

## SAMPLING & ANALYSIS PLAN

### 2025 MYSTIC LAKES DISSOLVED OXYGEN PROBE DEPLOYMENT

CN#: 610.0

March 2025 to November 2025



Massachusetts Department of Environmental Protection  
Division of Watershed Management  
Watershed Planning Program  
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**NOTE: This draft sampling plan provides detail re: sampling locations, frequencies, analytes, etc. and is intended to augment WPP's multi-year programmatic QAPP approved by EPA for 2020 through 2024. The contents mirror selected elements of WPP's programmatic QAPP (i.e., QA-R5 EPA Guidance). See the QAPP for relevant information not provided in this SAP.**

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## Project Organization

The 2025 Mystic Lakes Dissolved Oxygen Probe deployment project is conducted to supplement data collection efforts targeting three lakes in the Mystic River Watershed. The Watershed Planning Program (WPP) will use the continuous dissolved oxygen data collected through this project to support TMDL development for selected lakes.

This Sampling and Analysis Plan (SAP) provides details of the monitoring plans for deploying dissolved oxygen probes to three lakes in the Mystic River Watershed. Specific descriptions of WPP staff roles and responsibilities for the 2025 monitoring are detailed in Table 1.

**Table 1: Project Roles and Responsibilities Related to Monitoring and Data Use**

Project Personnel	Responsibility
<u>Project Coordinators</u> -Timothy Fox (lead)	Responsible for lake reconnaissance, obtaining landowner access permission, defining logistics for efficient monitoring and generation of useable data at assigned sites.
<u>Water quality survey training</u> -James Meek (lead) -Dan Davis (lead)	Responsible for training seasonal employees and Project Coordinator in deploying probes
<u>Water quality survey crews</u> -Timothy Fox (lead) - James Meek (lead) - TMDL section staff -WPP monitoring staff and seasonal employees	Responsible for the collection of samples and data at assigned lakes using the sample collection techniques and probe use procedures contained in the Targeted Assessment Monitoring (TAM) Field Operations Manual for lakes, this SAP and WPP SOPs. Also responsible for monthly QAQC field visits.
<u>Water quality download and QAQC</u> -Timothy Fox (lead) -Jasper Sha -Suzanne Flint	Responsible for calibrating and preparing DOT probes and downloading dissolved oxygen and temperature data. Also responsible for QAQC.

## Project Definition and Background

Section (§) 303(d) of the federal Clean Water Act (CWA) requires states to identify waters within their boundaries that are not meeting state water quality standards. For these impaired waterbodies, CWA §303(d) further requires the U.S. Environmental Protection Agency (USEPA) and states to develop a Total Maximum Daily Load (TMDL) for the pollutant(s) violating or causing violation of water quality standards. In Massachusetts, impaired waterbodies requiring a TMDL are listed in Category 5 of the Integrated List of Waters, such as the *Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle* (MassDEP, 2022).

Horn Pond, Wedge Pond and Spy Pond are lakes located in the Mystic River watershed. These three lakes are impaired by nutrients and are listed in Category 5 of the integrated List of Waters and require a TMDL. The goal of this monitoring effort is to collect continuous vertical profiles of dissolved oxygen and temperature at four stations (two in Spy Pond, one in Horn Pond and one in Wedge Pond) to inform TMDL development.

These four stations were previously sampled by WPP in 2019, 2021 and 2022. This effort focused on collecting data to estimate the current trophic status of the three lakes and calibrate the Lake Loading Response Model (LLRM) to develop TMDLs. A secondary goal of the project was to assess the attainment of designated uses (*Aquatic Life Use, Recreational Use, Aesthetic Use*) at sampled lakes.

The types of data that were collected previously at the three lakes included:

- Vertical profile (dissolved oxygen, temperature, pH, conductivity)
- Secchi disk transparency
- Nutrients (Total Nitrogen, Total Phosphorus, True Color, Turbidity)
- Chlorophyll *a* (Depth Integrated)
- Aesthetics observations
- Human disturbance observations
- Bathymetry

Prior to 2019, Spy Pond (MA71040) had not been sampled by MassDEP since the 1980s. Horn Pond and Wedge Pond had not been sampled by MassDEP since 2004. However, other studies conducted in the in the early to mid-2000s demonstrated that sediments were a significant source (20-30%) of phosphorus loading to Spy Pond (Durant 2007). Stormwater best management practices were installed in several areas within the Spy Pond watershed in 2001 and Spy Pond was treated with alum in 2004. The water quality sampling conducted in Spy Pond, Horn Pond, and Wedge Pond as part of the Mystic Lakes sampling effort provided a more up-to-date assessment of the ponds' current trophic status.

