Design of Herbicide Concentration Monitoring Plans for Small-Scale Herbicide Treatments

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Objective: Monitoring herbicide concentrations following aquatic plant management actions can provide essential information necessary to interpret and assess management outcomes. The analysis of lake water samples following application of herbicides utilized for aquatic plant control can provide valuable information on herbicide dissipation and degradation patterns within lakes. When this information is paired with pre- and post-treatment aquatic plant data, it can also provide important insight into the observed target species control efficacy, native plant selectivity, and scale of impact.

This document provides guidance on the design of herbicide concentration monitoring plans for small-scale (e.g., 'spot') aquatic herbicide treatments. A small-scale herbicide treatment is defined in this document as an application of one or more aquatic herbicides that will result in a lake-wide concentration which is insufficient to impact target and/or non-target aquatic plant species on a lake-wide scale, assuming complete dissipation throughout the waterbody. Guidance for the design of herbicide concentration monitoring associated with large-scale treatments can be found in this document.

Approach: An herbicide concentration monitoring plan template is available. The plan should include the following information:

- Lake name, county, and waterbody identification code (WBIC)
- Lake surface area, mean depth, and maximum depth
- Lake trophic status and lake type
- Herbicide active ingredient and application rate
- Treatment area and target species
- Map of lake with labeled sampling sites
- Sample site lat/long coordinates
- Sampling intervals
- Instructions for in field sample collection, sample storage, and shipping
- A copy of the sample data sheet specific to the lake
- Contact information for person(s) coordinating the sampling

Sample sites:

- One to three sampling sites should be sufficient to characterize herbicide concentration exposure times in most small-scale treatment areas. One sampling site would likely be sufficient within a small (< 5 acre) treatment area. Two or three sampling sites may be required within larger or more complex treatment areas (Figure 1). If there are resources of concern near the treatment area (i.e., wild rice bed), a sampling site can also be placed within this untreated area.

- If a limno-barrier curtain is being used, two sites should be placed within the interior of the barrier curtain, and two sites placed directly outside the barrier curtain. See this document for more information.
- Sample locations should be located precisely on a map, and the numerical lat/long coordinates should be provided in decimal degrees for use in a GPS.
- Each sample location must have a SWIMS Station ID assigned to it. The WDNR's Surface Water Data Viewer can be used to find existing SWIMS Station IDs on a waterbody. Contact your regional DNR APM coordinator if you need a new SWIMS Station ID created for a sample location.

Sample intervals: Sampling intervals should be specified in the herbicide concentration monitoring plan. Sample time intervals are specified in hours after treatment (HAT) and may vary depending on treatment area and configuration. Sampling intervals may also vary depending on the specific herbicide being monitored. Factors that affect the anticipated exposure time include: size of treatment area, configuration of treatment area, water flow, wind velocity and direction, and the proximity of other treatment areas. Larger treatment areas and those located in more protected areas of lakes (i.e., bays or channels) generally result in longer exposure times. Contact your regional DNR APM coordinator for additional guidance on sampling intensity. Sample intervals should generally include:

- Open water treatments (<5 acres): 3, 6, 9, 24 & 48 HAT
- Protected bay treatments or larger (>5 acre) treatment areas: 3, 6, 9, 24, 48, 96, & 168 HAT
- If a limno-barrier curtain is being used, samples should be taken at approximately 1, 6, and 24 HAT, and then every 24 hours until barrier removal. Samples should then be taken at approximately 1, 3, 6, 12, & 24 hours after barrier removal. See this document for more information.
- For florpyrauxifen-benzyl (e.g., ProcellaCOR™) treatment lakes:
    - The Wisconsin State Lab of Hygiene (WSLH) currently does not have the capability to analyze water samples for florpyrauxifen-benzyl, and samples are analyzed by EPL Bio Analytical Services (EPL). In addition to the post-treatment water samples, the lab requests that a single water sample be collected prior to the treatment as an untreated control. This pre-treatment sample can be collected from any site at a time that is most convenient, but as close to the treatment date as possible.

