



Herbicide Containment Study Protocol

Eagle Lake, NY

Introduction

When herbicides are applied in a lake system, many factors dictate the movement of the active ingredient, including the type of product applied (granular vs. liquid), water currents, wind action, and rainfall events. Turbidity curtains can be deployed to contain the active ingredient in target treatment areas, and restrict the movement into environmentally sensitive areas. The following protocol details the methodology to be used to perform a dye study on three treatment plots at Eagle Lake (Essex County, NY), in an effort to demonstrate that turbidity curtains can be used effectively to contain herbicides.

Containment Areas

For this study, three containment areas will be utilized, as depicted on the attached map. Prior to the study, the client needs to perform a bathymetry survey of all three sites to determine curtain depth. The measurements of the curtain are estimated. Actual curtain lengths will be determined based on the size of the Eurasian water milfoil bed in the target area. These sites are described as follows:

Containment Site 1: This site is located along the southern shoreline in the lower basin. Two 300 foot sections of the turbidity curtain will be deployed at this site anchored to the shoreline, and a fixed point in the water. The target Eurasian water milfoil bed is #47 on the Eagle Lake Eurasian Water Milfoil Location Map.

Containment Site 2: This site is located to the south of the island off the southeast shoreline in the upper basin, near the bridge where route 74 crosses the lake. Two sections of turbidity curtain will be deployed at this site. The south curtain will be attached to the southeast part of the island and the southern shore, approximately 300 feet long. The east curtain will be attached to the east point of the island to the west shore of the peninsula, approximately 450 feet long. The target Eurasian water milfoil beds are # 6 through #10 on the Eagle Lake Eurasian Water Milfoil Location Map.

Containment Site 3: This site is in the open water of the upper basin, west of the island. Four 300 foot sections of curtain will be attached to four fixed points, creating a square containment area. The target Eurasian water milfoil bed is #1 on the Eagle Lake Eurasian Water Milfoil Location Map.

Turbidity Curtain Specifications

The turbidity curtain used for this study is similar to those employed by Allied Biological, Inc. (2005, Lamoka Lake, NY using Sonar AS) and Getsinger, et. al. (1997, using triclopyr). The curtain is manufactured by Indian Valley Industries, located outside of Binghamton, NY. The curtain is classified as a Type I floating turbidity curtain constructed of 14 oz. impermeable PVC. The curtain is manufactured in 50 foot sections (for ease of deployment) that need to be attached by hand. It is assumed the curtain will be 15 foot high, although this height will be determined following the bathymetry survey. Floatation is provided by 12"x 12" EPS foam blocks, which provides 60 lbs. of buoyancy per LF. The top of the curtain is 5/16" vinyl-coated cable (9800# strength) that is attached to other sections via heavy duty clips and also serves as the anchoring points. The bottom of the curtain is 1/4" ballast chain that keeps the curtain on the lake bottom. The seams of the curtain are heat-sealed. Each 50 foot section is attached to another section via hand tying ropes into #4 grommets spaced 12" apart along the seam. Velcro overlaps along the entire seam ensure a tighter seal.

Curtain Installation

Prior to installation, the individual sections of the curtain need to be attached by hand. This is accomplished by hand-tying short lengths of rope along all of the grommets of the seam, and then firmly pressing the Velcro flap over the seam. The cable at the top is attached to the next section via a heavy-duty clip. Likewise, the ballast chain is attached to the next section of chain via a heavy-duty clip. Next, the bottom of the curtain is bundled/folded up to the floatation top and secured with another length of rope. The assembly should be performed on the shore, and then the whole assembled curtain is towed into place on the lake by a boat.

The curtain cable needs to be attached to a solid object (a tree is best, or a 4" by 4" post sunk into the ground or lake bottom in the case of the apex of site # 1, or the corners of the containment at site 3) on each side. Once the cables are attached, and the curtain is in position, it should be inspected for twists. Following inspection, the top ropes are cut, and the curtain unfurls to the lake bottom. The curtain should be examined by divers, or an underwater camera to ensure it is lying flat on the bottom. In addition, the curtain is anchored to the bottom of the lake with 22 lb. danforth-style anchors, situated on each side of the curtain, every 100 feet apart. Containment site 3 might require additional anchors. Three feet of 1/2" chain will be attached to each anchor lead-line, which is affixed with a 1 foot diameter buoy.

It is estimated the installation of the curtains will take five field technicians two days to complete.

Dye Application

Rhodamine WT (Keystone Aniline Corp., Chicago, IL) is the dye of choice in water tracing applications. This liquid fluorescent dye is readily detected in the water with a fluorometer, simulates the movement of an herbicide in the water column, and is environmentally safe to use in aquatic systems. It's a bright red fluorescent dye (approximately 21% active dye) with exceptionally high tinctorial strength and a low tendency to stain silt, sediment, organic matter (plants) or suspended matter in fresh or salt water. Rhodamine WT dye liquid is certified by the National Sanitation Foundation International to ANSI/NSF Standard 60: Drinking Water Treatment Chemicals-Health Effects, for use in tracing drinking water under the following conditions, "Concentrations of Rhodamine WT Liquid in drinking water is not to exceed 0.01 PPB and exposure (end) use is to be infrequent." For more information on Rhodamine WT Liquid dye, see the MSDS sheet and technical bulletin 89 attached to this protocol.

