**Sampling & Analysis Plan**

For the:

**2024 NWQI Monitoring Project**

**Manhan River**

Massachusetts Department of Environmental Protection

Division of Watershed Management

Watershed Planning Program

8 New Bond Street

Worcester, MA 01606



CN 598.0

March 2024

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***NOTE: This sampling plan provides 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; USEPA 2017a). See the most recent WPP Programmatic QAPP for relevant information not provided in this SAP (MassDEP 2020).***

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# Project Organization

The National Water Quality Initiative (NWQI) was developed by the Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA) to address non-point sources of pollution associated with agriculture, within relatively small watersheds (Hydrologic Unit Code-12, or HUC-12), identified and prioritized by individual states (USEPA 2017b). MassDEP conducted a review of freshwater stream segments within the Massachusetts portion of the Connecticut watershed to identify high priority, HUC-12 watersheds for further monitoring and non-point source (NPS) protection/restoration actions (Reardon 2020). The Upper Manhan River HUC-12 (AU MA34-11) in Easthampton, Southampton, and Westfield received a high score in the restoration prioritization ranking (2nd of 90 waterbodies), based on its impairment by *E. coli* from unknown non-point sources, its land use characteristics (relatively high percentage of agriculture and natural land uses, and low impervious cover), and its high Recovery Potential Index value. The study area consists of the Manhan River between the outlet of the Tighe Carmody Reservoir, Southampton and the confluence with the North Branch of the Manhan River, Southampton, and the associated drainage area; in general, this may be considered to be the mid-reach of the Manhan (see Figure 1).

MassDEP will begin baseline monitoring[[1]](#footnote-2) in the mid-reach of the Manhan River watershed in 2024 according to the procedures outlined in the most recent Watershed Planning Program (WPP) Quality Assurance Project Plan (QAPP; MassDEP 2020). This Sampling and Analysis Plan (SAP) provides details for collecting samples for analyses i.e., nutrients, Total Suspended Solids (TSS), and bacteria (*E. coli*), and for measuring in situ parameters (e.g., temperature, dissolved oxygen and conductivity) in 2024. These data will provide us with the information needed to determine the effectiveness of future NPS implementation actions in these watersheds. Given the desire to create a strong baseline of current conditions within the recreational period, a moderately intensive sampling frequency was chosen. Descriptions of WPP staff roles and responsibilities are detailed in Table 1.

# Project Definition and Background

The Upper Manhan River HUC-12 watershed has a drainage area of approximately 36.3 square miles (mi2), located entirely in Massachusetts; the study area encompasses 21.0 mi2, extending from the Tighe Carmody Reservoir Dam to the confluence with the North Branch Manhan River. The four sampling stations on the mainstem Manhan River are in Easthampton and Southampton; the three tributary stations are located at/near the pourpoints of Brickyard, Moose, and Potash Brooks in the same municipalities, as well as Westfield. In Figure 1, the study area within the Upper Manhan River HUC-12 is highlighted in yellow and shaded in turquoise; the upper part of the HUC-12, which is outside of the study area, is shaded and outlined in red.

The types of data collected at each site will allow us to determine the effectiveness of future NPS restoration actions in the Upper Manhan River HUC-12 watershed. Parameters that will be measured include:

* + - * Nutrients (total phosphorus, orthophosphate, total nitrogen, nitrate-nitrite as nitrogen, and ammonia as nitrogen)
* Other water quality parameters (total suspended solids)
* Pathogens (*E. coli*)
* Instantaneous measurements (temperature, pH, dissolved oxygen, specific conductance, total dissolved solids)
* Continuous measurements (dissolved oxygen, temperature; 4-month duration)
* Site observations (aesthetics)

Figure 1 Upper Manhan River HUC-12 Watershed[[2]](#footnote-3)

Map

Description automatically generated

Table 1 MassDEP Project Roles and Responsibilities related to monitoring and data use

| **Project Personnel** | **Responsibility** |
| --- | --- |
| Project Coordinator  -Therese Beaudoin | Coordination with EPA, site reconnaissance, staff training in field procedures, and defining logistics for efficient monitoring and generation of useable data at assigned sites using the procedures contained in WPP SOPs. |
| Water quality survey crews  -WPP staff and seasonal employees | Sample and data collection at assigned sites using the sample collection techniques and probe use procedures contained in WPP SOPs. |

# Project Description

**Overview of 2024 monitoring activities in the Upper Manhan River HUC-12 watershed**

The objective of this project is to collect water quality data during the late Spring, Summer and Fall of 2024 in the mid-reach of the Manhan River and key tributaries, to support the NWQI goal of determining the effectiveness of NPS protection and restoration efforts in these areas of the Upper Manhan River HUC-12 watershed. It is likely that the collection of baseline data for the study area will be conducted in 2-3 subsequent years as well.

