table 2-5**). As indicated in Section 2.3.1, the goal was to maintain a concentration of 1 to 3 ppb over the course of the treatment. Sonar® H4C is a slow-release, pellet formulation of fluridone resulting in higher application rates than the target concentration for the water column. All application rates are in accordance with approved herbicide product label.

Table 2-5 In-lake Fluridone Herbicide Application Summary for Cayuga Inlet

Date	Application Rate (ppb)	Total Pounds of Sonar® H4C			
		Tremans State Marine Park Boat Launch	Cass Park	Cornell Crew Bay	Cascadilla Creek
6/30/2022	20	15	34	20	63
7/7/2022	20	15	34	20	63
7/14/2022	13.75	10	23	14	44
7/21/2022	13.75	10	23	14	44
7/28/2022	13.75	10	23	14	44
8/4/2022	13.75	10	23	14	44
8/11/2022	13.75	10	23	14	44
8/18/2022	13.75	10	23	14	44
8/25/2022	13.75	10	23	14	44
9/1/2022	13.75	10	23	14	44
Total Pounds		110	252	152	478

ppb = parts per billion

A chelated copper spot treatment application occurred within the Cornell Crew Bay along with one of the fluridone treatment events, on September 1, 2022, at an application rate not to exceed 1,000 ppb (1 part per million; see **Table 2-6**). The spot treatment area consisted of the 2.5-acre Cornell Crew Bay (see **Figures 1-1** and **1-2**). The chelated copper spot treatment was identified as being necessary because Hydrilla fragments were seen floating in the area near the dock in Cornell Crew Bay by the Tompkins County Soil and Water Conservation District, and subsequent rake tosses found Hydrilla.

Table 2-6 In-lake Chelated Copper Herbicide Application Summary for Cayuga Inlet

Date	Plot /Acres	Target Concentration/Application Rate (ppb)	Total Pounds of Harpoon® Granular
9/2/2022	Cornell Crew Bay	1,000	797
Total Pounds			797

ppb = parts per billion

2.4 Water Quality Sampling Methodology

As discussed above, for the Fall Creek, Cayuga Lake East, and Cayuga Lake West general treatment areas, fluridone was applied during 10 treatment events. Fall Creek was treated between June 16 and August 18, 2022. Cayuga Lake East, Cayuga Lake West, and the Cayuga Inlet were treated between June 30 and

September 1, 2022. The JV and USACE performed in-lake water quality sampling to determine the fluridone concentrations and dispersion of herbicide. The JV sampled weekly between June 20 and September 2, 2022, and USACE performed water quality sampling at 15 sites on three dates during the season: July 14, August 10, and September 7, 2022. See Appendix A for analytical results of the sampling.

2.4.1 JV Sampling

The JV collected 14 in-lake water samples across the four treatment areas and three reference locations (outside of a treatment area) following each of the fluridone treatment events except for the first two; only Fall Creek was treated during the first 2 weeks of the season (see **Figure 2-1** and **Table 2-7** for sample locations). The purpose of the sampling was to determine the fluridone concentrations just prior to the next planned treatment event so that herbicide application could be refined, if necessary, to maintain the proper concentrations throughout each event (i.e., to ensure follow-up applications would not exceed approved rates/concentrations). The sampling events were weather-dependent and scheduled so that results from each event were available for review by the Project team prior to the next application. Weekly sampling events occurred approximately 4 days following each application.

No samples were collected for the copper spot treatment.

Table 2-7 In-Lake Water Fluridone Sample Collection Sites Stewart Park, Cayuga Lake Hydrilla Demonstration Project

Treatment Areas	Sample Location	Latitude ^a	Longitude ^a
Fall Creek	FC	42.45940000000	-76.50750000000
Cayuga Lake East	SP1	42.46180000000	-76.51180000000
Cayuga Lake East	SP2	42.46200000000	-76.50830000000
Cayuga Lake East	SP3	42.46260000000	-76.50490000000
Cayuga Lake East	CS1	42.46880000000	-76.50190000000
Cayuga Lake West	TSMP1	42.46390000000	-76.52160000000
Cayuga Lake West	TSMP2	42.46320000000	-76.51790000000
Cayuga Inlet	TSMPL	42.45620000000	-76.51190000000
Cayuga Inlet	CP	42.45350000000	-76.51150000000
Cayuga Inlet	CC	42.45170000000	-76.50790000000
Cayuga Inlet	CCB	42.44760000000	-76.51120000000
Non-treated areas	OutN	42.47630000000	-76.50760000000
Non-treated areas	OutW	42.47040000000	-76.52690000000
Non-treated areas	OutS	42.44050000000	-76.51500000000

Note:

^a Latitude and longitude are provided in decimal degrees (WGS84).

CCB = Cornell Crew Bay

All of the samples were collected with a peristaltic pump as bottom samples. The 14 in-lake sampling locations were as follows (see **Figure 2-1**):

- Eleven samples within the treatment areas – one within the Fall Creek treatment area, three within the Cayuga Lake East treatment area, two within the Cayuga Lake West treatment area, and four within the Cayuga Lake Inlet treatment area;
- One sample approximately 0.5-miles north of the Cayuga Lake East treatment block along the eastern shoreline (OutN);
- One sample approximately 0.5- miles north of the Cayuga Lake West treatment area along the western shoreline (OutW); and

- One sample approximately 0.5-miles south of the Cayuga Inlet treatment area (OutS).

