**Sampling & Analysis Plan**

2022 Monitoring

Regional Monitoring network

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Massachusetts Department of Environmental Protection

Division of Watershed Management

Watershed Planning Program

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**Table of Contents**

**Project Organization**………………………………….. …………………………………………………………………………….3

**Project Definition and Background**…………………………………………………………………………………………..4

**Project Description**…………………………………………………………………………………………………………………...5

*Continuous Temperature Monitoring*……………..………………………………………………………………5

*Benthic Macroinvertebrate Community*………………………………………..………………………………..5

**Sampling Process Design**…………………………………………………………………………………………………………..5

**Non-Direct Measurements**……………………………………………………………………………………….…….………..8

**Literature Cited**……………………………………………………………………………………………………………...…….….9

**List of Tables**

Table 1. Project roles and responsibilities related to monitoring and data use…………………………..4

Table 2. Reference Monitoring Network (RMN) sites……………………………………………………..………….7

Table 3. Project schedule for Reference Monitoring Network………………………………………………..….8

Table 4. External data sources used for RMN monitoring………………………………….……………………….8

Table 5. USGS gages in proximity to RMN sites…………………………………………………….……………………9

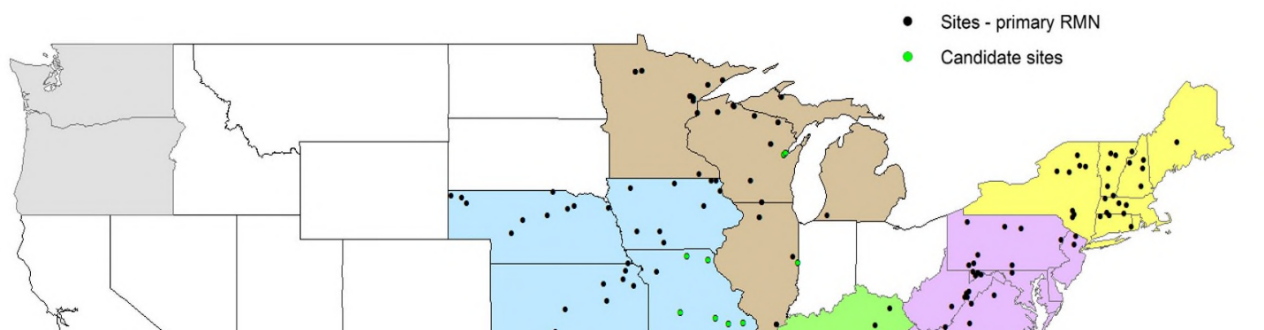
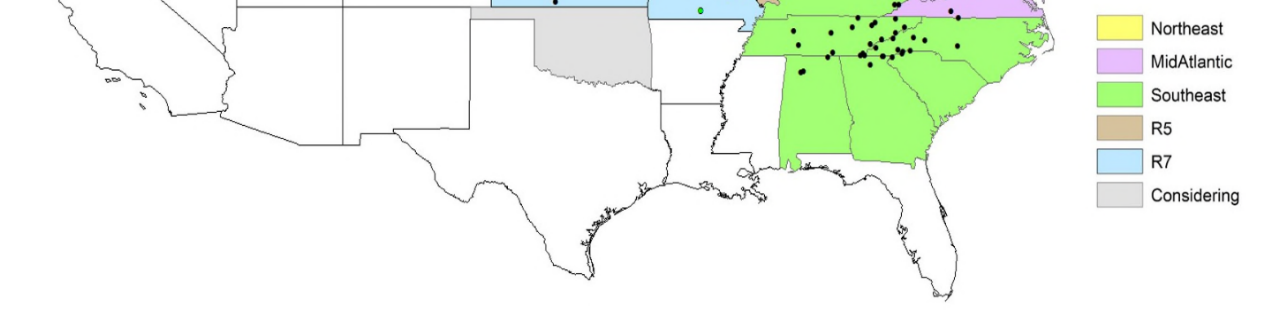
**List of Figures**

Figure 1. Current Regional Monitoring Network (RMN) sites by region………………………………………3

Figure 2. Reference Monitoring Network (RMN) sites in Massachusetts………….……………..…………6

