Maine Lake and Stream Watershed Survey Generic Quality Assurance Project Plan

Maine Department of Environmental Protection
Bureau of Water Quality
Division of Environmental Assessment
Watershed Management Unit

1. Title and Approval Sheet

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3. Distribution List

The following individuals will receive a copy of the final Quality Assurance Project Plan (QAPP) and any revisions made in the future.

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Watershed Management Unit Staff

4. Project and Task Organization

Included in this section:

- *Generic Quality Assurance Project Plans and Survey Implementation Plan.*
- *Key personnel and organizations involved in watershed surveys, including data users.*
- *Specific roles and responsibilities.*
- *Organizational Chart.*

The U.S. Environmental Protection Agency (USEPA) has two approaches to Quality Assurance Project Plan development. One approach is a project specific approach requiring all QAPP elements to be addressed in detail. The second approach is a generic project or umbrella level approach where details are provided for elements that all projects share. Watershed surveys following methods developed and refined by Department of Environmental Protection (DEP) and partners as described and referenced in this document allow for a generic approach as provided in this document. A survey implementation plan (SIP) will need to be created by each watershed organization doing a survey and working under this QAPP. The survey implementation plan provides specific information about the survey such as objectives, when and where the survey will occur, who will do the training and how the information will be managed.

Department of Environmental Protection Division of Environmental Assessment (DEA)-Watershed Management Unit (WMU) staff provide technical guidance, training, and other assistance on these surveys. Soil and Water Conservation Districts (SWCD), consultants and other qualified organizations or individuals may also provide guidance, training and other assistance to watershed groups. Often, DEP staff work with the SWCDs or others to carry out these surveys.

Nonprofits, governmental and quasi-governmental organizations may receive funding to do surveys through the Maine Nonpoint Source Program (NPS), funded in part through EPA under Clean Water Act (CWA) Sections 319 or 604(b). Each NPS funded project is assigned to a DEA-WMU staff person, who provides administrative and technical oversight. DEP staff's role, beyond oversight, depends on the needs and resources of the grantee. It generally includes assistance with survey training, and sometimes site assessment/survey follow-up and report writing.

Watershed organizations may also do surveys without NPS funding. DEP WMU staff may provide assistance in the form of technical guidance, training and/or report writing on these surveys as well. The DEP encourages these projects to use this QAPP, if possible, so methods and resulting data are consistent with other grant funded surveys. Results obtained from surveys using methods different than this QAPP will undergo greater scrutiny when used as a support for applying for NPS implementation funding.

The following individuals are involved with these surveys. Their respective roles and responsibilities are listed in Figure 1.

Wendy Garland, NPS Coordinator
Responsibilities: Provides oversight on NPS funded projects, ensures that project proposals include QAPP/SIPs, reviews and approves QAPP/SIPs; maintains official approved QAPP; ensures annual QAPP review and 5-year renewal; distributes QAPP to distribution list.

DEP Division of Environmental Assessment-Watershed Management Unit Staff:
Responsibilities: Provide project administration and technical oversight/assistance; assists partners (below) with SIP preparation and review; ensure QAPP/SIP is followed

- Kathy Hoppe, Northern Maine Regional Office
- Greg Beane, Eastern Maine Regional Office
- Kristin Feindel, Central Maine Regional Office
- Amanda Pratt and Addie Halligan, Southern Maine Regional Office

Technical Staff and Watershed Managers
Responsibilities: Provide project administration and technical oversight/assistance; work with DEP to prepare and carryout SIPs

- Soil and Water Conservation Districts
- Consultants
- Universities
- Regional Watershed Associations
- Other qualified individuals and organizations

Watershed Groups
Responsibilities: Provide project oversight and administration, volunteer organization, data compilation, and outreach. Some larger watershed groups may have experienced staff that serve as technical staff.

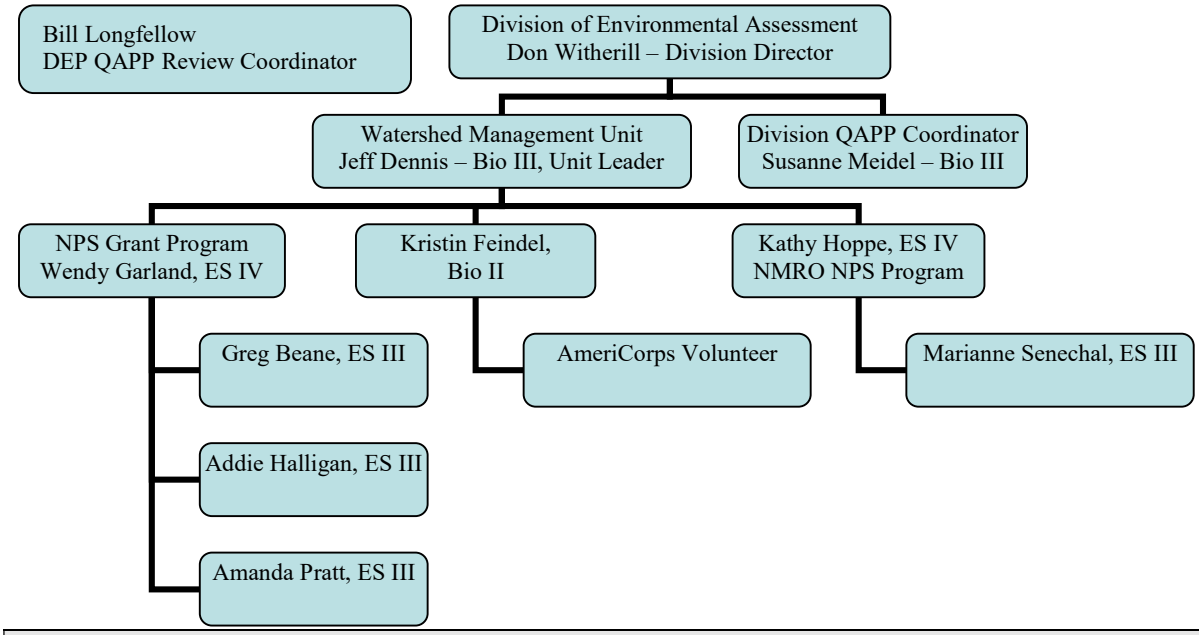
- Lake Associations
- Stream and River Watershed Organizations

DEP Quality Assurance Managers
Responsibilities: Carry out QAPP reviews; track SIPs; coordinate with program staff and EPA

- Susanne Meidel, Division of Environmental Assessment
- Bill Longfellow, DEP QAPP Review Coordinator

Survey data are used for 319 and 604(b)-funded projects including for development of watershed management plans and for identification of candidate sites for implementation projects. Watershed groups also use the data independently of 319 funded projects. They may bring the information to the attention of municipal officials, road associations and residents and encourage each group to address identified problems sites. They may also use the data to develop strategies for watershed protection and restoration.

Figure 1- DEP Watershed Management and QAPP Review Organizational Chart



5. Project Definition and Background

Included in this section:

- *Description of the problem that watershed surveys are designed to address.*
- *Background information such as previous studies.*
- *How watershed survey data will be used and who will use it.*

Description of Problem

The Division of Environmental Assessment is responsible for monitoring and assessing the health of Maine's waters. DEA also develops recommendations for water quality standards pursuant to the Federal CWA and State of Maine Article 4-A, Maine's Water Classification Program, and oversees the Nonpoint Source Program, which provides funding through Sections 319 and 604(b) of the Clean Water Act. DEA is comprised of the following units: Lakes Assessment, Invasive Aquatic Species, Marine, Engineering, Rivers and Streams, Biological Monitoring, Water Quality Standards and Environmental and Geographic Analysis Database (EGAD) / Geographic Information System (GIS) Support, Environmental Geology, and Watershed Management.

The Watershed Management Unit is responsible for coordinating the assessment of priority watersheds throughout the state and for providing assistance to local and regional groups in protecting or restoring water quality in these watersheds. (See Figure 1 for the WMU Organization Chart.) The unit focuses on waters that are either threatened or impaired and do not attain water quality classifications due to nonpoint source pollution. The staff provides support for watershed surveys to find the causes for water quality impacts and assists in developing plans for protection or restoration. Unit staff provides administrative oversight of 319 nonpoint source grant awards to develop and implement these plans. The unit also maintains the Stormwater Best

Management Practices (BMP) Manual and provides guidance to manufacturers and consultants on BMP evaluation and design. The unit also develops Total Maximum Daily Loads (TMDLs) for impaired streams pursuant to Clean Water Act requirements.