Samples from each location listed in **Table 2-7** were collected approximately at lake bottom to be representative of the fluridone concentrations where the plants were actively growing. The depth at each sample location was determined from the boat using a weighted tape to determine depth to bottom.

For each sample, the tubing intake was attached to a weighted tape and dropped down to the bottom to determine depth to bottom. The pump was started up as it was lowered and was lowered until sediment could be seen in the water flowing out of the end of the tubing, ensuring that the pump was on the lake bottom. Once on the bottom, the pump was raised slightly. When water in the tubing cleared of sediment, the sample was taken, and the depth of the tubing was recorded. The sample was retrieved and transferred into a brown high-density polyethylene 30-milliliter sample bottle provided by the laboratory. All samples were stored to avoid light exposure and shipped in coolers to SePRO Corporation (SePRO) in Whitakers, North Carolina, for analysis.

In-lake fluridone water samples were analyzed using a high-performance liquid chromatography (HPLC) method specific for fluridone. The standard operating procedure for measuring fluridone is a proprietary HPLC method developed by SePRO. The laboratory reported results for fluridone at a reporting limit of 1 ppb (micrograms per liter [$\mu\text{g/L}$]). Quality control samples were collected in the field during the post-application sampling period and consisted of field duplicate sample pairs collected at the same location at the rate of 5%.