Furthermore, to better understand the magnitude of the sediment-nutrient flux rate in these three Ponds, WPP will be conducting a sediment core incubation study in 2025. The rate of nutrient exchange will be estimated under different oxygen conditions for the four sites sampled in 2019, 2021, and 2022. One additional site will be sampled in Spy Pond and Horn Pond.

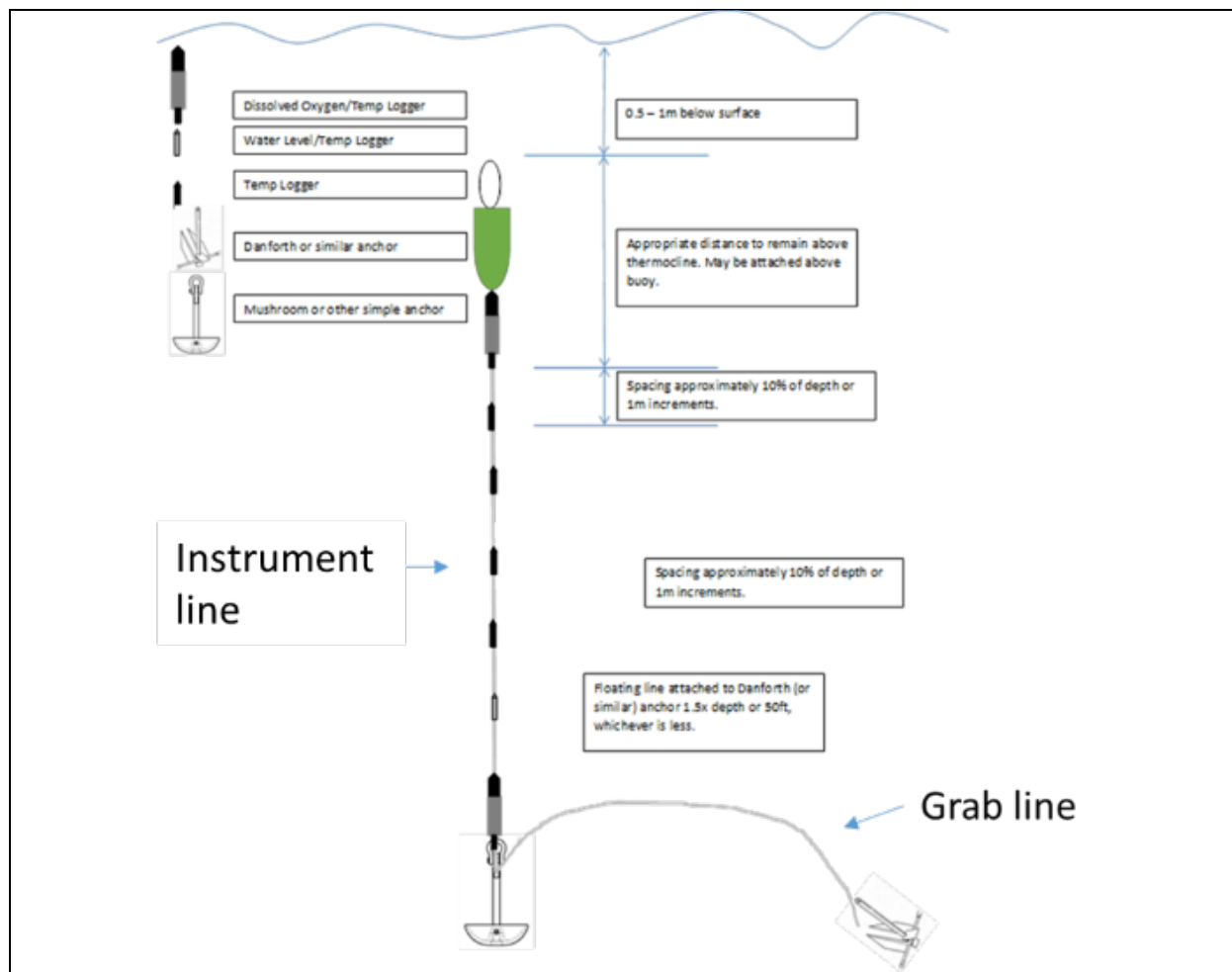
## Project Description

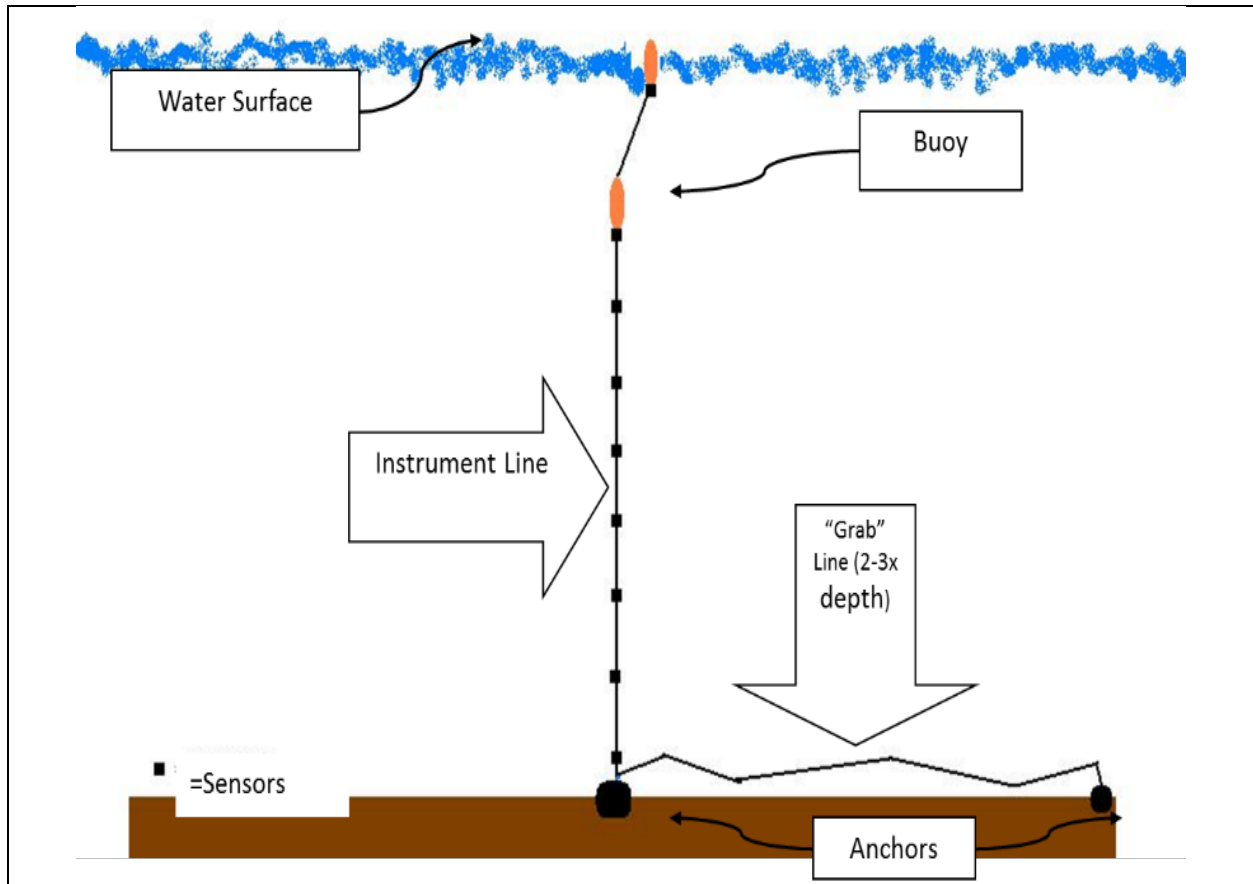
Onset MX801 multiprobes (dissolved oxygen and temperature) and MX2203 Tidbits (temperature) will be deployed on a long-term continuous basis from April (or ice out) through October (or fall turnover) at each of the four stations sampled by WPP using the TAM Field Operations Manual for lakes (MassDEP 2023). The probes will be deployed vertically on a stringer with a buoy at the top and anchor at the bottom to provide data on stratification and dissolved oxygen changes over time. Two Onset multiprobes will be deployed on the stringer one meter from the surface and one meter from the bottom with Tidbits every 0.5 or 1 meter (depending on overall depth and equipment availability) between the Onset multiprobes (Figure 1). This project expects to deploy 31 Tidbits. In addition, a pressure transducer will be deployed on the stringer near the bottom to continuously measure water level and another pressure transducer will be deployed on land to allow barometric pressure corrections. At deployment and prior to retrieval of multiprobes, as well as monthly intervals during the deployment, QC readings will be taken using a separate meter as specified in WPP's unattended probe SOPs (MassDEP 2023). A draft schedule

for sampling activities is displayed in Table 2. The dates in Table 2 are subject to change based on weather or staffing limitations. After retrieval of deployed multiprobes, post-deployment calibration check, and QC checks on the data will be performed.