The Watershed Management Unit is responsible for administering Federal grants from EPA for the purposes of reducing or eliminating nonpoint source pollution. The federal funding, under CWA Section 319 and 604(b) supports watershed management work within the division as well as an annual competitive pass-through grants program for watershed projects to help restore or protect lakes, streams, rivers or coastal waters from NPS pollution. The pass-through projects help communities identify nonpoint water pollution sources, prepare watershed-based management plans (WBPs), and implement WBPs.

To carry out its focus of preventing and reducing nonpoint source pollution, the WMU employs survey tools to identify nonpoint source problems in watersheds and/or describe stream conditions. Nonpoint Source staff administers EPA's 319(h) grant award to Maine. Grant subrecipients (also referred to as grantees by Maine DEP) apply for funding for nonpoint source watershed planning projects that frequently include surveys. The Watershed Management Unit is also responsible for several activities that may involve surveys:

- Watershed-based planning
- Assisting municipalities with the development of watershed management plans
- Working with lake associations on watershed surveys (locally-funded)

Lake Watershed Surveys - The lake watershed survey method was formalized in the document "A Citizen's Guide to Volunteer Lake Watershed Surveys-How to Conduct a Nonpoint Source Phosphorus Survey", which was first published by Maine Congress of Lake Associations and Maine DEP in 1992. It was updated by DEP in April 1997 and September 2011. The basic approach and methods described in the manual are still widely used.

The primary purpose of lake surveys is to identify erosion problems, since erosion is the primary cause of phosphorus and sediment loading to lakes. Secondarily, surveys serve to educate the community and landowners and promote stewardship. During these surveys, surveyors drive or walk sections of the watershed and document erosion sites.

Stream Watershed Surveys - The Stream Watershed Survey method was formalized by the Maine DEP in "Stream Survey Manual (Volume I): A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds" (February 2009). Stream watershed surveys are similar to lake watershed surveys in that they identify and document nonpoint sources of pollution. Soil erosion and sediment is the primary type of nonpoint source pollution source identified. However, stream surveys can also be designed to identify sources of nutrients, bacteria, toxics, thermal pollution, stormwater runoff and riparian degradation. Again, a secondary purpose is to promote stewardship and educate the community about the watershed, water quality and nonpoint source pollution.

Depending on the resources available and potential problems, the organizers may choose to do further assessments. Some of these additional types of assessments might include (1) a more thorough assessment of stream riparian condition, (2) a more detailed assessment of stream

crossings to assess them as possible fish barriers, or (3) visual assessments of in-stream habitat and geomorphology conditions ("Stream Corridor Survey"). Refer to "Stream Survey Manual (Volume I)" (DEP 2009) for guidance and/or references related to these types of surveys. These additional types of assessments are not covered under this QAPP.

How Survey Data are Used

Lake and stream watershed data are compiled, and a watershed survey report is prepared either solely or jointly by the DEP, SWCD, a consultant or a watershed association. The report includes an overview the typical problems and an inventory of sites where best management practices should be installed. Watershed surveys are generally an important component of watershed-based plans, which are required for CWA Section 319-funded watershed implementation projects. The data are also used by the DEP, SWCDs, and/or watershed associations for watershed management or watershed-based planning.

6. Project and Task Description

Included in this section:

- *General description of the work the volunteers perform and where it will take place.*
- *Kinds of information that will be collected.*
- *How results will be evaluated (making sense of findings).*
- *Project timetable.*

General Project Description

Lake watershed surveys follow the protocol in "A Citizen's Guide to Volunteer Lake Watershed Surveys" (2011). Stream watershed surveys follow the "Stream Survey Manual: Volume I" (Unit 6: Stream Watershed Survey) (2009). In both types of surveys, volunteers and trained technical staff walk or drive assigned developed areas in a given watershed and identify and document sources of water pollution. General recommendations are also made about how to correct the problems and the sources are prioritized. The survey data provide an inventory of pollution sources to be remediated and are used in partnership with lake/stream associations, municipalities and others working on improving the water quality of their resource.

Project Timeline

Lake and stream watershed surveys typically take nearly a year to plan and fully carry out. However, timelines can be condensed if needed. Surveys should be scheduled so that field assessments are done during the best time of the year for observing erosion sites and runoff. The best time of year is spring (late April-early June) because the ground is usually saturated, ground cover vegetation is absent and many roads have not yet been graded. Fall is the second-best time, but it should be done before extensive leaf fall occurs covering the ground and before hunting season. In some cases, projects might need to take place outside of this timeframe due to volunteer availability, funding constraints, field conditions or other planning considerations. Table 1 (below) shows a typical timeline for a survey project.

Table 1. Sample Project Timeline

Major Tasks	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan
1. Project Design	X	X	X									
2. Survey Preparation		X	X	X								
3. Volunteer Training				X	X							
4. Watershed Survey				X	X							
5. Quality Control												
Survey Follow-up						X	X	X				
Review Forms						X	X	X				
Enter Data								X	X	X	X	
6. Data Interpretation									X	X	X	
7. Final Report Preparation											X	X

Watershed Survey Task Descriptions

Several tasks are involved with planning, carrying out and reporting survey findings. Generally, a survey can be divided into the seven tasks listed in Table 2 (below).

Table 2. Sample Task Description

Task	Who	Tasks
1. Project Design	Project Manager Tech team/leader	Gather information about the watershed Determine NPS sources and area to survey Form steering committee Appoint technical team to oversee project Prepare SIP
2. Survey Preparation	Project Manager Tech team/leader Steering Committee	Recruit survey volunteers and plan training Recruit and train (if necessary) technical leaders Send letters to watershed residents (permission) Publicize training and project Divide watershed into survey sectors Organize supplies and create maps Advise local law enforcement
3. Volunteer Training	Project Manager Tech team/leader Survey Volunteers	Conduct classroom training on survey methods Conduct field training led by technical staff
4. Watershed Survey	Tech team/leader Survey Volunteers	Identify and document watershed erosion sites Return completed survey forms and photos
5. Survey Finalization and Quality Control		
Survey Follow-Up	Tech team/leader	Staff conduct follow up visits to complete any unsurveyed sections and check data
Review Forms	Tech team/leader	Review and organize forms and photos
Enter Data	Data Coordinator	Enter data into Microsoft Excel Spreadsheet and check for errors

Task	Who	Tasks
6. Data Interpretation	Tech team/leader Project Manager	Prepare preliminary summary Generate GIS maps showing site locations Generate tables and charts on survey findings Check tables and charts for errors
7. Final Report Preparation	Project Manager Steering Committee	Develop recommendations for watershed Prepare final report Distribute reports to partners Conduct outreach on survey results

Task 1 - Project Design (see also 10. Survey Design, below)
The project manager works with the local watershed organization/organizers to form a steering committee. The steering committee provides overall guidance, sets the schedule and provides local knowledge about watershed issues. A technical team is also created that can oversee the project design and quality control issues that arise. A DEP staff person should be part of this team.

Information and data about the stream/lake and its watershed is gathered from various municipal, state and federal organizations and other sources. This information will be used to plan the project. Data may include aerial maps, topographic maps, land use maps, water quality data and reports. Lake watershed surveys are designed specifically to focus on erosion issues usually from development and roads. However, there may be erosion problems from land uses such as agricultural operations, gravel mining and/or forestry present in the watershed. The steering committee/technical committee will need to determine whether and how these areas are included. Stream watershed surveys identify a number of different issues. Again, the steering committee/technical committee will need to determine the scope of the project. A windshield survey (i.e., driving around the watershed) is an optional method for gathering preliminary information about problems (including the extent of active agriculture) in the watershed. Also depending on the size of the watershed, identified water quality priorities and anticipated resources available, the project may only focus on a portion of the watershed. For example, if it is not feasible to survey all of a 20-square mile watershed, the project might focus in on the most heavily developed areas covering only 5 square miles.