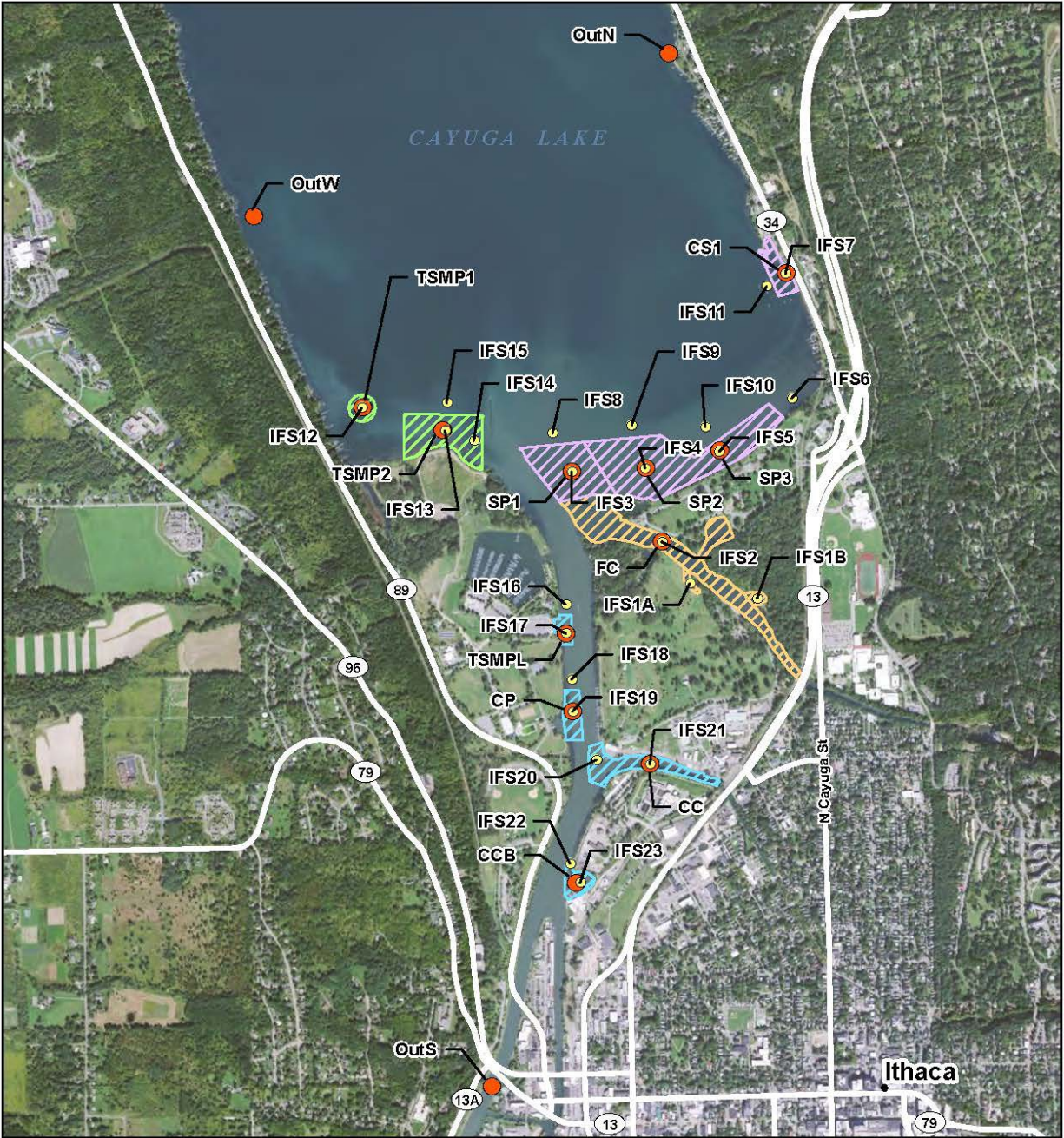


Figure 2-1 In-Lake Water Sample Locations
Cayuga Lake, Tompkins County, New York

2022 Hydrilla Treatment Areas

- Cayuga Inlet
- Cayuga Lake East
- Cayuga Lake West
- Fall Creek

- Fluridone Sample Sites- USACE
- Fluridone Sample Sites- EAS E&E JV

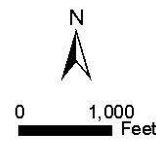


Figure 2-1 In-Lake Water Sample Locations

2.4.2 USACE Sampling

The USACE collected water samples at 23 sampling locations on three dates following the fluridone treatments. Sampling events occurred on July 14, August 10, and September 7, 2022. Samples were collected from within and adjacent to the four general treatment areas: Fall Creek, Cayuga Lake East, Cayuga Lake West, and Cayuga Inlet (see **Figure 2-1** and **Table 2-8**). Two samples were collected at each location, with the exception of the Golf Course lagoon (Site IFS1A) and Fall Creek Lagoon (Site IFS1B), which, due to shallow water depth, only had one sample taken at elbow depth. At all other sites, one sample was collected in the middle of the water column, and one was collected at the lake bottom with a water pump lowered to appropriate depth in the water column to address dilution and spread of herbicide. Due to the granular nature of fluridone, sampling in the middle and bottom of the water column is more likely to pick up herbicide residues than sampling at the water’s surface. USACE samples were analyzed by the Community Science Institute in Ithaca, New York, using the RaPID assay (enzyme-linked immunosorbent assay) method (RaPID Assay Fluridone Test Kit). The laboratory reported results for fluridone to a lower reporting limit of 0.5 ppb and an upper reporting limit of 10.0 ppb.

Table 2-8 Water Fluridone Sample Collection Sites Grouped by Treatment Area, Stewart Park, Cayuga Lake Hydrilla Demonstration Project

Treatment Areas	JV Sample Location	USACE Sample Location
Fall Creek	FC	IFS1A IFS1B IFS2
Cayuga Lake East	OutN SP1 SP2 SP3 CS1	IFS3 IFS4 IFS5 IFS6 IFS7 IFS8 IFS9 IFS10 IFS11
Cayuga Lake West	OutW TSMP1 TSMP2	IFS12 IFS13 IFS14 IFS15
Cayuga Inlet	OutS TSMPL CP CC CCB	IFS16 IFS17 IFS18 IFS19 IFS20 IFS21

CCB = Cornell Crew Bay

2.5 Results

The results for the JV fluridone water samples are presented in four separate tables, one for each general treatment area. **Table 2-8** lists the sample locations associated with each treatment area, and non-treatment area samples are included for comparison. The Fall Creek results are shown in **Table 2-9**, Cayuga Lake East results are shown in **Table 2-11**, and Cayuga Lake West results and Cayuga Inlet results are presented in **Table 2-13** and **Table 2-15**, respectively. In general, the highest concentrations of fluridone were detected in the areas within Cayuga Lake West.

2.5.1 Fall Creek Sampling

JV Sampling

For samples taken within Fall Creek proper, fluridone concentrations were below detection limits for the first two sampling events. For the next eight sampling events, fluridone concentrations were above detection limits and ranged from 2.8 to 7.5 ppb. Those higher values may have been influenced by the Sonar® Genesis applications upstream. As indicated in **Table 2-1**, the Sonar® Genesis injection system was online from June 21, 2022, through September 1, 2022.

Table 2-9 Fall Creek Treatment Area – JV Water Sampling Results for Fluridone

Date	Sample Location	Fluridone Concentration (ppb) ^{a,b}
6/20/2022	FC	<1
6/27/2022	FC	<1
7/5/2022	FC	6.6
7/11/2022	FC	6.2
7/18/2022	FC	5.8
7/25/2022	FC	2.8
8/1/2022	FC	<1
8/8/2022	FC	7.5/7.2
8/15/2022	FC	4.8
8/22/2022	FC	5.8
8/29/2022	FC	6.4

Note:

^a Two reported results in a single cell indicate an instance where a field duplicate sample was collected.

^b Bold denotes a sample location within application area as well as positive sample detections.

ppb = parts per billion

USACE Sampling

A variation of 1 ppb or less in herbicide residues was detected within the water column, as evidenced by differences in fluridone concentration between middle and bottom samples taken at the IFS2 MID/BOT locations (see **Table 2-10**). It is likely that these two sample locations were influenced by the Sonar® Genesis (liquid) via the injection system that was used in Fall Creek. Sampling results from September 7, 2022, 13 days after the final Sonar® H4C treatment within the lagoons, indicate that concentrations were 5.0 ppb at ISF1A and 2.5 ppb at IFS1B and <0.5 ppb for IFS2. Samples taken within the Golf Course lagoon (IFS1A) and Fall Creek lagoon (IFS1B) showed higher concentrations than those taken at the other sample sites within this treatment area on the last sampling date, potentially due to the small size of treatment areas and their position off of the creek, which may have meant slower flow and less mixing with the creek. Those factors may have facilitated less mixing within the lagoons.