The actual sampling intervals may vary due to hazardous weather conditions, volunteer availability, and unique lake conditions. If a sample cannot be collected at the time noted in the plan, the sample should be collected as soon as reasonably possible, and the change should be recorded on the datasheet. Direct communication between the water sample collector and the herbicide applicator is necessary to ensure the collector is prepared to collect samples after treatment is completed.

A copy of your proposed monitoring plan should be sent to your regional DNR APM coordinator for review and approval well in advance of any proposed treatment. Once a monitoring plan is approved, your coordinator can provide assistance in obtaining the necessary sampling supplies (i.e., samples bottles, acid, etc.) from the respective lab.

Instructions for sample collection, sample storage, and shipping:

- Water samples should be collected using an integrated sampling device (Figure 2), which is used to collect a surface water sample from 0 to 6 feet deep.
- Upon arrival at the site, rinse the integrated sampler and composite water collection bottle three times with lake water before each sample collection.
- Take the water sample from the opposite side of the boat as you rinsed. Slowly lower the integrated sampler vertically to 6 feet deep (which is typically marked with a line). After reaching 6-foot depth, slowly pull sampler up vertically. If the sampling location is shallower than 6-feet, lower the sampler into the water column so that it remains at least 1 foot above the lake sediment bottom.
- Empty the contents of the integrated sampler into the composite water collection bottle by pushing the ball valve end against the bar installed across the bottle's mouth, which pops the ball valve up and releases water from the sampler (Figure 2).
- Gently mix the water in the composite bottle, and carefully pour the water into the sample bottles provided by the lab.
- Depending on the herbicide being analyzed, a small amount of acid may need to be added to each sample bottle.
    - The WSLH can analyze for 2,4-D, endothall, and copper; they will provide a sampling kit which will include bottles, labels, acid, datasheets, a shipping cooler, and sample handling instructions (Figure 3).
    - The sampling kit provided by EPL for florpyrauxifen-benzyl analysis contain amber bottles with a pre-measured amount of preservative already within them (Figure 4).
- Write the sampling site, sampling interval (e.g., 9 HAT), date (MM/DD/YY), and collection time (e.g., 18:35) on the bottle's label.
    - The WSLH will provide datasheets for use when collecting water samples (Figure 5). Similar datasheets can be printed off and included with samples sent to EPL. <u>It is important to use a separate data sheet for each sampling interval that you monitor.</u>
    - On each sampling sheet, include: lake name, county, WBIC, collector name, phone number, test requested (e.g., herbicide active ingredient), and sampling interval.
    - Within each row, write the site name, SWIMS station ID, sample depth, date, time, water temperature (see Figure 6 for Fahrenheit to Celsius conversion table), and wind direction and speed.
- Samples should be temporarily stored in a cooler for transport, and then in a refrigerator until shipped.
- Once all sample intervals are completed, the water samples and datasheets should be shipped overnight and with an ice pack to the appropriate lab. Samples should not be shipped on loose ice. Samples should not be shipped on a Friday, but rather refrigerated and shipped on the following Monday.
    - For analysis of 2,4-D, endothall or copper:
        - Wisconsin State Lab of Hygiene
          EHD Organic Chemistry Dept.
          2601 Agriculture Drive
          Madison, WI 53718

    - For analysis of florpyrauxifen-benzyl (e.g., ProcellaCOR™):

- EPL Bio Analytical Services
  9095 W. Harristown Blvd.
  Niantic, IL 62551

Figure 1. Example of sample locations in a small-scale treatment area.