The project manager prepares a Survey Implementation Plan using the SIP template (Appendix D). The SIP needs to be approved by the Maine DEP prior to field work. The project manager and DEP watershed management unit staff retain a copy of the approved SIP in their respective project files. The project manager is responsible for communicating the SIP and QA/QC requirements to Technical Leaders working on the project.

The SIP will reference this generic QAPP. The SIP will include a distribution list, descriptions of specific roles and responsibilities, site information, a project description and schedule, and reporting requirements. Deviations from the generic QAPP will be included in the SIP. The project manager is responsible for providing procedures for deviations from the generic QAPP. An example SIP outline is as follows:

1. Distribution List

2. Project & Task Organization
    Roles and Responsibilities
3. Project Definition & Background
    Site Map
    Watershed Description
    Previous Surveys and Assessments
    Survey Purpose
4. Project & Task Description
    Survey Scope
    Project Framework, Specifics and Deviations from QAPP
    Schedule
5. Reports to Management
    How Results are Reported and to Whom

Task 2: Survey Preparation (see also 10. Survey Design, below)
Project staff will review town tax maps and compile a mailing list of all watershed landowners. Project staff and steering committee will send notification letters or postcards to all households on the list prior to the field survey. The letter will describe the project, enlist volunteers and give landowners the opportunity to exclude their properties from the survey. Properties that ask to be excluded from the survey will be clearly identified in survey materials.

In addition to landowner letters, the public is notified about the survey through other methods that may include public information meetings and press releases. The local police are also notified before the survey. Volunteers are recruited by the steering committee and through survey publicity. Volunteers are notified about training details, including expectations and any items they should bring to the training. The steering committee plans the location, date and time for the volunteer training, and the project manager prepares the training presentation and agenda.

Staff review watershed maps and divide each watershed into several sectors that will be assigned to small teams of volunteers. The number of sectors in each watershed varies and is determined based on the expected number of survey volunteers, expected number of technical leaders available on the training day, anticipated NPS problems and number of developed properties. Ideally, each sector should have between two and four volunteers and one technical leader. See 10. Survey Design, below, for more information about dividing watersheds into sectors.

Survey materials (including field sheets, GIS maps and/or tax maps, landowner identification tables, photo identification numbers and educational handouts) are compiled in binders or packets for each sector. Tablets are provided for surveys using digital forms. Signs to place in car windshields and surveyor identification (ID) badges (optional) are prepared to clearly identify surveyors in the field. Technical leaders will be recruited to attend the volunteer training and lead small group field sessions. Prospective technical leaders will be trained in survey methods if they have not served as a leader in past surveys.

Task 3: Volunteer Training (see also 8. Training Requirements, below)
Training is provided by technically qualified individuals (i.e., technical team members) who have been selected by the steering committee. Names of qualified individuals can be obtained

from the Division of Environmental Assessment of the Maine DEP or the County SWCD. The Maine DEP can also provide a standard training presentation for stream and lake watershed surveys.

Training is generally broken into two sessions. The first is an indoor session providing volunteers with background information on stream/lake and watershed ecology and an overview of how the survey is conducted. The outdoor training follows one of two options. If there are enough technical leaders, the large group is divided into smaller sector groups, and each small group goes into the field with a technical support person. Those groups lacking adequate technical support may conduct a large group field training. Technical leaders ensure that each volunteer has the opportunity to practice identifying a site, filling out the survey form, and receiving feedback.

Task 4: Watershed Survey (see also 11. Survey Methods, below)
Sites are documented by completing standard forms (either on paper or with a digital version of the survey form created using ESRI Survey123 or similar software), taking digital photos, and recording the Global Positioning System (GPS) coordinates. Survey teams should make sure they visit all developed areas in the assigned sector; if any areas are omitted intentionally (for example because a homeowner did not grant permission to enter a property), it must be noted in the survey documentation. Ideally, surveys will be completed within one month of the survey training date. Completed forms should be reviewed for completeness and submitted to the project manager.

Task 5: Survey Finalization and Quality Control (see also 14. Quality Control, below)
Immediately after the survey is finished, all data are reviewed by the technical team leader to be sure the survey forms are properly completed and all survey sectors have been completely covered. If questions arise, the team leader will contact volunteers as soon as possible for resolution. Sites that were completed by volunteers only (without a technical team leader) are followed up on by the project manager and/or technical team members as soon as possible. This allows for both checking the accuracy of documented sites and looking for additional undocumented sites. After each site is checked, technical staff initial and date the shaded area at the top of each field sheet (paper lake forms) or note it on the field sheet (stream surveys) to indicate that the site has been checked by technical staff.

The technical advisor (or sometimes a volunteer Data Coordinator) then enters selected data from each survey form into an Excel spreadsheet. The resulting spreadsheet is then double-checked to make sure it matches the original field sheet. If using digital forms, the data are downloaded into Excel, checked for completeness, and columns and rows are edited for clarity as needed. After GIS maps are created, the site locations are cross-checked with the location described on the field sheet. Spreadsheets and maps are considered final after review by the project manager.

Task 6: Data Interpretation (see also 19. Data Management, below)
The survey data are analyzed to determine key findings such as the predominant land uses associated with NPS problems, the impacts of the identified sites and the approximate cost to fix the problems. Graphics and/or tables are typically created to depict the breakdown of problem sites by land use, impact and cost to fix. These summary graphs and tables are checked to make

sure that data match the spreadsheet information. The technical team prepares a preliminary report of findings that is shared with the steering committee and stakeholders.

Task 7: Final Report Preparation (see also 19. Data Management, below)
The project manager, with assistance from the technical team, prepares a final report. The survey report includes a watershed overview, description of survey methods and limitations, results, GIS maps, site list, data analysis and general recommendations for the watershed. Members of the steering committee and technical team review the report and provide feedback. The survey report is then printed and shared with town officials and watershed residents. Survey findings are also publicized through local press, mailings, partners' websites and other avenues.

7. Data Quality Objectives

Included in this section:

- *Description of DQOs relevant to watershed surveys.*

Data Quality Objectives (DQOs) are the quantitative and qualitative terms used to describe how good your data need to be to meet your project's objectives. DQOs for measurement data are precision, accuracy, representativeness, completeness, comparability and measurement range. *Precision* is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of your methods. *Accuracy* is a measurement of confidence that describes how close a measurement is to its "true" value. *Measurement range* is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. *Representativeness* is the extent to which measurements actually represent the true environmental conditions. *Comparability* is the degree to which data can be compared directly to similar studies. Using standardized sampling, analytical methods, and units of reporting helps to ensure comparability. *Completeness* is the comparison between the amount of data you planned to collect versus how much usable data you collected, expressed as a percentage.

Precision, Accuracy and Measurement Range
Standardized field sheets should be filled out for each confirmed NPS site. See Appendix B for detailed guidance on filling out the sections of the form. Digital survey forms are created using ESRI Survey123 or similar software and contain the same information as paper forms. Each site location is described (road name, house #, tax map #, nearest utility pole #). This allows the site to be located by technical staff if needed. Additionally, GPS location data are collected as described in 'Guidance on Filling out Lake Watershed Survey Field Forms' (Appendix B).

The GPS units are provided by DEP and technical resource groups (e.g. SWCDs, consultants) who provide technical leadership for the survey or local volunteers. Volunteers or technical leaders may also download and use apps to collect GPS data. The DEP and other resource agencies are responsible for ensuring that the units are properly operating and set to the correct coordinate system. The survey form provides the correct number of digits to help reveal errors with system settings (see Appendix A. Lake Survey Form and Appendix C Stream Survey Form). Digital forms allow users to select their exact location using an interactive map, and the form automatically records the error associated with the measurement. The measurement error or accuracy should also be filled in on the form.

Aside from the above considerations, these data quality objectives generally do not apply to lake/stream watershed surveys as water quality samples or measurements are not collected.

Representativeness

Lake Watershed Surveys - The entire watershed is delineated into survey sectors. For most surveys, all developed areas are surveyed to include shoreline areas, roads, and development along roads. Areas within survey sectors that are remote or undeveloped (e.g., wetlands, forested areas) are not surveyed. Additional areas such as logging roads and operations, large farms, and gravel mining may or may not be included depending on accessibility, landowner permissions and extent of the land use in the watershed. Any areas and land uses excluded from the survey must be described in the final survey report.