Table 2-10 Fall Creek - USACE Water Sampling Results for Fluridone^a

Sample Location	Fluridone Concentration (ppb)		
	7/14/2022	8/10/2022	9/7/2022
IFS1A^b	7.9	7.6	5.0
IFS1B^b	7.1	5.6	2.5
IFS2 MID	8.6	6.9	<0.5
IFS2 BOT	9.8	5.9	<0.5

Notes:

- ^a Bold denotes sample location within application area as well as positive sample detections.
 - ^b Due to shallow depth, only one sample taken at elbow depth.
- BOT = bottom of water column; MID = middle of water column; ppb = parts per billion

2.5.2 Cayuga Lake East In-Lake Sampling

JV Sampling

Fluridone concentrations at the sample location (OutN) outside the treatment area remained below detection limits for the duration of the monitoring period between June 27 and September 2, 2022 (see **Table 2-11**). The fluridone concentrations at sample location SP1 were highest on seven of the ten sampling dates, which was likely due to the application of Sonar® Genesis in Fall Creek. Fall Creek flows directly into the area where SP1 is located. The highest fluridone concentration during the monitoring period was observed on July 11, 2022, at SP3 at 7.0 ppb. Fluridone concentrations on seven out of the ten sampling dates showed concentrations above the upper limit of the target concentration range (3.0 ppb). Overall, good retention of fluridone concentrations at or just above the target concentration of 1 to 3 ppb was evident at all three locations within treatment areas, with the exception of the Cornell Community Sailing Center (CS1) where concentrations were below detection limits for the first three dates sampled.

Table 2-11 Cayuga Lake East — JV Water Sampling Results for Fluridone^a

Sample Location	Date										
	Fluridone Concentration (ppb)										
	6/27/2022	7/5/2022	7/11/2022	7/18/2022	7/25/2022	8/1/2022	8/8/2022	8/15/2022	8/22/2022	8/29/2022	9/2/2022
OutN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
SP1	NS	1.6	3.6	6.4	3.4	5.4	>1	1.7	4.8/4.7^a	2.2	2.9
SP2	NS	1.1	6.7	2.1	2.9	4	<1	1.2	1.9	2	2.8
SP3	NS	<1	7.7	4	3.1	1.5	<1	<1	1.3	1.7	<1
CS1	NS	<1	<1	<1	1.2	1.5	2.6	4	3.7	3.2	2.5

Notes:

^a Bold denotes positive sample detections.

^b Two reported results in a single cell indicate an instance where a field duplicate sample was collected.

ppb = parts per billion; NS = No sample collected

USACE Sampling

Slight variations in fluridone concentrations between samples taken at the bottom versus samples taken in the middle of the water column were observed across all three sampling dates at multiple sample locations (see **Table 2-12**). In general, samples taken within the treatment area evidenced higher concentrations than samples taken outside, as expected. However, concentrations at IFS10, outside and north of the Stewart Park 1 treatment area on August 10, 2022, were higher than several treatment area sample locations. The highest concentrations within the Cayuga Lake East treatment area were seen at the three locations within the Stewart Park 1 and 2 treatment areas (IFS3, IFS4, and IFS5) on July 14, 2022. That may be an indication of the influence of the Fall Creek treatment areas, as the creek flows into the Stewart Park 1 and 2 treatment areas (see **Figure 1-1**). Sample location IFS11, located just outside the Cornell Community Sailing Center treatment area, had the lowest concentrations over the three sampling dates. Sampling results from September 7, 2022, 6 days after the final treatment, which occurred on September 1, 2022, indicate that concentrations were 2.0 ppb or below at the majority of sample locations, exceptions being ISF7 and ISF11. Generally speaking, retention of fluridone concentrations at or just above the target concentration of 1 to 3 ppb was evident for all sample locations within treatment areas.

Table 2-12 Cayuga Lake East — USACE Water Sampling Results for Fluridone^a

Sample Location	Fluridone Concentration (ppb)		
	7/14/2022	8/10/2022	9/7/2022
IFS3 MID	8.3	5.8	1.0
IFS3 BOT	9.5	6.5	<0.5
IFS4 MID	7.3	4.8	1.3
IFS4 BOT	7.5	4.4	1.4
IFS5 MID	7.9	4.4	1.5
IFS5 BOT	7.2	4.2	1.3
IFS6 MID	3.6	0.6	1.4
IFS6 BOT	4.0	0.5	1.8
IFS7 MID	1.0	2.0	2.8
IFS7 BOT	4.4	1.8	3.9
IFS8 MID	3.9	2.9	0.7
IFS8 BOT	4.4	5.2	0.6
IFS9 MID	1.4	1.9	1.3
IFS9 BOT	1.5	1.3	1.1
IFS10 MID	2.2	5.2	1.2
IFS10 BOT	2.1	5.2	1.2
IFS11 MID	<0.5	<0.5	1.9
IFS11 BOT	<0.5	<0.5	2.1

Notes:

^a Bold denotes sample location within application area as well as positive sample detections.

BOT = bottom of water column; MID = middle of water column

Although the JV and USACE sampling results were generally consistent, there were exceptions. For example, sampling conducted by the JV on July 11 and July 18, 2022, indicated a result of <1 ppb for CS1 within the Cornell Community Sailing Center and sampling conducted by USACE on July 14, 2022, indicated that the bottom sample taken at IFS7 was 4.4 ppb. The difference in concentrations may be due

to the fact that USACE sampled on an application date (July 14, 2022) and that resulted in a higher concentration at that location.

2.5.3. Cayuga Lake West Sampling

JV Sampling

Fluridone concentrations at the sampling location 0.5-miles north of the treatment area (OutW) were below detection limits for the duration of the monitoring period between June 20 and September 2, 2022 (see **Table 2-13**). Fluridone concentrations in the treatment area remained above detection limits for all sampling dates at both sampling locations within treatment areas with the exception of Treman State Marine Park 2 (TSMP2) on September 2, 2022. Fluridone concentrations were elevated on five of the sampling dates at sampling location TSMP1, which ranged from 7.9 to 22 ppb. TSMP1 had the highest fluridone concentrations across the Project area in 2022. This is likely a result of the lower incidence of storms and rain events and the relatively high macrophyte abundance in this areas which likely reduces the mixing often seen in other areas. Scheduled fluridone treatments were cancelled on two dates (August 4 and September 1, 2022) in TSMP1 due to elevated fluridone concentrations.