**Table 2: Schedule**

Date	Action
April 15th, 2025	-Spy Pond Probe Deployment -Spy Pond QC reading
April 16th, 2025	-Horn Pond/Wedge Pond Probe Deployment -Horn Pond/Wedge Pond QC reading
May 13th, 2025	-Spy Pond QC reading
May 14th, 2025	-Horn Pond/Wedge Pond QC reading
June 17th, 2025	-Spy Pond QC reading
June 18th, 2025	-Horn Pond/Wedge Pond QC reading
July 15th, 2025	-Spy Pond QC reading
July 16th, 2025	-Horn Pond/Wedge Pond QC reading
August 19th, 2025	-Spy Pond QC reading
August 20th, 2025	-Horn Pond/Wedge Pond QC reading
September 16th, 2025	-Spy Pond QC reading
September 17th, 2025	-Horn Pond/Wedge Pond QC reading
October 15th, 2025	- Spy Pond Probe Pickup - Spy Pond QC reading
October 16th, 2025	-Horn Pond/Wedge Pond Probe Pickup -Horn Pond/Wedge Pond QC reading





**Figure 1: Examples of vertical profile deployments.**

## Sampling Process Design

### *Index Site - Water Quality (Chemical, Biological and Physical)*

Onset multiprobe (dissolved oxygen and temperature) and Tidbits (temperature) will be deployed to the single index sites in Horn Pond (Woburn) and Wedge Pond (Winchester), and two index sites in Spy Pond. The locations of the sites are provided in Table 3 and shown in Figure 2. The schedule for the overall project is provided in Table 4.

**Table 3: 2025 Mystic Lakes Monitoring Sites**

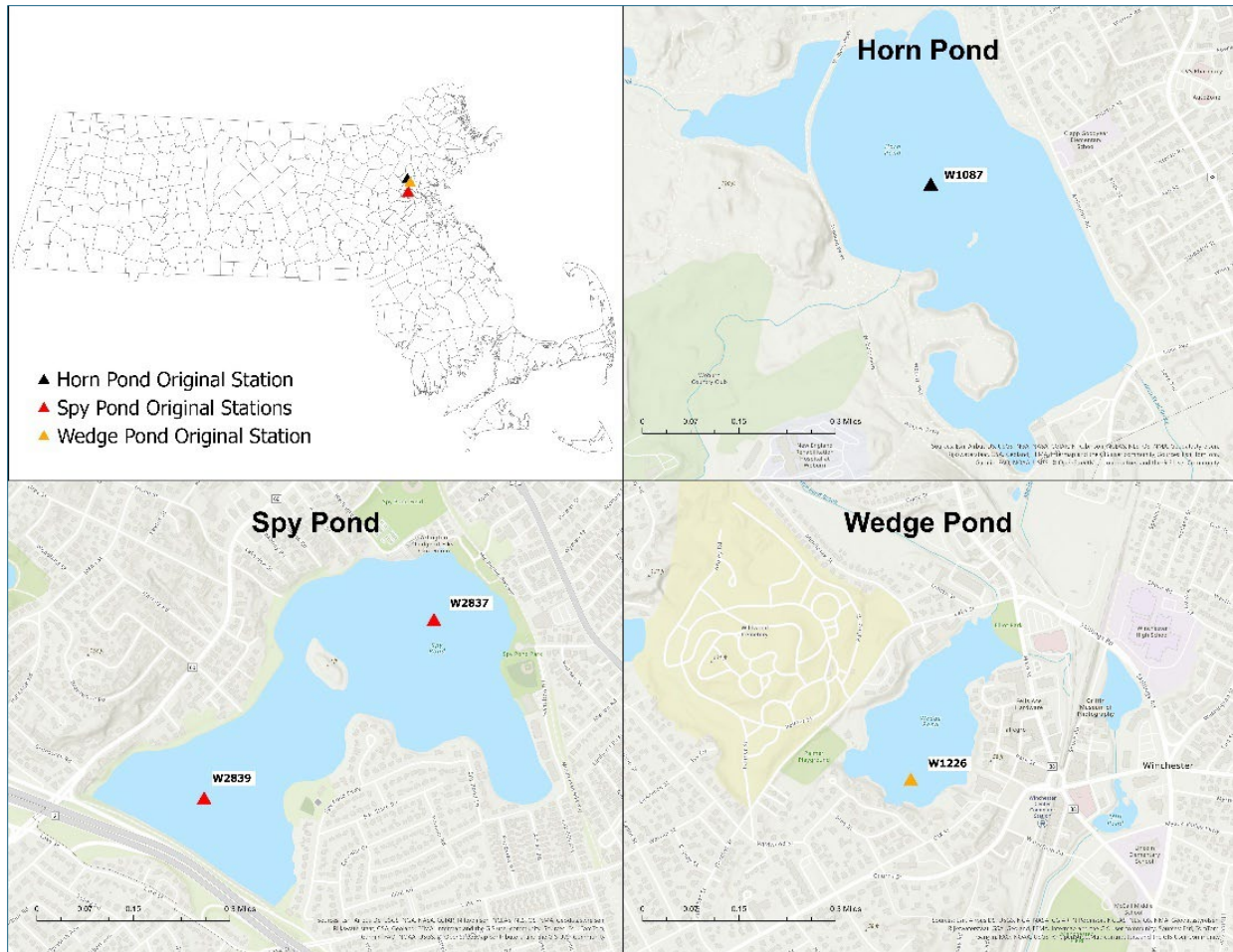
Station ID	Waterbody	Water Code	Unique ID	Site	Latitude*	Longitude*	Depth (approximate)	Station Type	Sampling Parameters
A	Horn Pond	71019	W1087	[deep hole, Woburn]	42.46963022	-71.15765018	14 meters (10 Tidbits)	Index Site	D,T
A	Wedge Pond	71045	W1226	[deep hole, Winchester]	42.45289418	-71.14158508	5 meters (2 Tidbits)	Index Site	D,T
A	Spy Pond	71040	W2837	[A, deep hole- Northern Lobe, Arlington]	42.40999949	-71.151994	11 meters (8 Tidbits)	Index Site	D,T
B	Spy Pond	71040	W2839	[B, deep hole- Southern Lobe, Arlington]	42.40600014	-71.15899647	7 meters (3 Tidbits)	Index Site	D,T