In some cases, the entire watershed may not be surveyed, particularly if the lake watershed is very large (> 10 square miles), highly developed or if there are limited technical support staff or volunteers. The technical team will decide which areas will be surveyed and might choose to focus on a portion of the watershed or a mix of representative sectors (e.g. shoreline areas, upland areas, higher developed areas).

Stream Watershed Surveys – Stream watersheds are also delineated into survey sectors. For smaller streams, generally the entire watershed will be surveyed, including riparian areas, roads and trails (e.g., ATV, snowmobile), and developed areas. Areas within survey sectors that are remote or undeveloped (e.g. wetlands, forested areas) generally are not surveyed. Additional areas such as logging roads and operations, large farms, and gravel mining may or may not be included depending on accessibility, landowner permissions and extent of the land use in the watershed. Any areas and land uses excluded from the survey must be described in the final survey report. (It is worth noting that experience has shown that dirt roads and trails in remote areas frequently are some of the more common, significant contributors of sediment pollution to streams and rivers, so they should at least be considered.)

For larger streams and rivers, it may not be feasible to survey the entire watershed. In this case the technical team will prioritize sub-watersheds to be surveyed. For example, the technical team may choose to focus on impaired tributaries/stream segments and the sub-watersheds that are the most highly developed, or it could select tributaries/stream segments that fisheries biologists know have high value habitats for pollution-sensitive fish species such as brook trout and Atlantic salmon. The watershed organization could also decide to survey the entire watershed in phases (e.g., half the watershed the first year and half the second year).

Comparability

Lake Watershed Surveys - Volunteer teams follow protocols in "A Citizen's Guide to Volunteer Lake Watershed Surveys" (2011). The field form (Appendix A) includes a list of options under the "Land Use/Activity", "Description of Problems" and "Recommendations" sections, which ensures comparability as surveyors review the list that covers all possibilities. The form also includes an assessment of Impact, Cost to Fix (high, medium, low) and Technical Level to Install. For these qualitative estimates, there are descriptions provided to aid in selection. The classroom and field portions of the volunteer training also provide surveyors with practice selecting an appropriate rating. During the survey, the field forms are completed collectively by

the survey team that includes between two and four volunteers and a trained technical leader. Surveys that are completed by volunteers only (without a technical leader) are revisited by technical staff to make sure all sites were properly documented.

Stream Watershed Surveys – Surveys follow protocols in "Stream Survey Manual (Volume 1): A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds" (February 2009). Volunteers use a standardized form (Appendix C) for each problem site identified. The form is similar to the lake watershed survey form and provides a list of items for "Issues" and "Recommendations". Criteria are provided on the form to rate the impact of the problem. The field forms are also completed collectively by the survey team that includes between two and four volunteers and a technical leader. Surveys that are completed by volunteers only (without a technical leader) are revisited by technical staff.

Completeness
Watershed surveys do not have any legal or compliance requirements. Additionally, there is no requirement that a certain percent of data be collected to meet statistical requirements.

Immediately after each survey is finished, technical team leaders review all field sheets to ensure they are fully completed and all survey sectors have been completely covered. Any missing information is obtained and filled in as needed. For projects using Survey123, DEP set up standard digital survey forms with required fields to ensure that all necessary data are entered.

For surveys that are completed using USEPA Nonpoint Source (319) funds, it is expected that the proposed survey areas will be completed. If portions of the watershed are not surveyed due to landowner permissions, resource limitations or other reasons, these exclusions and the reason must be described in the survey report. Also, the survey report should clearly describe the types of NPS covered by the survey methods. For example, most lake watershed surveys focus primarily on soil erosion sources in the watershed.

8. Training Requirements

See also Task 3, Volunteer Training, in section 6. Project and Task Description, above.

Included in this section:
- *Training requirements for technical leaders.*
- *Training requirements volunteers will need to successfully complete their tasks.*
- *How training will be provided and how to evaluate volunteer performance.*

Technical leaders should have background knowledge about NPS issues and Best Management Practices (BMPs) and experience with NPS site identification. Prior to serving as a technical leader, individuals shall either 1) have participated in a separate watershed survey, alongside an experienced technical leader or 2) have attended a DEP training workshop for technical leaders[1]. The project manager will ensure that all technical leaders have this required training and

[1] DEP has periodically held workshops when there has been a need to train several new staff involved with watershed surveys. Contact DEP well in advance of the survey date to see if such training can be arranged.

experience. If the technical leaders are known when the SIP is developed, their training and experience will be included in the SIP. The project manager records survey volunteers, training attendance and technical leaders. This information is kept with the project file.

Training of volunteers is required for lake/stream watershed surveys. Table 3 (below) describes the classroom and field training requirements for each type of survey. Following the classroom survey training, small group field training is led by a technical resource staff person. The technical leader evaluates volunteer performance during the training since site ratings are initially discussed as a group. The technical leader also evaluates performance by reviewing information collected on the field forms during the training and at the end of the day.

Stream watershed survey field training may also be done as a larger group. Sectors that are not completed on the training day may be completed on subsequent dates by volunteers and the forms submitted to the project manager. Any sectors or portions of sectors surveyed by volunteers only are followed up and verified by technical staff as soon as possible after the training date to ensure correct completion.

Table 3. Volunteer Training Requirements

Survey Type	Description of Training	Training provided by
Lake Watershed Survey	**Classroom training** – covers lake ecology, typical NPS problems and solutions, practice field sheet completion, safety and talking to property owners **Field training** - "hands on" with technical resource or consultant staff leading volunteer teams	DEP technical staff, SWCD staff, and/or consultants
Stream Watershed Survey	**Classroom training** - covers stream ecology, NPS pollution, typical problems and solutions, data sheet completion, safety, talking to landowners **Field training** - 2 options: Option A-Field training done "hands on" with technical resource staff leading a small volunteer team through survey. Option B-Large group training - group visits example problem sites, discusses problems and practices completing data sheets.	DEP technical staff, SWCD staff, and/or consultants

9. Documentation and Records

Included in this section:

- *Field information and records needed for this project (field data sheets etc.).*
- *Information on how long and where records will be maintained.*

The project manager is responsible for ensuring that project organizers and technical leaders have a current version of the QAPP, SIP, survey instructions and field data forms. Forms for lake watershed surveys are available in the appendices of this document and the "Lake Watershed Survey" manual (DEP 2011). Since the forms tend to undergo minor modifications

over time, the project manager should contact DEP prior to the start of a survey to see if an updated version is available. The stream watershed forms (Appendices) are from the "Stream Survey Manual (Volume 1)", developed by DEP. Digital versions of watershed forms tailored to the target watershed are produced specifically for individual surveys and are made available through the Survey123 app.

Watershed survey field teams are provided a binder or packet that includes maps and data forms, and a tablet if using digital survey forms. Field forms are completed for each site with an identified NPS problem. At the end of the survey, watershed survey forms are reviewed by the survey team technical leader to ensure that each form is filled out correctly and completely. Any questions or problems are corrected at that time, if need be after consultation with field team members. Completed forms are provided to the project manager.

The project manager reviews the forms and enters the information into an Excel spreadsheet (or downloads the digital survey data). Projects may choose different data to include in their spreadsheets; however, commonly used categories include those listed in Table 4 below. The project manager keeps an original set of field forms (or digital copy of survey results, when digital forms are used) for a minimum of five years. Site photos are compiled by the project manager. Some groups may choose to save on online platforms such as Dropbox. The approved SIP will be stored as an appendix to the QAPP electronically in Maine DEP Nonpoint Source project files.

Table 4. Sample Information to Include in Survey Report Spreadsheets

Site #	Land Use	Location	Description of Problem	Area (sq.ft.)	Recommendations	Impact	Cost to Fix
1-1	Residential	81 Birch Drive	Bare soil. Slight surface erosion at roof dripline. Lack of buffer.	50 x 5	Install dripline trench, seed/mulch bare soil. Plant buffer.	Low	Low
1-2	Private Road	North end of Birch Drive	Clogged culvert. Moderate shoulder and road surface erosion. Direct flow into stream.	200 x 12	Replace culvert and armor ends with riprap. Add new road material and crown road. Install turnout into woods.	High	Medium

Measurement and Data Acquisition

10. Survey Design (Experimental Design)

See also Tasks 1 and 2, Project Design and Survey Preparation, in section 6. Project and Task Description, above.