**Project Organization**

The United States Environmental Protection Agency (U.S. EPA) is working with its regional offices, states, tribes, river basin commissions, and other entities to establish Regional Monitoring Networks (RMNs) to detect climate change effects in least disturbed freshwater, wadeable streams. In order to address the need for long term contemporaneous biological, thermal, and hydrologic data, RMN surveys build on existing bioassessment efforts and aim to collect comparable data that can be pooled at a regional level. The objectives of the RMNs align with and supplement Clean Water Act (CWA) goals and therefore have been integrated into the monitoring efforts of the Massachusetts Department of Environmental Protection (MassDEP), Division of Watershed Management (DWM), Watershed Planning Program (WPP) since 2012. This Sampling and Analysis Plan (SAP) provides details of the monitoring plans for collecting continuous temperature, benthic macroinvertebrate, and habitat data.



**Figure 1.** Current Regional Monitoring Network (RMN) sites by region.

**Table 1.** Project roles and responsibilities related to monitoring and data use.

|  |  |
| --- | --- |
| **Project Personnel** | **Responsibility** |
| Project Coordinator  -Allyson Yarra | Responsible for defining logistics for efficient monitoring and generation of usable data at assigned sites using procedures contained in WPP SOPs. |
| Continuous temperature monitoring  -Allyson Yarra (lead)  -WPP staff and seasonal employees | Responsible for quarterly download of water temperature loggers using procedures contained in WPP SOPs. |
| Benthic macroinvertebrate surveys  -Allyson Yarra (lead)  -WPP staff and seasonal employees | Responsible for benthic macroinvertebrate and aquatic habitat survey data collection using procedures contained in WPP SOPs. |

**Project Definition and Background**

RMNs have been established in the Northeast, Mid-Atlantic, Midwest, and Southeast (Fig. 1) and new networks are expanding into other regions. With the intention of pooling comparable data with other organizations in the Northeast network, MassDEP is working to provide data that can be used by biomonitoring programs for multiple purposes over short and long timeframes. The overarching goals of the RMNs are:

* Detecting trends attributable to climate change
* Supplementing CWA programs and initiatives
  + Informing criteria refinement or development under Section 303
  + Defining natural conditions and quantifying natural variability to support Section 305(b)
  + Developing biological indicators for protection planning for Section 303(d) programs
* Gaining a better understanding of ecosystem responses and recovery from extreme weather events
* Gaining a better understanding of relationships between biological, thermal, and hydrologic data
* Monitoring the condition of minimally and least disturbed streams
* Gaining insights into effects of regional phenomena such as drought and pollutant/nutrient deposition on aquatic ecosystems and bioassessment programs

The goal of the RMN in 2022 is to collect sufficient data at five sites to contribute to the need for long-term simultaneous biological and thermal data in least-disturbed freshwater wadeable streams. The types of data that will be collected at each of the sites to reach the above goals are:

* Continuous temperature (long-term deployments)
* Temperature (instantaneous)
* Benthic macroinvertebrate community
* Habitat assessments