\* WGS 1984

D = Continuous dissolved oxygen depth profile

T= Continuous temperature depth profile





**Figure 2: Station Locations**

**Table 4: Project Schedule for the 2025 dissolved oxygen**

Activity	Approx. Date of Initiation	Approx. Date of Completion	Deliverable
Coordination, staff meetings, reconnaissance, river/stream sampling plan development, site selection, etc.	March 2025	Apr 2025	Draft sampling plan; meeting notes, etc.
Draft sampling plan review and approval	March 2025	April 2025	Internal WPP concurrence on sampling plan
Vertical profile probes deploy/retrieval	April 2025	Oct 2025	Continuous DO/temperature data
Data QA/QC review and validation	Jan 2026	Jun 2026	2024 Data Validation Report
Data review, analysis, and preliminary reporting	Jun 2026	Mar 2027	Final data analysis

## Non-Direct Measurements

Table 5 presents a brief list of relevant external data sources that may be used in coordinating monitoring efforts or the interpretation of monitoring data. For example, stage data from the USGS could be used to determine if water levels are appropriate for certain types of sampling or rain data from NCEI could be used to determine if a sampling event occurred during wet or dry weather.

**Table 5: External data sources used for the 2024 targeted assessment monitoring**

Organization	Data
United States Geological Survey (USGS) <a href="https://www.usgs.gov/centers/new-england-water/">https://www.usgs.gov/centers/new-england-water/</a>	Continuously stream stage and discharge measurements at gage stations within the project extent.
National Centers for Environmental Information (NCEI) <a href="https://www.ncdc.noaa.gov/">https://www.ncdc.noaa.gov/</a>	Daily precipitation and temperature data weather stations within the project extent.
The Weather Underground <a href="http://www.wunderground.com/">http://www.wunderground.com/</a>	Daily precipitation and temperature data weather stations within the southwestern basin group.

## Literature Cited

Durant, et al. 2007. Long-Term Fate of a Pulse Arsenic Input to a Eutrophic Lake. *Environmental Science & Technology*/ Vol 41, NO. 9, 2007.

MassDEP. (2022). *Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle*. CN 505.1, Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA. Retrieved from <https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-20182020-reporting-cycle/download>

MassDEP. 2023. *Massachusetts Targeted Assessment Monitoring Program Field Operations Manual Lakes Version 1.1*. CN 584.0 Massachusetts Department of Environmental Protection, Division of Watershed Management. Watershed Planning Program. Worcester, MA.

USEPA. 2011. 2012 National Lakes Assessment. Field Operations Manual. EPA 841-B-11-003. U.S. Environmental Protection Agency, Washington, DC