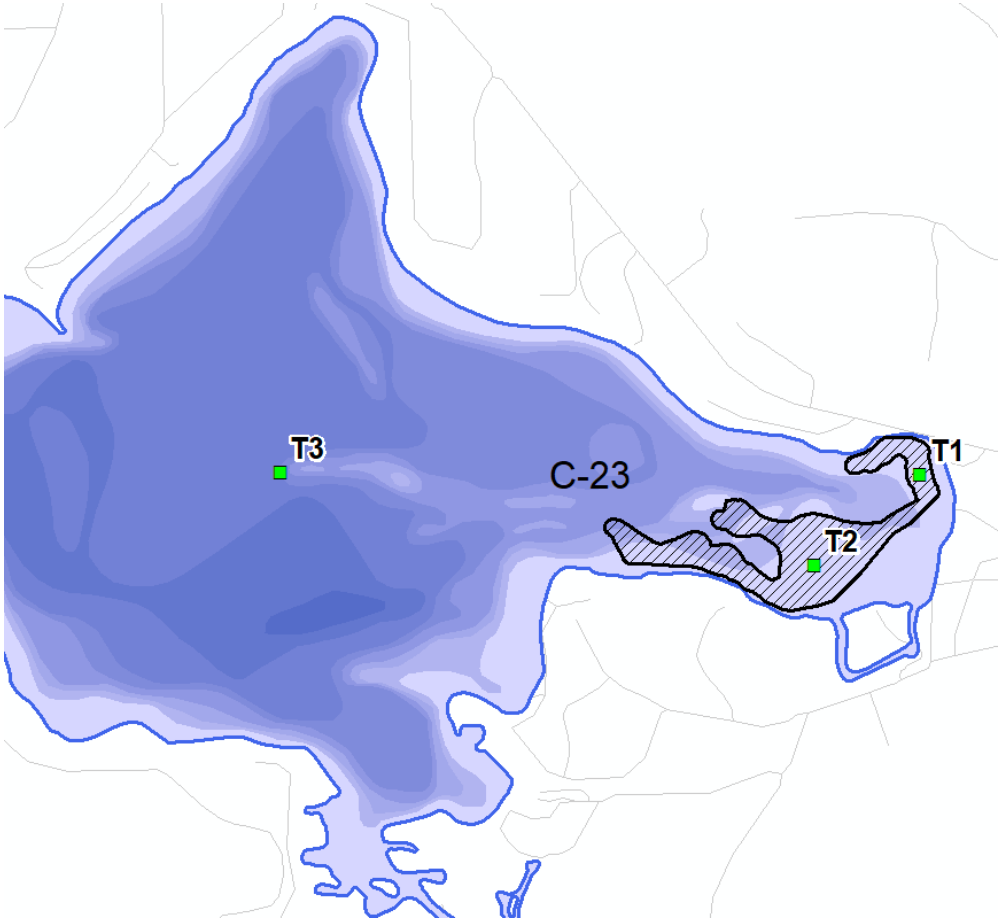

Figure 2. Photo of 6-foot integrated sampler (top) and composite water collection bottle (bottom).

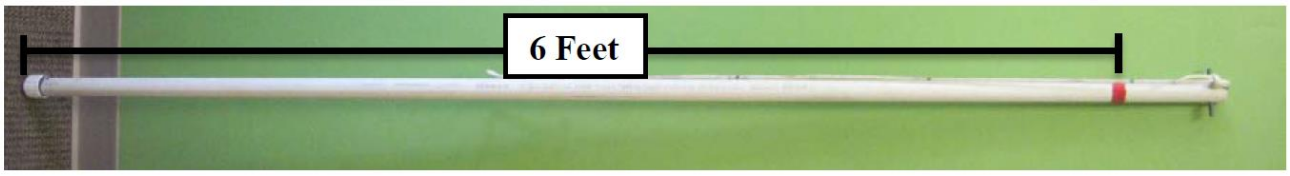

Figure 3. Photos of cooler, bottles, and sampling supplies provided by Wisconsin State Lab of Hygiene.

Figure 4. Photos of amber sampling bottles and labels provided by EPL Bio Analytical Services.