Included in this section:

- *Survey design information.*
- *How constraints such as weather, seasonal variations, or site access might affect scheduled activities, and how to handle those constraints.*

- *Site safety plans.*

Survey Design

Staff review watershed maps and divide each watershed into several sectors that will be assigned to small teams of volunteers. The number of sectors in each watershed varies and is determined based on the expected number of survey volunteers, expected number of technical leaders available on the training day, anticipated NPS problems and number of developed properties. Ideally, each sector should have between two and four volunteers and one technical leader. Each sector should be able to be completed by volunteers in 6 – 15 hours (which includes the survey training day).

The time it takes to survey an area can be difficult to predict. If there are very few NPS problems, volunteers can move quickly through a large area. Oftentimes, steep gravel roads and high-density lakefront developments have more NPS sites and take longer to survey. If the survey takes place when most landowners are home, it can take time to stop and talk. A general rule of thumb in lake watersheds is to assign sectors with comparable numbers of lakefront properties (e.g., 2-30 lakefront properties would be a feasible number to survey on the survey day). Back lots and roads should also be assigned to each sector in such a way that it is clear where each sector begins and ends. Since development patterns vary throughout a watershed, sector size will also vary. Areas with dense lakefront development would be in a considerably smaller sector than forested areas in the upper watershed.

Prior to field work, the project manager will prepare a SIP that will be approved by the Maine DEP. The SIP will reference this generic QAPP. The SIP will include a distribution list, descriptions of specific roles and responsibilities, site information, a project description and schedule, and reporting requirements.

<u>Lake Watershed Surveys</u>

Volunteers start at one side of their assigned survey sector and walk or drive all roads and properties (except where landowners have denied access). At any location where volunteers observe signs of soil erosion (e.g., bare soil, rill, gullies, bank slumping, exposed roots, deposited sediment), volunteers investigate the potential for the sediment to reach the lake. The site is documented if it is likely that the eroded soil directly washes into the lake or it reaches the lake via a stream, intermittent stream or ditch. However, if the soil clearly settles out into a forest buffer far from the lake, stream or ditch, it is not documented. Also, sites with bare soil, even in close proximity to the lake or a tributary, are not documented if there is no sign of soil transport, the exposed area is relatively small, or there is low potential for soil movement due to flat slope.

Note: The watershed survey methods in this QAPP focus on existing <u>erosion</u> sites. If a property lacks a vegetated buffer, but it does not have any visible signs of soil erosion, it should not be documented as a site unless the project steering committee determines during the planning stage the survey should collect this additional information. If problems and concerns in a watershed extend beyond erosion sites, the project SIP, survey forms and training should be adjusted accordingly. Other issues that may be important to consider include agriculture, septic systems, stream crossings and forestry.

In addition to the site location and GPS information, the following items are documented for each site: land use/activity, description of problems, whether there is direct flow to a waterbody or waterway, size of area exposed or eroded, and recommendations for problem correction. The form provides a menu of choices for each question so there is documentation/evaluation consistency among sites. The 'Guidance on Filling out Lake Watershed Survey Field Forms' (Appendix B) provides extensive instructions for completion of the form. Each site is also rated as high, medium or low impact by completing a scoring table (see Table 5, excerpt from lake survey form, Appendix A).

Table 5. Impact Rating Section of Watershed Survey Form

Impact: Circle one choice in each column, add the three selected numbers together, and then circle the site's corresponding impact rating (high, medium, or low).

Type of Erosion	Area	Buffers and Other Filters	IMPACT
Gully - **3**	Large - **3**	No filter, all channelized direct flow into lake or stream - **3**	High: 8-9 pts
Rill - **2**	Medium - **2**	Some buffer or filtering, but visible signs of concentrated flow and/or sediment movement through buffer and into lake - **2**	Med: 6-7 pts
Sheet - **1**	Small - **1**	Significant buffer or filtering* - **1**	Low: 3-5 pts

* Confirm there is likely sediment/runoff delivery. If not, do not write up as a site.

Survey teams indicate the approximate cost to fix the site by selecting one of the following ratings: low (<$500), medium ($500-$2,500) or high (>$2,500). A list of typical costs associated with common BMPs is provided in survey packets for reference.

Optionally, groups may choose to ask teams to also rate the technical level needed to fix the site as follows: low (property owner can accomplish with reference materials), medium (technical person should visit site and make recommendations) and high (site requires engineering design). If the lead organization has access to a summer Youth Conservation Corps (YCC), survey forms may also include a question: Is this a candidate YCC site?

Stream Watershed Surveys

Stream watershed surveys are very similar to lake watershed surveys. Surveyors walk and/or drive all developed areas in their assigned sectors. The volunteers identify nonpoint source sites and document each site on a field form (Appendix C). Each site location is described (road name, house #, # of nearest utility pole, etc.). This allows a site to be located by technical staff if needed.

In addition to site location and GPS information, the following items are documented for each site: land use type, area affected, nonpoint source issue, and recommendation for problem correction. The form provides a menu of choices for each question so there is documentation/evaluation consistency among sites. The 'Guidance on Filling out Lake Watershed Survey Field Forms' (Appendix B) provides extensive instructions for completion of the form. Each site is also rated as high, medium or low impact based on a scoring system comparable to that shown in Table 5, above.

Nonpoint source issues assessed for stream watershed surveys may include soil erosion, bacteria, nutrient and toxic sources; temperature impacts, and buffer, stream channel and culvert crossing problems. The project steering committee should consider stream stressors prior to the survey and adjust the SIP, survey forms and training accordingly to focus on the NPS issues of greatest concern. For more information about identifying stream stressors, refer to the DEP's 'Guide to Identifying Stream Stressor' (2019) at https://www.maine.gov/dep/land/watershed/Stream Stressor Guide October 2019final.pdf.

Potential Survey Constraints

Surveys should be scheduled so that field assessments are done during the best time of the year for observing erosion sites and runoff. The best time of year is spring (April-May) because the ground is usually saturated, ground cover vegetation is absent and many roads have not yet been graded. If a spring survey is not possible, the next best time is fall. Conditions, however, may not be as favorable, and safety issues are greater because of fall hunting season.

It is often easy to identify problems if the survey takes place when it is raining or soon after a rainstorm. That said, it can be difficult to conduct the survey during a steady rain or downpour conditions. Unless write-in-the-rain paper is used, it can be difficult to clearly fill out field sheets. Photos can also be of poor quality in the rain. Rainy conditions are also uncomfortable for volunteers so they might not be as thorough in their survey methods. In such cases, volunteers should be given the option to discontinue the survey and reschedule the remainder of their field work under better conditions.

Survey Planning and Safety Considerations

Prior to training, watershed surveys are publicized through several possible methods. This may include press releases, flyers in locations such as the local library or town office and/or articles in local newspapers or association newsletter. Letters or postcards are also sent to all watershed property owners. The letter explains the survey and requests that anyone who does not want their property accessed contact the survey organizers. Volunteers are provided a list of what to bring (e.g., water, lunch, raingear) to the training and told what to expect.

During the training, safety issues are reviewed, and the volunteers are instructed on how to talk to property owners and when not to access private property. If appropriate, the training also covers potential hazards such as ticks, poison ivy and lightning. Each survey binder includes cell phone numbers for project managers and the local emergency phone numbers. Safety vests are provided to each team to wear on busy roads or during hunting season. Survey signs and/or badges are provided for each survey team to place in the windshield of their car. DEP technical leaders are trained in CPR and first aid. Surveys are set up and organized so there is a team of two or more volunteers per survey sector so that no one conducts field work alone.

11. Survey Methods

Included in this section:

- *Description of survey methods.*
- *Information on parameters to be sampled and the associated supplies and equipment.*

Survey Methods
Survey teams will complete field forms, collect GPS coordinates and take photos of each documented site (see Table 6. Supplies and Equipment needed for Survey Parameters). The technical leader will attempt to resolve and correct any problems that occur during the survey. If further assistance is needed, they will contact the project manager.