**Project Description**

**Overview of Reference Monitoring Network in 2022**

*Continuous Temperature Monitoring*

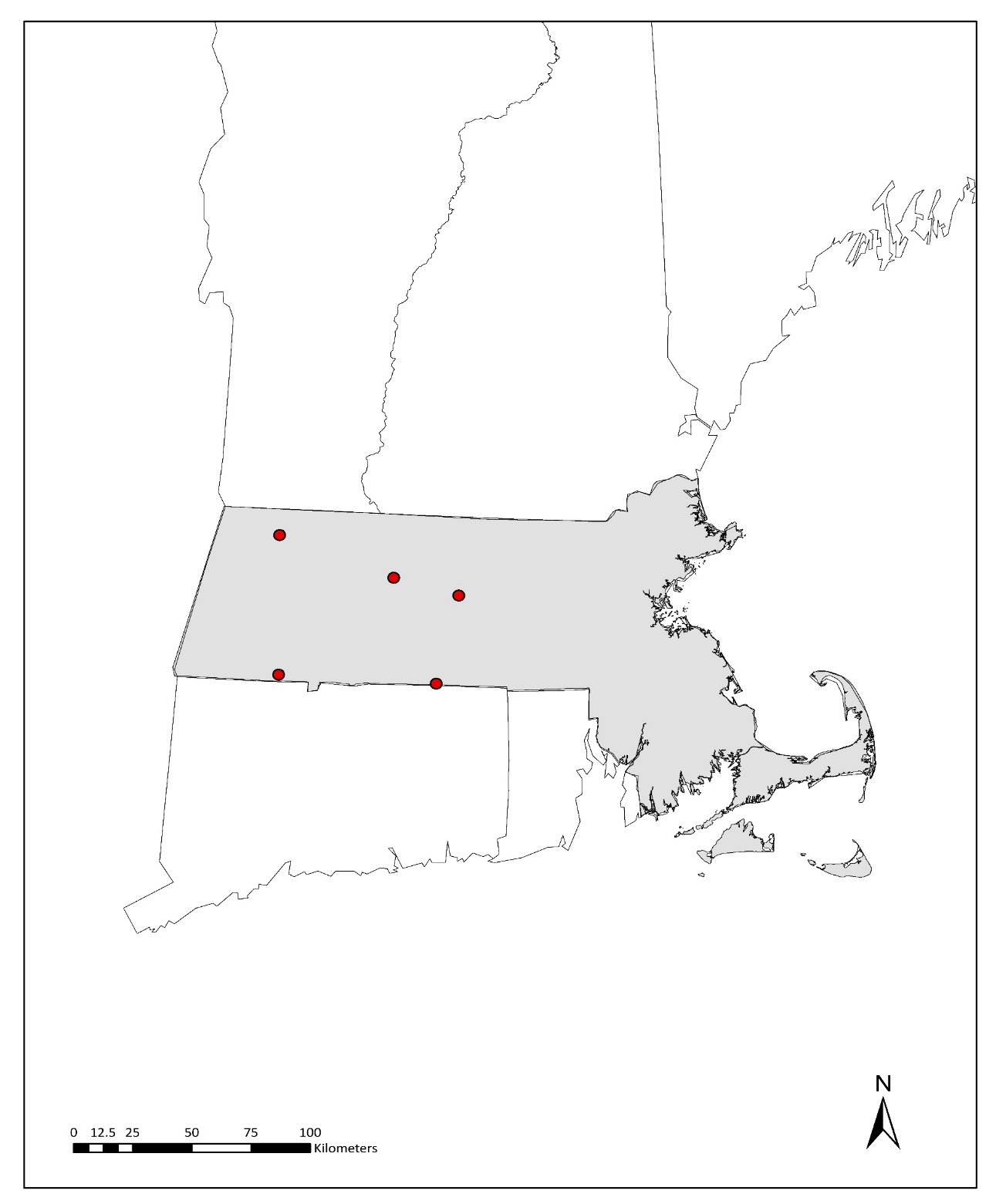
Water temperature loggers will be deployed on a long-term basis (ongoing, end date unspecified) at each site and will be swapped out as needed due to loss or battery failure. Loggers will be locked to protective PVC housing and attached to a permanent feature (e.g., tree root) with cable. QC readings will be taken using a separate meter during each visit as specified in WPP’s unattended probe SOPs. Temperature data will be downloaded on a quarterly basis (January, April, July, October) using a HOBO shuttle. Upon data download in the field, the water temperature loggers will be reset and data will be offloaded from the shuttle in the lab. Temperature data will be subject to QA/QC review and validation.

*Benthic Macroinvertebrate Community*

The benthic macroinvertebrate community will be sampled once at all sites in mid-October. These organisms integrate environmental conditions (chemical – including nutrients and toxics; and physical – including flow and water temperature) over an extended period and are an excellent measure of a water body’s health. All streams under study are high gradient and will be sampled using WPPs standard operating procedure for sampling high gradient streams (i.e., Rapid Bioassessment Protocol (RBP III) kick method). At each site, all sampling will be conducted within a pre-established 100-meter reach and five kick samples will be composited into 2L Nalgene jars, preserved with denatured 95% ethanol and transported to the WPP lab for storage. A contractor will subsample and enumerate the macroinvertebrate samples and perform taxonomic identifications. Metrics based on benthic macroinvertebrate functional feeding group, community composition, biotic index using pollution tolerance, and abundance will be calculated to determine biological condition. In addition, RBP III habitat assessments will be completed at all sites.