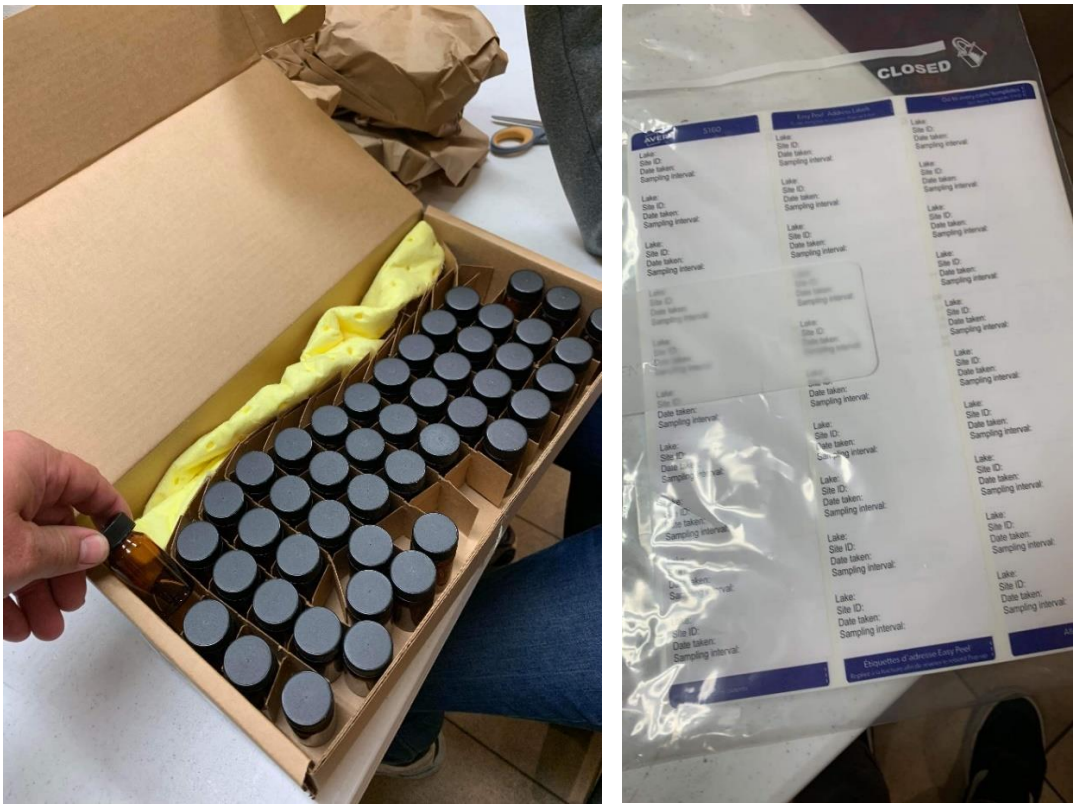

Figure 5. Example of a Sample Data Sheet

_____ Lake, _____ County				Herbicide Sampling Data Sheet		
Account number:				**Sample Matrix:**	Surface Water (SU)	
DNR User ID:				**Project:**	HerbicideMonitoring	
WBIC:				**Collector Name:**		
				Phone Number:		
Test Requested:						
Sample Interval:						
Site	**Station ID**	**Sample Depth**	**Date**	**Time (24:00)**	**Water Temp in C**	**Wind Direction and Speed**

Figure 6. Fahrenheit to Celsius conversion table.

Convert Fahrenheit to Celsius

T(°C) = (T(°F) - 32) × 5/9

Degree F	Degree C	Degree F	Degree C	Degree F	Degree C	Degree F	Degree C
50	10.0	60	15.6	70	21.1	80	26.7
51	10.6	61	16.1	71	21.7	81	27.2
52	11.1	62	16.7	72	22.2	82	27.8
53	11.7	63	17.2	73	22.8	83	28.3
54	12.2	64	17.8	74	23.3	84	28.9
55	12.8	65	18.3	75	23.9	85	29.4
56	13.3	66	18.9	76	24.4		
57	13.9	67	19.4	77	25.0		
58	14.4	68	20.0	78	25.6		
59	15.0	69	20.6	79	26.1		