Table 6. Supplies and Equipment Needed for Survey Parameters

Lake Watershed Survey	
Assessment Field Form Parameter	Supplies/Equipment
Sector & Site, Tax Map & Lot	Maps
Location, Building color/#, Landowner Name	Tax Maps/Landowner List
GPS Coordinates	GPS Unit/Phone app/tablet
Other	Camera, Photo ID #s
Stream Watershed Survey	
Assessment Field Form Parameter	Supplies/Equipment
Sector # or Reach #, Site #, Waterbody	Maps
# Photos taken	Camera, Photo ID #s
Location Description	Maps
GPS Coordinates	GPS Unit/Phone app/tablet

Field Forms – The survey team completes a field form for each NPS site based on what is observed in the field. Volunteers should fill out all sections of the field sheet for each site according to the guidance in Appendix B. Field forms are kept in a binder for field work (or saved digitally to the Survey123 app, if using digital forms). The binder or packet also includes sector maps, tax maps (if available), landowner names/addresses and handouts for property owners. On each site form, the sector number is noted. Sector numbers are pre-assigned by the technical leader or organizer. Each site identified in the field is assigned a sequential number. For example, the third documented problem site in sector 4 would be identified as 4-3.

Location Information – Surveyors collect information on the survey sector and site, tax map and lot number, specific location information, building color, landowner name and whether a conversation with the landowner took place.

GPS Coordinates – Surveyors should record GPS coordinates for each site using a GPS unit, phone app or tablet. The coordinate system selected for the survey should be selected in the settings for the device that will be used prior to the survey.

Photos - Surveyors should take one or two photographs of the site using a camera or phone. Each survey team is provided with a number booklet that allows surveyors to select a unique site ID number for each site. A volunteer holds the booklet with the site ID number so that it is visible in each photograph. If using digital survey forms through Survey123, there is an option to capture and attach photos (which should still include the site ID number booklet) directly to the form for each site.

12. Sample Handling and Custody

There are no samples associated with lake or stream watershed surveys.

13. Analytical Methods

There are no laboratory or field analyses associated with lake or stream watershed surveys.

14. Quality Control

Included in this section:

- *Quality Control procedures.*

A number of quality control steps or checks (e.g., organization and planning, training of volunteers, data management) have been described throughout earlier parts of this QAPP. The following summarizes quality control checks for watershed surveys.

1. Prior to training, organizers recruit technical leaders to cover survey sectors. The goal is to have a technical leader for each volunteer survey sector team. Training will be provided, as needed, to technical leaders to help ensure consistency of qualitative ratings and survey methods.

2. Classroom training includes an overview of typical nonpoint source problems and solutions, and how to complete the field sheet. At the end of the training, photos are presented to the group showing sample problems. The group discusses how to describe and fix each problem.

3. The general approach for the watershed survey field work is that each volunteer survey team includes a technical leader that leads the team and provides a quality check. At each site, the team discusses the problem and recommendations and completes the field sheet together. Survey sectors that are not completed on the scheduled survey day may be completed later by the volunteer survey team without a technical leader. All sites not completed with a technical leader are revisited by a technical staff person. Notation is made on the top of each survey form to indicate if a site has been checked by a technical staff person.

4. All survey teams use existing standard field forms to document nonpoint source sites. Both paper and digital forms provide instructions such as “circle only one” or “circle all that apply” for several sections. The options listed in the “Description of Problems/Issues” and “Recommendations” sections are also organized by category (e.g., culvert, agriculture etc.) to help guide volunteers to appropriate responses.

5. At the end of the training/survey day, the technical leader reviews the field sheets to ensure forms are complete. Digital survey forms have required fields to ensure all necessary data are collected. The binder, and associated photos, are turned in or sent to the project manager/data coordinator when surveying is complete.

6. The data coordinator/project manager reviews the forms for apparent accuracy and completeness. Any questions are followed up on as soon as possible. The project manager

determines which areas of each sector need to be checked by a technical staff person by talking with the volunteers that return survey materials and by checking the surveyor initials listed on each survey sheet. The project manager then inspects and surveys the remaining portions of each sector.

15. Instrument/Equipment Testing, Inspection and Maintenance Requirements

Included in this section:

- *Description of the plan for routine inspection of field equipment.*
- *List of equipment that will be routinely inspected and what spare parts will be on hand to keep field operations running smoothly.*

Digital cameras, phones and/or tablets are checked and charged, and extra batteries are provided in preparation for the field survey. Organizers ensure that each team has a GPS unit (with extra batteries), tablet or phone app to collect GPS data for the training and survey day. The GPS geographic coordinate system should be set to either UTM Zone 19, or Latitude & Longitude System using either NAD83 or WGS84. The project manager should decide which coordinate system they prefer based on the software planned for mapping and then make sure each GPS unit is set to the proper system. Site location data is recorded when at least 4 satellites have been acquired by the GPS unit.

Since all GPS units have some error associated with them, GPS error (indicated on the GPS unit or app) is recorded on the field form. The field forms have the correct number of place holders to ensure all numbers are recorded. Digital survey forms automate the recording of GPS locations and GPS error, but users must still verify that GPS locations are correct. Latitude and longitude are recorded to decimal degrees. Sites are spatially checked using a GIS computer mapping program (e.g., ArcView or ArcMap, Google Earth, Google Map) using address/location information listed on field forms.

16. Instrument and Equipment Calibration and Frequency

There are no calibration requirements for equipment used in lake and stream watershed surveys.

17. Inspection and Acceptance Requirements for Supplies

Included in this section:

- *How to determine if supplies are adequate for training and surveys.*

All supplies will be prepared and organized before the scheduled training and survey date. This includes organizing the field binders/packets and ensuring that enough field forms and other materials are provided for each group. Organizers ensure there are enough cameras/tablets and GPS units for the number of survey teams and that the tablets/cameras/GPS units are charged and in working order. If a volunteer group runs out of forms or encounters problems with

equipment, they will be directed to contact the project manager at the cell phone number listed in the survey binder.

18. Non-Direct Measures and Data Acquisition Requirements

Included in this section:

- *Types of data that are not obtained through a survey.*
- *Any limits on the use of this data resulting from uncertainty about its quality.*

Watershed surveys use maps derived from United States Geological Survey (USGS) maps and State of Maine Office of GIS coverages to delineate watershed survey sectors. The State of Maine GIS data layers typically have metadata (data used to describe other data) associated with them explaining any background information and limitations it may have.

Town tax maps may also be used to supplement the GIS survey maps. Generally, the tax maps are used to note tax map lot number and landowner name. Tax maps and landowner names may be obtained from towns or from GIS maps. This information is updated infrequently, especially in GIS, so some of this information listed on field sheets might be inaccurate. Some lake associations also maintain mailing list for their outreach purposes.

Surveyors make every effort to correctly identify each site's map/lot number by cross checking maps, signs and local knowledge. However, there is also some potential for mistakes, especially in densely developed areas without numbers clearly marked on houses. If the steering committee and project manager decide to include the landowner name, tax map and lot, and/or address on the site spreadsheet in the survey report, a disclaimer should be included to let readers know of the possibility of error. The disclaimer could be something similar to the following: "Although every effort was made to ensure their accuracy, Tax Map and Lots #s, listed in this table might not be the actual location of the problem cited."

When planning for a survey, organizers may review existing studies and other watershed information. This information can be useful in helping to prioritize survey areas and in providing knowledge about the stream or lake. Examples of information includes water quality data, pollution source data, and land use data. Limitations of such information will be determined on a case-by-case basis.

19. Data Management

Included in this section:

- *Path data takes from field survey to data storage and use.*
- *How to check for completeness of field forms, and to minimize and correct errors in calculations, data entry to forms, and reports.*
- *Computer software used to manage data.*

The volunteer field teams use existing field forms to document nonpoint source sites. Sample forms are attached in Appendix A and C. After the survey, the field forms are reviewed by the project manager to ensure that the forms are properly completed. If information is missing or

incomplete, the project manager contacts the technical leader and/or volunteer(s) to request or clarify the information. If the information was not collected during the survey, the project manager should try to determine the information from the photo if possible or return to the site. The spreadsheet will also be compared to any summary graphs or tables produced for the report. If inconsistencies are found, the project manager will go back to the field sheet to determine the source of the errors. In general, the field sheet will be viewed as the more reliable information source.