# Sampling Process Design

Sampling will be conducted in the Manhan River and tributary streams on a biweekly basis from May 13 through October 1, 2024, as shown in Table 2. A total of 11 sampling events are currently scheduled.

Table 2 Sampling Dates for the 2024 NWQI Upper Manhan River Project

| **2024 Sampling Dates\*** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **May** | **June** | **July** | **August** | **September** | **October** |
| Monday, May 13 | Tuesday, Jun 11+ | Tuesday, Jul 9+ | Tuesday, Aug 6+ | Wednesday, Sep 4+ | Wednesday, Oct 1+ |
| Tuesday, May 28 | Monday, Jun 24 | Monday, Jul 22 | Monday, Aug 19 | Monday, Sep 16 |  |
| \*Final sampling dates will reflect the laboratory schedule and the availability of equipment. Dates may also be changed to reflect weather conditions and other factors.  +Monitoring includes attended probe measurements (as QC checks on deployed probes). | | | | | |

The locations to be sampled in 2024 were selected by MassDEP and are based upon historical data and logistical considerations (e.g., accessibility, seasonal low flow). These sites are depicted in Figure 2, with further details in Table 3, and include (in order, upstream to downstream, starting with the mainstem):

Manhan River

* MR01, at Manhan Road approx. 0.6 miles downstream of the Tighe Carmody Reservoir Dam, Southampton, MA
* MR03, near Brickyard Road Extension, Southampton, MA
* MR04, at Gunn Road, Southampton, MA
* MR05b, Whittemore Conservation Area

Key Tributaries

* BRB01, Brickyard Brook at Root Road, Westfield, MA
* MO01, Moose Brook at Brickyard Road Extension, Southampton, MA
* PB01, Potash Brook at an abandoned railroad crossing, Southampton, MA
* TB01, Tripple Brook at Pleasant St, Southampton, MA

Figure 2 Monitoring locations in the 2024 NWQI Upper Manhan River Project

Map

Description automatically generated

Table 3 Monitoring stations in the 2024 NWQI Upper Manhan River Project

| **Segment** | **River Name** | **Site ID** | **Unique ID** | **Latitude**  **(°N)** | **Longitude (°W)** | **Impaired 1° or 2° *E. coli*1** | **Impaired Aesthetics1** | **Impaired Aquatic Life1,2** | **Impaired Fish Consumption1** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA34-11 | Manhan River | MR01 | W3417 | 42.20958700 | -72.77300400 | Yes | No | Yes | N/A |
| MA34-11 | Manhan River | MR03 | W3195 | 42.21801700 | -72.72520700 | Yes | No | Yes | N/A |
| MA34-11 | Manhan River | MR04 | W3400 | 42.24112700 | -72.70532700 | Yes | No | Yes | N/A |
| MA34-11 | Manhan River | MR05b | W3421 | 42.261215 | -72.698367 | Yes | No | Yes | N/A |
| MA34-13 | Brickyard Brook | BRB01 | W3418 | 42.18889500 | -72.746425 | N/A | N/A | N/A | N/A |
| MA34-17 | Moose Brook | MO01 | W3196 | 42.21765200 | -72.723963 | No | No | No | N/A |
| MA34-12 | Potash Brook | PB01 | W3419 | 42.229545 | -72.719543 | N/A | N/A | N/A | N/A |
| 1As reported in Massachusetts Year 2022 Integrated List of Waters (MassDEP 2023).  2N/A = Not Assessed | | | | | | | | | |

***Water Quality (Chemical and Physical)***

At each station, surface grab samples will be collected and analyzed for the parameters and methods outlined in Table 4. The U.S. Environmental Protection Agency (EPA) in Chelmsford, MA will conduct the nutrient and TSS analyses, while WPP will perform the *E. coli* analyses. The survey crew will filter (orthophosphate only) and preserve all samples before submitting them to the lab for processing and analyses. For each sampling date, a minimum of one duplicate and one blank sample per analyte will be tested each sampling crew (10% of the samples). At least one filter blank for orthophosphate will also be analyzed. A bottle blank will be collected and analyzed for each parameter for each new batch of bottles being used. All sample collection will be done in accordance with WPP’s field sampling SOPs. EPA laboratory methods and SOPs are outlined below (Table 4).

All samples will be placed on ice immediately following collection, stored in a secure sample refrigerator at WPP in Worcester. The samples will be transported to the EPA Region 1 Laboratory within 1-2 days of collection, for analysis.

A minimum of approximately 444 samples will be analyzed for the parameters listed in Table 4 below (7 sites, 11 visits per site, 41 total sample bottles per sampling event with 10 samples per parameter including 1 duplicate and one blank per parameter per visit, plus a filter blank for orthophosphate; and a minimum of one round of bottle blanks per parameter to be collected on the first survey only). There may be additional samples if more than one round of bottle blanks is required. Note that analysis of Total Nitrogen as N, Nitrate/Nitrite as N, Ammonia as N, and Total Phosphorus as P will originate from the same sample bottle.