**Sampling Process Design**

One aim of the RMN is to target minimally or least disturbed sites (per Stoddard et al., 2006). The use of high-quality waters allows for a better separation of natural variation and human-induced changes and minimally disturbed waters serve as a standard against which other bioassessment sites can be compared. In order to select minimally disturbed reference sites in Massachusetts, site selection was based on best professional judgement. Considerations included land use, percent impervious cover, and these considerations were confirmed using site reconnaissance. The location of RMN sites in Massachusetts is illustrated in Figure 2 and Table 2. The project and monitoring schedule is shown in Table 3.



CR01ACC

HRCC

WSR01CC

PBCC

BB01CC

**Figure 2**. Reference Monitoring Network (RMN) sites in Massachusetts.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Site ID** | **Unique ID (WQ)** | **Unique ID (Benthic)** | **Basin** | **Waterbody** | **Description** | **Latitude** | **Longitude** |
| CR01ACC | W2467 | B0824 | Deerfield | Cold River | [approximately 70 meters upstream/north of South County Road, Florida.] | 42.6669 | -73.0302 |
| HRCC | W2468 | B0825 | Farmington | Hubbard Brook | [approximately 245 meters upstream/northwest of West Hartland Road, Granville.] | 42.0654 | -72.9675 |
| BB01CC | W2220 | B0737 | Quinebaug | Browns Brook | [approximately 645 meters upstream from May Brook Road, Holland] | 42.0348 | -72.1616 |
| WSR01CC | W2218 | B0736 | Chicopee | W Br Swift River | [approximately 195 meters upstream from Cooleyville Road Extension, Shutesbury] | 42.4647 | -72.3845 |
| PBCC | W0678 | B0823 | Chicopee | Unnamed and/or Undefined SARIS | [unnamed tributary (known as Parkers Brook on USGS 1988 Barre quad) approximately 160 meters west (downstream) of Coldbrook Road, Oakham (due south of Route 122)] | 42.3943 | -72.0492 |

**Table 2**. Reference Monitoring Network (RMN) sites in Massachusetts.

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity** | **Approx. Date of Initiation** | **Approx. Date of Completion** | **Deliverable** |
| Draft sampling plan review and approval | March 2022 | April 2022 | Internal WPP concurrence on sampling plan |
| 2020-2024 WPP monitoring QAPP | March 2022 | TBD | 2020-2024 WPP monitoring QAPP |
| 2021 taxonomic data received from contractor and input into mabenthos | June 2022 | December 2022 | mabenthos up to date with 2021 data |
| Quarterly temperature data download | April 2022 | April 2022 | Field data |
| Quarterly temperature data download | July 2022 | July 2022 | Field data |
| Quarterly temperature data download | October 2022 | October 2022 | Field data |
| Annual Benthic/Habitat sampling survey | October 2022 | October 2022 | Field data; benthic samples to contractor |
| Quarterly temperature data download | January 2023 | January 2023 | Field data |
| Data QA/QC review and validation | January 2023 | June 2023 | 2022 data validation report |

**Table 3**. Project schedule for Reference Monitoring Network.

**Non-Direct Measurements**

Table 3 is 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 may be used to determine if water levels are appropriate for certain types of sampling or rain data from The Weather Underground could be used to determine if a sampling event occurred during wet or dry weather.

**Table 4**. External data sources used for RMN monitoring.

|  |  |
| --- | --- |
| **Organization** | **Data** |
| United States Geological Survey (USGS)  <http://ma.water.usgs.gov/> | Continuous stream stage and discharge measurements at gaging stations within the project extent. |
| The Weather Underground  <http://www.wunderground.com/> | Daily precipitation and temperature data weather stations within the project extent. |

**Table 5.** USGS gage locations in proximity to RMN sites.

|  |  |  |  |
| --- | --- | --- | --- |
| **Station and Location** | **Station Number** | **Latitude** | **Longitude** |
| Cold River at Florida, MA | 01168250 | 42.666694 | -73.030167 |
| Hubbard River near West Hartland, CT | 01187300 | 42.037500 | -72.939328 |
| West Branch Swift River near Shutesbury, MA | 01174565 | 42.455000 | -72.382222 |
| Ware River near Barre, MA | 01172500 | 42.425000 | -72.025000 |

**Literature Cited**

Stoddard, J.L., Larsen, D.P., Hawkins C.P., Johnson, R.K., and R.H. Norris. 2006. Setting expectations for the ecological condition of streams: The concept of reference condition. Ecological Applications 16(4):1267-1276.