The project manager should also look for data gaps on the GIS maps of identified sites. If there are large, developed areas without any identified NPS sites, the project manager should consult with the technical team leader to make sure the area was actually surveyed and, if so, why no sites were found (e.g., extensive buffers, flat slope etc.). If the GPS coordinates used to generate maps are inaccurate (e.g., sites appear in the lake or outside the watershed), additional field sheet information are reviewed and/or site visits are conducted to fix the coordinates.

Photos can be downloaded on a laptop at the end of the survey training day or submitted to the project manager via email or thumb drive. Photos may also be uploaded to an online sharing site such as Dropbox.

For surveys using digital forms, each technical leader must upload completed forms using the Survey123 or similar app. The information can then be downloaded by Maine DEP staff using Survey123 Connect software, saved, and shared with project partners. Digital forms reduce data entry and calculation errors and save time by eliminating the need for manual survey data entry.

Site information from the field forms is entered into a Microsoft Excel spreadsheet at the DEP office, project manager's office or volunteer's home computer, depending on who enters the data. If a volunteer completes the data entry, the electronic file will be provided to the project manager and/or DEP staff and saved on their computer system. Original field forms, or scanned or paper copies thereof, are provided to DEP or the Project Manger to allow for data review to ensure the spreadsheet matches the information from the original field sheets.

The project manager prepares a final report in Microsoft Publisher or Word. The report typically includes a watershed overview, survey description, results, GIS maps, site list, compilation of NPS problems and general recommendations for fixing each type of site. Charts, figures, tables and descriptive statistics are generated using Microsoft Excel. The summary information in the graphs and tables are checked against the spreadsheets to ensure that the numbers align (e.g., total number of sites, number of sites by each land use, number of sites by impact). GIS maps of site locations are prepared by the project manager or DEP (if time allows) using Google Earth, Google Maps, ArcView, ArcMap or other mapping software. Locations on the maps are checked against the information provided on the field sheets to ensure correct placement.

Copies of the field forms (either hardcopies or digital copies) are kept in the DEP or project manager's files for a minimum of five years. The DEP office computer system is maintained by the State of Maine Office of Information Technology and secured through daily back up procedures.

Assessment and Oversight

20. Assessment and Response Actions

Included in this section:

- *How to evaluate survey activities and records.*
- *How any problems identified through these evaluations will be addressed.*

Watershed surveys are completed by a volunteer survey team led by a technical leader. The technical leader reviews performance of the volunteers during the survey and informs volunteers of corrections needed. Technical leaders are staff or consultants who have a background and experience in survey work. They include DEP Division of Environmental Assessment staff, SWCD staff, AmeriCorps volunteers and consultants. If any sector is not completed at the end of the training and survey day, it may be completed by volunteers without a technical leader. Sectors or sites not completed with a technical leader are revisited by a technical staff person. The technical staff also documents any sites in the sector not identified by the volunteers.

If technical leaders identify any problems during a survey, they take appropriate action to resolve them, for example by reminding volunteers of appropriate techniques, pairing up inexperienced volunteers with experienced ones, or performing certain tasks themselves. Unresolved problems are reported to and addressed by the project manager.

Project managers review submitted survey forms for completeness and apparent accuracy. Any questions are followed up on as soon as possible with technical leaders and appropriate action is taken to resolve problems identified. Such action may involve revisiting a survey site, consulting with volunteers, or flagging data.

In situations where the GPS equipment or a tablet has been shown to be faulty, the equipment is replaced or another method is found. If it is shown that better training is required, training requirements may be revised and/or the project manager may request additional training support from the DEP to ensure that training is completed properly.

21. Reports to Management

Included in this section:

- *Frequency, content, and distribution of reports to data users, and partnership organizations that detail project status, results of internal assessments, and how quality problems have been resolved.*

Survey data is shared with users and partners in a summary report, which is completed within one year of survey completion. Interim project updates are also frequently reported to users through emails, newsletter articles or other outreach methods. Significant quality problems are summarized in the survey report. If the survey is funded through a 319 grant, project status

updates, quality problems, and results of any internal assessments are also described in semi-annual progress reports and a Final Project Report, which are submitted to DEP.

Data Validation and Usability

22. Data Review, Verification and Validation

Included in this section:

- *How to review data, assess their quality and make decisions regarding accepting, rejecting, or qualifying the data.*
- *Who will perform these tasks.*

All field forms are reviewed by the sector's technical leader and then by the project manager. There are not specific criteria for validating the data. The project manager uses best professional judgment in deciding to accept, qualify or reject the data. The project manager can review several sections of the field form to see if they make sense together. Site photos and follow-up visits to questionable sites will be used during the review process as necessary.

The ratings for 'Impact' and items listed under 'Description of Problem' and 'Size/Area' should be consistent and appropriate. For example, small sites with only 'slight surface erosion' should probably not be listed as 'high impact' sites. Project managers should also check forms to see if types of problems and solutions match. For example, a site with an unstable culvert should have some culvert-related recommendations listed. Similarly, project managers should review the 'Recommendations' and 'Size/Area' to see if the 'Cost' rating is appropriate. For example, a small site with 'mulch' as the only recommendation should probably have a 'low cost' rating.

23. Validation and Verification Methods

Included in this section:

- *Procedures you use to validate and verify data. This can include, for example, comparing computer entries to field data sheets; looking for data gaps; and mapping GIS coordinates.*
- *Description of how errors, if detected, will be corrected, and how results will be conveyed to data users.*

Methods for verification and validation of data, including review/proofing procedures are outlined in the Data Management and Data Review, Verification and Validation sections. Any decisions regarding the usability of data will be ultimately left to the project manager; however, the project manager may consult DEA staff. When it is found that data do not meet the quality objectives or do not adhere to the quality control measures, the project manager determines what corrective action must be taken. Incomplete data may necessitate a re-survey particular sections or reaches if the data are insufficient to meet project goals. When data quality is poor, the project manager may choose to have the sector re-surveyed or data verified or may include a written explanation with the data in any project reports.

24. Reconciliation with Data Quality Objectives

Included in this section:

- *Once the data results are compiled, describe the process for determining whether the data meet project objectives.*
- *Actions might include discarding the data, setting limits on the use of the data, or revising the project's data quality objectives.*

All survey data will be compared to the data quality objectives outlined above. If limitations in the watershed survey data are identified, they will be described and their effects discussed in all reports produced. Possible limitations that should be noted in the report include portions of the watershed that were not surveyed (e.g., properties that asked to be excluded or areas excluded due to staff limitations), sources of NPS that were not investigated (e.g., septic systems, agricultural land uses), and possible inaccuracies (e.g., tax map and lot numbers, landowner names, addresses).

If the project objectives have not been met, corrective actions, as discussed above, are initiated by the project manager. If failure to meet project specifications is found to be unrelated to equipment or survey methods used, specifications may be revised. Revisions are submitted to the DEP for approval.

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Appendix A

Final Site #_____ Checked by _____ Date _____

Lake Watershed Survey

REMINDER: Only write up if there is likely transport of sediment or phosphorus into the lake.

Sector & Site _____ Date_____ Surveyor Initials _____

Location *(house #, road, utility pole #)* _____

Building Color _____ Landowner Name _____

Tax Map & Lot _____ Talked to Landowner? _____

Flow into Lake via (check ONE): ❒ Directly into Lake ❒ Stream ❒ Ditch ❒ Minimal Vegetation

Note: If flow does not make it into lake, do not fill out a form. It would not be considered a site.