USACE Sampling

Significant variation in fluridone concentrations between the water column and bottom samples was evident at IFS12 within the TSMP one treatment area on July 14, 2022 (see **Table 2-14**). This may have been due to westward drift of herbicide from Treman State Marine Park 2. With the exception of the 10.3 ppb fluridone concentration documented in the bottom sample at that location and the 5.6 ppb concentration documented on August 10 at that same location, the overall fluridone concentrations within the Cayuga Lake West treatment area were within the target range of 1 ppb to 3 ppb. Sampling results from September 7, 2022, 6 days after the final treatment, which occurred on September 1, 2022, indicate that concentrations were 2.9 ppb or below at all locations. These results are generally consistent with JV sampling conducted on September 2, for sample locations that directly overlapped with USACE sampling locations (see **Figure 2-1**).

Table 2-13 Cayuga Lake West — JV Water Sampling Results for Fluridone^a

Sample Location	Fluridone Concentration (ppb)											
	6/20/2022	6/27/2022	7/5/2022	7/11/2022	7/18/2022	7/25/2022	8/1/2022	8/8/2022	8/15/2022	8/22/2022	8/29/2022	9/2/2022
OutW	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TSMP1	NS	NS	3.2	2.9	15.2	8.7/7.9^b	22	2.5^c	12.3	3.9	13.4	2.1/2.4^b
TSMP2	NS	NS	2.5	2	5.8	4.4	3.1	2.3	3.2	1.6	7.2	<1

Notes:

^a Bold values denote positive detections.

^b Two reported results in a single cell indicate an instance where a field duplicate sample was collected.

^c TSMP1 was not treated on August 4, 2022, and September 1, 2022, due to elevated fluridone concentrations.

ppb = parts per billion

Table 2-14 Cayuga Lake West - USACE In-Lake Water Sampling Results for Fluridone

Sample Code	Fluridone Concentration (ppb) ^a		
	7/14/2022	8/10/2022	9/7/2022
IFS12 MID	3.3	3.4	1.7
IFS12 BOT	10.3	5.6	2.8
IFS13 MID	2.4	1.9	2.4
IFS13 BOT	2.4	1.6	2.9
IFS14 MID	2.7	1.5	1.9
IFS14 BOT	2.7	1.5	1.4
IFS15 MID	0.7	1.1	1.3
IFS15 BOT	2.6	1.0	0.7

Notes:

^a Bold denotes sample location within application area as well as positive sample detections.

BOT = bottom of water column; MID = middle of water column; ppb = parts per billion

2.5.4 Cayuga Inlet Sampling

JV Sampling

Fluridone concentrations at the sample location (OutS) outside the treatment area remained below detection limits for the duration of the monitoring period between June 20 and September 2, 2022 (see **Table 2-15**). Overall, the concentrations were generally within the target range of 1 to 3 ppb, with several exceptions. The highest fluridone concentration during the monitoring period was observed on August 22, 2022, at Cornell Crew Bay (CCB) at 6.5 ppb.

USACE Sampling

Fluridone concentrations were measured at or below detection limits up to 5.2 ppb for the Cayuga Lake Inlet treatment area for USACE samples. The highest concentration (5.2 ppb) was reported on August 10, 2022, at IFS21. USACE sampling indicates that lower fluridone concentrations were documented for the northern sites within Cayuga Inlet compared with samples taken within Fall Creek and the CCB. Sampling results from September 7, 2022, 6 days after the final treatment, which occurred on September 1, 2022, indicate that concentrations were 4.4 ppb or below at all locations, with locations outside of treatment areas (IFS16 and IFS18) reporting less than detection limits. Overall, the JV sample results were generally consistent with the USACE sample results.

Table 2-15 Cayuga Lake Inlet — JV In-Lake Water Sampling Results for Fluridone^a

Sample Location	Fluridone Concentration (ppb)											
	6/20/2022	6/27/2022	7/5/2022	7/11/2022	7/18/2022	7/25/2022	8/1/2022	8/8/2022	8/15/2022	8/22/2022	8/29/2022	9/2/2022
OutS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TSMPL	NS	NS	<1	1.4	1.7	2.3	2.4	1.2	1.5	2.4	<1	1.6
CP	NS	NS	<1	<1	1.1	1.3	2.3	1.6	1.3	2.2	1.1/1.4^b	1
CC	NS	NS	<1	3	4.3	3.1	4.7	5.6	4.6	2.3	5.5	4
CCB	NS	NS	<1	1.3	3.2	2.6	3.3	1.5	<1	6.5	2.9	4.4

Notes:

^a Bold values denote positive detections.