A permit is required for its application in New York, which could take 12 to 16 weeks to apply for and be granted.

The rhodamine WT dye needs to be applied to each containment plot at a 10 ppb concentration. The bathymetry data collected by the client will be used to calculate the water volume of each plot, to determine the amount of dye needed to achieve a 10 ppb concentration. The dye will be applied via a tank and pump array in an airboat through weighted diffuser lines below the surface of the water. Since this is a dye that stains everything it comes into contact with, dedicated tanks and lines need to be purchased and used solely for this application.

It is estimated the treatments in all three containment plots will take four to six hours to complete with two field technicians.

Dye Monitoring

The crucial part of the study is the monitoring of the dye after applied in the water. A discreet sampler attached to a calibrated fluorometer will be used to measure the concentration of the dye throughout the lake. The fluorometer used will be an Aquafluor™ (Turner Designs, Sunnyvale, CA) dual channel mini-fluorometer. The instruction manual for this meter is attached to this protocol. The unit uses a single point and blank calibration, and has a Rhodamine dye detection limit of 0.4 ppb.

Below is a table listing the recommended sampling sites, including site name, GPS coordinates, and a description of the site location. These sample sites are also depicted on the containment study map included with this protocol. At each site, samples will be collected one foot under the surface of the water, at mid-depth, and one foot above the lake bottom. Samples shall be labeled

with the site number, and then an S, M, or B, for the surface, mid-depth, and near bottom depths, respectively. For example, the site 1 bottom sample would be labeled 1B, while the site 15 mid-depth would be labeled 15M. Samples will be collected at each site 4, 8, 24, 48, 72, and 144 hours (6 sampling events, total) after treatment to cover a wide range of concentration exposure models.

Table 1 Dye Sample Sites

Site #	GPS Coordinates	Description
1	43°52'26.02"N 73°36'14.07"W	Boat Launch
2	43°52'20.63"N 73°35'58.93"W	Site 1, Inside West
3	43°52'20.79"N 73°35'56.02"W	Site 1, Inside East
4	43°52'22.05"N 73°35'58.81"W	Site 1, Outside West
5	43°52'22.51"N 73°35'54.28"W	Site 1, Outside East
6	43°52'35.40"N 73°35'36.46"W	South of Bridge
7	43°52'42.64"N 73°35'18.74"W	Site 2, Inside North
8	43°52'38.88"N 73°35'24.44"W	Site 2, Inside South
9	43°52'40.55"N 73°35'30.01"W	Site 2, Outside West
10	43°52'46.16"N 73°35'19.96"W	Site 2, Outside North
11	43°52'55.12"N 73°34'49.13"W	Site 3, Inside Southwest
12	43°52'54.24"N 73°34'50.35"W	Site 3, Inside Northeast
13	43°52'56.62"N 73°34'49.17"W	Site 3 Outside North
14	43°52'51.85"N 73°34'49.01"W	Site 3, Outside South
15	43°52'53.82"N 73°34'51.74"W	Site 3, Outside West
16	43°52'53.99"N 73°34'45.29"W	Site 3, Outside East

The dye monitoring will require a crew of two field technicians, trained to use and calibrate the fluorometer, and a boat to be on site for 6 days. The boat used to collect the dye water samples must not be the application boat, to prevent cross contaminating the sites. A clean supply of water (not from the lake) needs to be on hand to rinse the equipment between each sample to prevent dye contamination. The fluorometer will be calibrated each day before use. Additional calibrations might be required, if drift is suspected during the sampling. On day one, the unit will be calibrated with a 10 ppb standard, but a 5 ppb standard will be used on day two and beyond.

Turbidity Curtain Removal and Storage

Following the dye study, the turbidity curtain sections need to be removed. It is estimated this process will take a crew of five field technicians two days to complete, using two boats. The curtain will be removed three to four sections at a time. Each section will be towed back to the boat launch and carefully removed from the water, scrubbed with brushes and rinsed with lake water (through a gas powered water pump), dried, and folded for storage. Following removal of the curtain, anchors will be removed as well as any posts used to secure the curtain.

The folded sections of the curtain will then be placed on a truck and shipped to an inside storage facility until the following year (approximately 9 months). Then, the same pieces of the turbidity curtain can be reused to perform the herbicide application, provided the results of this study are approved.

References

Getsinger, K.D., E.G. Turner, J. D. Madsen, M. D. Netherland. 1997. *Restoring Native Vegetation in a Eurasian Water Milfoil-Dominated Plant Community using the Herbicide Triclopyr*. Regulated Rivers: Research & Management, vol. 13, p. 357-375.

Keystone Aniline R&D Laboratories. 2002. *Technical Bulletin # 89: Keyacid Rhodamine WT Liquid*. Keystone Aniline Corporation, Chicago, IL.