Table 4 Sampling and Analytical Summary for the 2024 NWQI Upper Manhan River Project

| **Parameter** | **# of Samples per Event** | **Name of Analytical Laboratory** | **Analytical Methods/SOP** | **Container** | **Preservation** | **Maximum Holding Time (from time of collection)** |
| --- | --- | --- | --- | --- | --- | --- |
| Total Suspended Solids | 10 | LSASD\* Chemistry  LSASD Chemistry | EIASOP-TSS-TDS-VRES6 | 1-Liter Precleaned HDPE | 1-6˚C | 7 days |
| Ortho Phosphate as P | 11 | EIASOP-INGTP11 | 120-ml Precleaned HDPE | 1-6 ˚C, Filter w/in 15 minutes | 48 hours |
| Total Nitrogen as N | 10 | LSBSOP-NO2-NO30 | (1) 500-ml Precleaned HDPE | Ultrex Sulfuric Acid 1:1 pH<2 | 28 days |
| Nitrate/Nitrite as N | LSBSOP-NO2-NO30 |
| Ammonia as N | EIASOP-AMMO0 |
| Total Phosphorus as P | EIASOP-INGTP11 |
| E. coli (ECMM) | 10 | WPP | EPA SM 9223B | 250-ml sterile | 1-6˚C | 8 hours |
| Total | 41 |  |  |  |  |  |
| \*LSASD: Laboratory Services and Applied Sciences Division; EPA Lab, Chelmsford, MA  Notes:   1. All bacteria samples must have headspace. 2. All sampling collection procedures will follow the appropriate WPP SOPs. 3. Deployed loggers will be checked to ensure continued submersion and the presence/absence of bio-fouling during each sampling event. 4. Orthophosphate samples will be filtered within 15 minutes of collection. 5. A filter blank will be collected on every sampling event to ensure no contamination occurs during the orthophosphate filtering procedure. 6. A bottle blank will be collected on the first sampling date, and on each subsequent date in which bottles are used from a different batch. | | | | | | |

A dissolved oxygen/temperature probe will be deployed on a long-term basis from May 13 through October 1 at the upstream- and downstream-most sites on the Manhan River (MR01, MR05b) to evaluate these parameters. QC readings will be taken using a separate, “attended” multiprobe meter as specified in the WPP unattended probe SOP (MassDEP, 2007), on a minimum of one survey per month. After retrieval of deployed probes and post-deployment calibration checks, QC checks on the data will be performed.

In addition, for each sampling event during which attended probes are used to conduct QC checks on the deployed probes, instantaneous measurements of temperature, dissolved oxygen, pH, total dissolved solids and specific conductance will be collected at all 6 sites. All stations were originally sited with GPS and photographs will be taken at each site during every sampling event. Field data and observations will be documented on MassDEP (paper) field sheets or as applicable electronic data capture.

Table 5 Project Schedule for the 2024 NWQI Upper Manhan River Project

| **Task Proposed** | **Approx. Date of Initiation** | **Approx. Date of Completion** | **Attendees/Responsible Staff** |
| --- | --- | --- | --- |
| EPA- DEP Coordination | 1/23/2024 | 2/23/2024 | Conville, Gould, Nelson, Morgan, Faber, Dombroski, Beaudoin, Das, De Leon |
| Laboratory Scoping Meeting | 3/1/2024 | 3/15/2024 | Bridges, Boudreau, Conville, Patel, Paar, Gould, Toompas, Faber |
| Water quality sampling surveys | 5/14/2024 | 10/1/2024 | Beaudoin and field crews |
| Data QA/QC review and validation | TBD (2024) | TBD (2025) | MassDEP Assessment and Data Section |
| WQ data review, analysis and preliminary reporting | 11/22/2024 | TBD | Beaudoin |

# Non-Direct Measurements

Table 6 contains a brief list of relevant external data sources that may be used in coordinating monitoring efforts or the interpretation of monitoring data. For example, rain data from NCDC could be used to determine if a sampling event occurred during wet or dry weather.

Table 6 External data sources used for the 2024 NWQI Upper Manhan River Project

|  |  |
| --- | --- |
| **Organization** | **Data** |
| National Climatic Data Center (NCDC)  <http://www.ncdc.noaa.gov/oa/ncdc.html> | Daily precipitation and temperature data weather stations within the project extent. |
| The Weather Underground  <http://www.wunderground.com/> | Daily precipitation and temperature data weather stations within the project extent. |

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1. Baseline monitoring describes data collection activities performed before the USDA initiates restorative measures to address bacterial contamination, where baseline data indicate that such measures are appropriate. [↑](#footnote-ref-2)
2. Note: In Figure 1, the entire Upper Manhan River HUC-12 watershed includes sections highlighted in both red and yellow. The study area for this project is only within the yellow-highlighted section outlined in turquoise. [↑](#footnote-ref-3)