^b Two reported results in a single cell indicate an instance where a field duplicate sample was collected.

ppb = parts per billion; NS= No sample collected

Table 2-16 Cayuga Lake Inlet - USACE Water Sampling Results for Fluridone^a

Sample Code	Fluridone Concentration (ppb)		
	7/14/2022	8/10/2022	9/7/2022
IFS16 MID	0.9	1.7	<0.5
IFS16 BOT	1.2	1.9	<0.5
IFS17 MID	1.2	1.4	<0.5
IFS17 BOT	1.8	1.9	<0.5
IFS18 MID	1.0	1.7	<0.5
IFS18 BOT	1.1	1.8	<0.5
IFS19 MID	1.4	1.6	0.5
IFS19 BOT	1.1	2.3	0.5
IFS20 MID	1.0	1.1	<0.5
IFS20 BOT	1.8	4.4	0.9
IFS21 MID	2.9	4.5	1.7
IFS21 BOT	3.9	5.2	3.0
IFS22 MID	1.4	1.0	<0.5
IFS22 BOT	1.5	1.5	0.8
IFS23 MID	1.9	2.1	3.4
IFS23 BOT	4.9	3.7	4.4

Notes:

^a Bold denotes sample location within application area as well as positive sample detections.

BOT = bottom of water column; MID = middle of water column; NS= No sample collected; ppb = parts per billion

2.6 Vegetative Monitoring and Treatment Summary

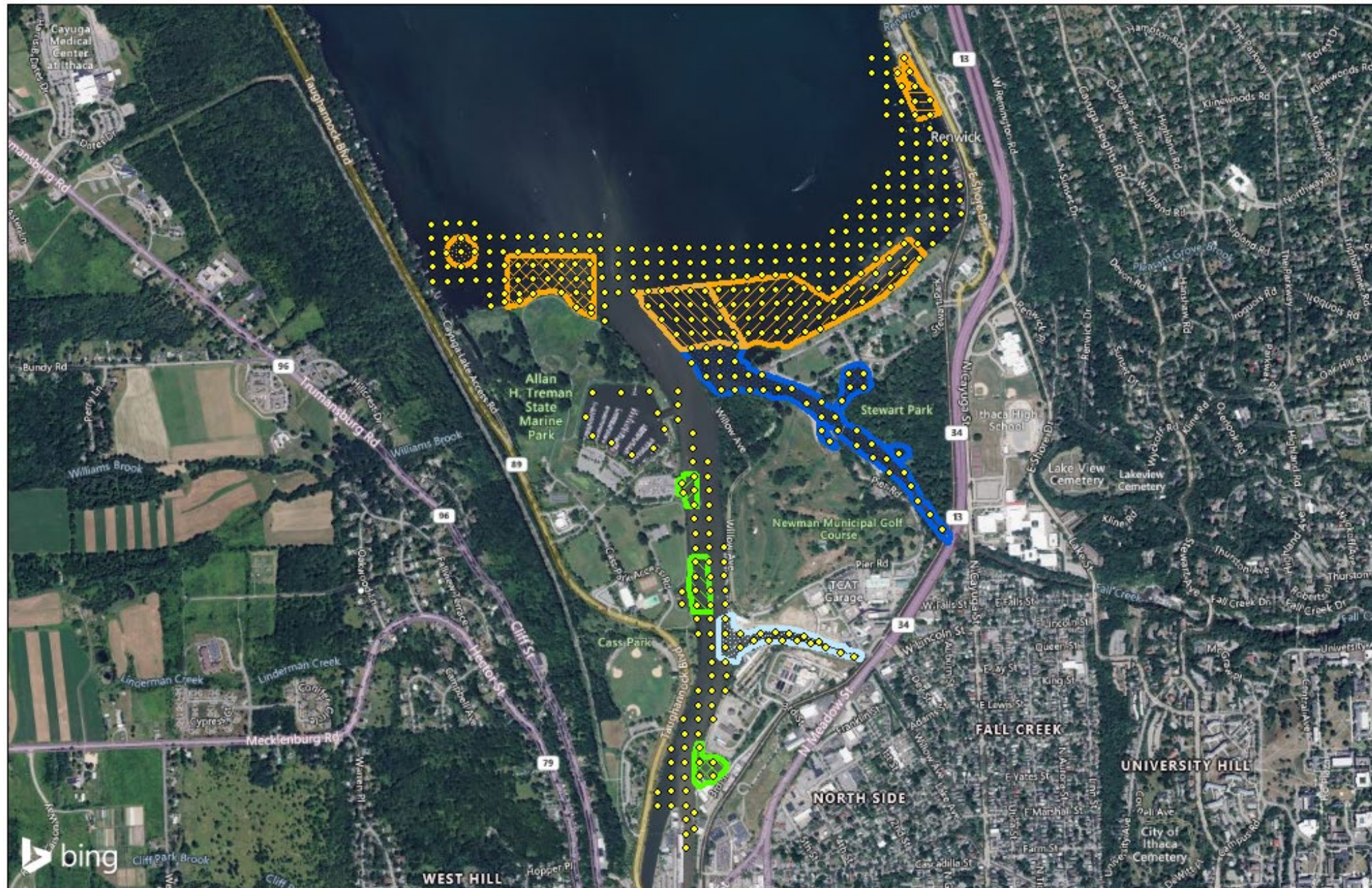
The USACE conducted point intercept surveys at all fluridone treatment locations on four dates [June 14th (pre-treatment), July 13th & August 10th (during treatment), and October 5th (post-treatment)] throughout the growing season to determine Hydrilla distribution (see **Figure 2-2**). Hydrilla was detected at six separate locations within the first three-point intercept surveys. Five of the Hydrilla patches detected in the point intercept surveys were located within the fluridone and/or chelated copper treatment plots (see **Figure 2-3**). Comparing pre-/post-treatment point intercept surveys demonstrates that the treatment was successful at eliminating known patches of Hydrilla within targeted treatment plots. No Hydrilla was found in the October post-treatment survey.

In addition, there was an observed drop in abundance of plants within all treatment areas again this year, but diversity of native plants was maintained with 8 of the 11 dominant species in the point intercept survey being native plants and the two of the invasive plants (starry stonewort and eurasian watermilfoil) decreased in percent occurrence this year (see **Table 2-17**).

Table 2-17 Summary of Dominant Species Percent Occurrence in Point Intercept Surveys

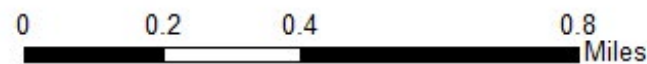
Species	Native/Invasive	Percent Occurrence (increase/decrease from 2021)
Sago pondweed (<i>Vallisneria americana</i>)	Native	+30.7
Coontail (<i>Ceratophyllum demersum</i>)	Native	-11.4
Small leaved pondweeds (<i>Potamogeton</i> spp)	Native	+10.5
Eelgrass (<i>Zostera</i>)	Native	-8.2
Muskgrass (<i>Chara vulgaris</i>)	Native	-6.2
Elodea (<i>Elodea</i> sp.)	Native	-6.1
Starry stonewort (<i>Nitellopsis obtuse</i>)	Invasive	-6.0
Curly-leaf pondweed (<i>Potamogeton crispus</i>)	Invasive	+5.0
Eurasian waterfnilfoil (<i>Myriophyllum spicatum</i>)	Invasive	-4.5
White-stem pondweed (<i>Potamogeton praelongus</i>)	Native	+4.3
Fragrant water lily (<i>Nymphaea odorata</i>)	Native	+3.2

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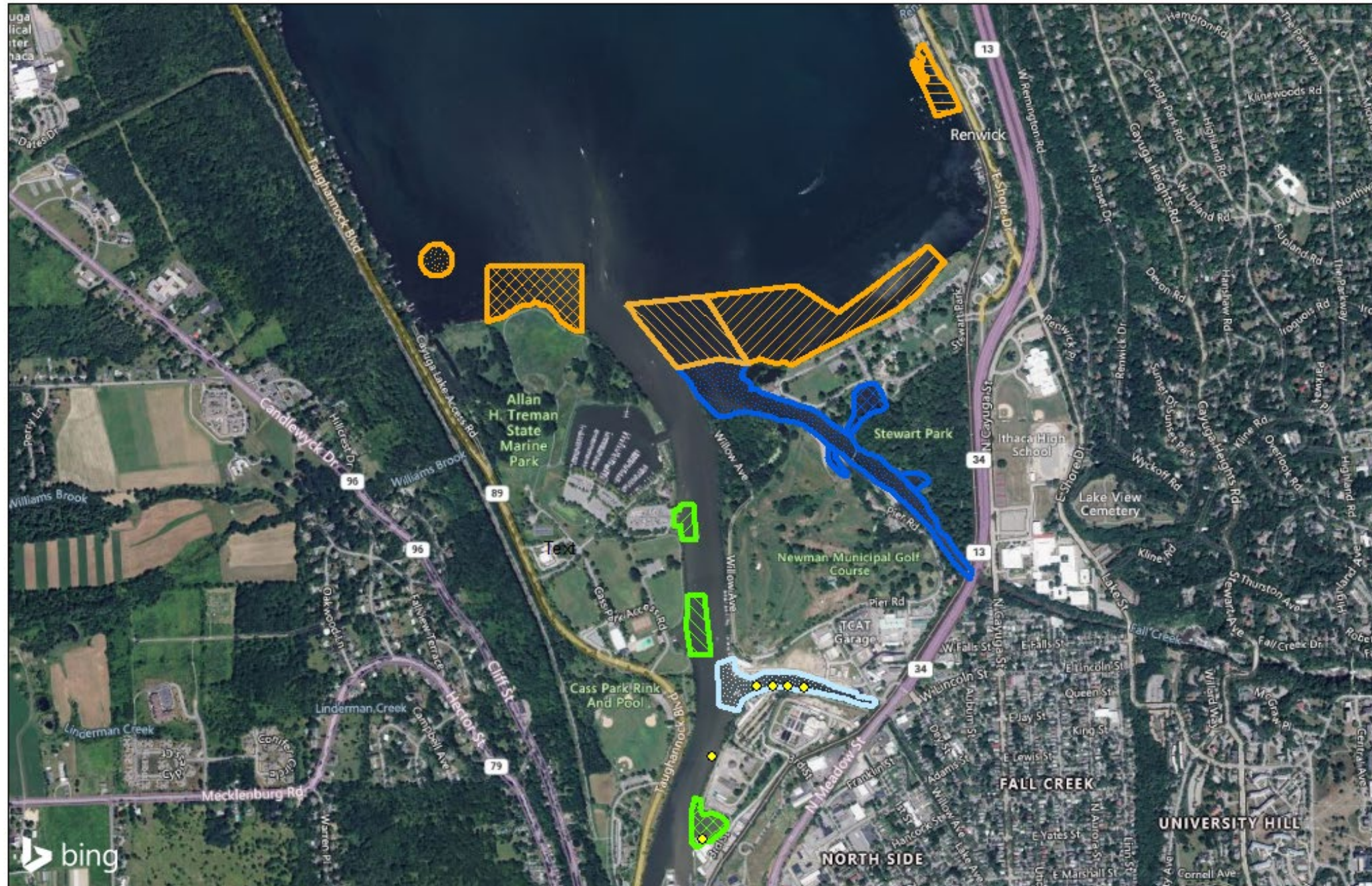
- ◆ 2022 Point Intercept Survey Points
- Floridae Treatment Areas: (93.6 acres)**
- Stewart Park 1 (27.5 acres)
- Stewart Park 2 (12.5 acres)
- Cornell Community Sailing Club (3.4 acres)
- Treman State Marine Park 1 (11.6 acres)
- Treman State Marine Park 2 (2.0 acres)
- CI-Treman State Marine Park Launch (1.5 acres)
- CI - Cass Park (3.1 acres)
- CI - Cornell Crew Bay (2.5 acres)
- Cascadilla Creek (6.7 acres)
- Fall Creek (18.7 acres)
- Golf Course Lagoon (8.6 acres)
- Fall Creek Lagoon (8.7 acres)
- Stewart Park Lagoon (2.5 acres)

2022 Point Intercept Survey Locations Cayuga Lake at Ithaca, NY



US Army Corps of Engineers.
Buffalo District
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Figure 2-2 Point Intercept Surveys Locations for 2022 in Cayuga Lake at Ithaca, NY



- Hydrilla Locations 2022
- Floridae Treatment Areas (93.6 acres)**
 - Stewart Park 1 (27.5 acres)
 - Stewart Park 2 (12.5 acres)
 - Carroll Community Sailing Club (3.4 acres)
 - Treman State Marine Park 1 (1.16 acres)
 - Treman State Marine Park 2 (2.0 acres)
 - CI - Treman State Marine Park Launch (1.5 acres)
- CI - Cass Park (3.1 acres)
- CI - Carroll Crew Bay (2.5 acres)
- Cascadilla Creek (6.7 acres)
- Fall Creek (18.7 acres)
- Golf Course Lagoon (0.6 acres)
- Fall Creek Lagoon (0.7 acres)
- Stewart Park Lagoon (2.5 acres)

2022 PIS Hydrilla Locations Cayuga Lake at Ithaca, NY

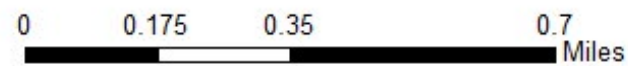


Figure 2-3 Hydrilla Locations from Point Intercept Surveys during June-August 2022 in Cayuga Lake at Ithaca, NY.

3 STUDY IMPROVEMENTS

The study improvements summarized in this section are based on lessons learned from the third year of the herbicide application effort, coordination with the study partners on work plan development, and activities conducted during the 2022 herbicide application.

3.1 Herbicide Application and Analysis

3.1.1 Herbicide Application

Transfer of the herbicide from the shore-based areas to the jon boat and airboat, and application of the herbicide in 2022 was smooth and efficient. The staging area at the Allen H. Treman State Park launch adequately supported operations for the in-lake treatments. Public access to the boat ramps during use by the applicators was uninterrupted. The Project team must continue to consider long-range weather forecasts when planning future applications/sampling and build in schedule flexibility for each event.

3.1.2 Analysis

SePRO's proprietary HPLC method was used for analysis of fluridone in the in-lake samples taken by the JV. USACE samples were analyzed by the Community Science Institute in Ithaca, New York, using the RaPID assay (enzyme-linked immunosorbent assay) method (RaPID Assay Fluridone Test Kit), which allowed for a comparison of fluridone testing results.

3.2 2022 Lessons Learned

3.2.1 Herbicide Application

Budgeting for the operation of the Sonar® Genesis injection system for 90 days with a limit of 80 cfs was sufficient given the rainfall experienced in 2022.

For 2022, new Kasco spreaders were used that seemed to work more accurately and created much less noise, making the application safer due to easier communications on the boat. For 2023, the spreaders should be mounted with a steeper upward angle to hopefully increase the diameter of product being dispersed.

3.2.2 Communication

Twenty-four-hour email notification prior to herbicide treatments, including changes in treatment schedule, was effective, and no issues were raised by the Tompkins County Health Department or other stakeholders. This type of communication needs to continue in future treatment programs.

Due to unpredictable weather conditions and the open nature of the lake, inclement weather can arise on short notice and cause delays or cancellations in applications or sampling events. No such delays occurred in 2022.

3.2.3 Sampling and Monitoring

Frequency of In-Lake Sampling and Logistics. In-lake samples should continue to be collected between day four and day seven after each fluridone application so that results can be obtained before the next treatment (assuming a 48-hour turnaround time [TAT]). That way, the results can be used to ensure that target concentrations are achieved and not exceeded.

Analytical Turnaround Times. Samples are analyzed on a 48-hour TAT. There are no apparent needs to change this TAT at this time. If weather significantly affects sampling, it may be necessary to implement a 24-hour TAT, if deemed necessary.

4 REFERENCES

- USACE (United States Army Corps of Engineers). 2022. *Architect-Engineer Scope of Work Aquatic Plant Control ERDC Demonstration Project Stewart Park, Cayuga Lake, Ithaca, NY*. April 2022.
- USGS (United States Geological Survey). 2022. Fall Creek Near Ithaca water discharge data. Available at: <https://waterdata.usgs.gov/monitoring-location/04234000/#parameterCode=00060&startDT=2020-06-01&endDT=2021-10-30>; accessed on October 7, 2022.