GPS Coordinates in **UTM**
(no degrees or decimal points)

0 ☐☐☐☐☐☐☐

_____ feet (Error) ☐☐☐☐☐☐☐

Land Use/Activity Circle ONE	**Description of Problems** Circle ALL that apply	
State Road*	**Surface Erosion**	**Soil**
Town Road*	Sheet	Bare
Private Road*	Rill	Uncovered Pile
Driveway*	Gully	Delta in Stream/Lake
Residential	**Culvert**	Winter Sand
Commercial	Unstable Inlet / Outlet	**Roof Runoff Erosion**
Municipal / Public	Clogged	**Shoreline**
Beach Access	Crushed / Broken	Undercut
Boat Access*	Undersized	Lack of Shoreline Vegetation
Trail or Path	**Ditch**	Inadequate Shoreline Vegetation
Logging	Sheet Erosion	Erosion
Agriculture	Rill Erosion	Unstable Access
Construction Site	Gully Erosion	**Agriculture**
OTHER:	Bank Failure	Livestock Access to Waterbody
	Undersized	Tilled Eroding Fields
* Is it: paved, gravel or other/unknown?	**Road Shoulder Erosion**	Manure Washing off Site
	Sheet	**OTHER:**
	Rill	
	Gully	
	Roadside Plow/Grader Berm	

Slope: ❒ Flat ❒ Moderate ❒ Steep **Size of Area Exposed or Eroded** (length & width): _____

Recommendations		
Culvert	**Roads / Driveways**	**Paths & Trails**
Armor Inlet/Outlet	Remove Grader/Plow Berms	Define Foot Path
Remove Clog	Build Up	Stabilize Foot Path
Replace	Add New Surface Material	Infiltration Steps
Enlarge	• Gravel	Install Runoff Diverter (waterbar)
Lengthen	• Recycled Asphalt	**Roof Runoff**
Install Culvert	• Pave	Infiltration Trench @ roof dripline
Install Plunge Pool	Reshape (Crown)	Drywell @ gutter downspout
Ditch	Vegetate Shoulder	Rain Barrel
Vegetate	Install Catch Basin	**Other**
Armor with Stone	Install Detention Basin	Install Runoff Diverter (waterbar)
Reshape Ditch	Install Runoff Diverters	Mulch / Erosion Control Mix
Install Turnouts	• Broad-based Dip	Rain Garden
Install Ditch	• Open Top Culvert	Infiltration Trench
Install Check Dams	• Rubber Razor	Water Retention Swales
Remove debris/sediment	• Waterbar	**Vegetation**
Install Sediment Pools	**Construction Site**	Establish Buffer
Other Suggestions:	Mulch	Add to Buffer
	Silt Fence / EC Berms	No Raking
	Seed / Hay	Reseed bare soil & thinning grass
	Check Dams	

Impact: Circle one choice in each column, add the three selected numbers together, and then circle the site's corresponding impact rating (high, medium, or low).

Type of Erosion	Area	Buffers and Other Filters	IMPACT
Gully - **3**	Large - **3**	No filter, all channelized direct flow into lake or stream - **3**	High: 8-9 pts
Rill - **2**	Medium - **2**	Some buffer or filtering, but visible signs of concentrated flow and/or sediment movement through buffer and into lake - **2**	Med: 6-7 pts
Sheet - **1**	Small - **1**	Significant buffer or filtering* - **1**	Low: 3-5 pts

* Confirm there is likely sediment/runoff delivery. If not, do not write up as a site.

Cost to Fix

High:	Greater than $2,500
Medium:	$500-$2,500
Low:	Less than $500

Technical Level to Install

High:	Site requires engineered design
Medium:	Technical person should visit site & make recommendations
Low:	Property owner can accomplish with reference materials

Appendix B

Guidance on Filling out Lake Watershed Survey Field Forms

Remember, only erosion sites which are a source of sediment or phosphorus which is likely to enter the lake should be documented as a problem site using this form. See the below section 'Flow into Lake via' or the "Lake Watershed Survey Site Guidelines" (in Appendix J of 'A Citizen's Guide to Volunteer Lake Watershed Surveys') for more details on determining whether to write up an erosion site as a problem site or not. The "Lake Watershed Survey Site Guidelines" may also be useful to bring into the field to use as guidance.

Each identified NPS site is documented on a form depending on what is observed in the field. Volunteers should fill out all sections of the field sheet for each site according to the following guidance:

Sector and Site - Sites are numbered by the designated sector number and the number of sites encountered in each sector. For example, if a group surveys Sector 2, the first site that they document should be labeled 2-1. This number should also be recorded on the field maps, sketch sheet and in the photograph (using the photo ID number).

Surveyor Initials – Include the initials of all the surveyors on the survey team at the time of site documentation.

Location & Building Color – Surveyors should provide detailed information to identify the site location. If the problem is located on a private driveway or residential area, the road name and house number should be provided. In many cases, however, the house number is not clearly marked. In this case, other information should be included (e.g., 3rd house on the right, between #7 and #9). House color should also be noted for problems associated with private properties (e.g., red with white shutters).

Landowner Name – Landowner name should be documented if available. This information helps make landowner contact for future mitigation efforts, and oftentimes landowners are interested in learning if there was a problem on their property. Landowner name might be clearly posted on a mailbox or house sign, and volunteers often know the names of their neighbors. If tax map and lot information is available, this is another way to obtain landowner names (but bear in mind that the information may be outdated).

Tax Map and Lot – If possible, each survey team should have town tax maps of their assigned sectors. If it is available, the tax map and lot should be noted for sites associated with a specific parcel. This will serve as a way to cross check the accuracy of the GPS points and also identify/contact landowners if properties change hands.

Talked to Landowner? – Surveyors should knock on the door of all private homes prior to surveying the property. If someone is home, surveyors should remind them about the watershed survey and letters that notified them about the project. They should confirm that they agree to

have their property included in the survey. If contact is made with the landowner, 'Yes' should be entered in this field with any relevant comments about the interaction (e.g., supports effort, would like more information about plants). If no one is home, 'No' should be entered in the field.

Flow into Lake via – Check the one box that best describes where the eroded sediment from a site goes. This field is used as a reminder to follow the flow of the erosion to determine where it goes, and to only write it up as a site if it likely makes it into the lake either directly, via a stream, via a ditch, or thru some vegetation. This field is also used to help determine the potential impact to the lake. Note: Select **Minimal Vegetation** if the sediment washes into a vegetated buffer next to the lake or a stream but it is likely that some sediment or phosphorus will still reach the lake. This would still be considered a problem site. However, it should not be written up as a site if the eroded sediment washes into a large, vegetated buffer without a clear connection to the lake or a feeder stream.

GPS Coordinates – GPS coordinates will be recorded for all point and line data. Site location data are to be recorded after at least 4 satellites have been acquired by the GPS unit, and GPS location data will include a measure of GPS error. If the sites will be mapped using ArcMap or Arc Info, data will be collected in UTM 19 (Universal Transverse Mercator) Zone 19 projection or latitude/longitude using either NAD 83 or WGS84 datum. If sites will be mapped using Google Earth or Google Map, latitude and longitude (in decimal degrees) should be collected. This decision should be made during survey planning and the form should be set up with the correct spaces and decimal points for the type of coordinates to be collected. Clarify with a technical leader if unsure which type of coordinates to use. This sample lake watershed survey form is formatted for UTM.

Land Use/Activity – Circle one land use that best describes the site. If it is not clear whether a road is town or private, circle both and place a '?' next to the entry. Project organizers can adjust later when checking the forms. Circle 'Residential' if the problem is located on a residential property, but it is not the driveway. Municipal / Public areas include public beaches, parks and parking areas owned by a municipality. The 'Beach Access', 'Boat Access', and 'Trail or Path' categories are usually areas with unclear ownership that are used by many parties. Trails are typically ATV trails through the woods. Typically, Boat Access areas are shared right-of-ways that appear to be used primarily to launch boats. Beach access areas are typically shared right-of-ways that appear to be used primarily for swimming or lounging activities. Construction sites are areas undergoing new home construction or major renovations with extensive bare soils due to excavation activities.

Note: Erosion problems that cross multiple land uses should be documented as two separate sites on two separate sheets. For example, a problem that starts on a private road and continues onto a private residential area should be designated as two different sites. Also, if there is a problem noted on one property's driveway **and** the same property's adjacent yard, this should also be documented on two field sheets. Make a note on each survey form to cross-reference if there is an important connection between multiple sites.

Description of Problems – The problems observed at each specific site should be documented by circling all the characteristics that apply. Circle only items listed under each bold-faced category. The bold-faced categories should not be circled; they are listed to prompt surveyors to think about potential problems with a given land use (e.g., culvert, ditch, road shoulder).

Surface Erosion categories (sheet, rill, gully) should be circled for soil erosion sites that are not covered in one of the following categories. This usually applies to erosion on areas including residential lands and road surfaces. However, if there is soil erosion along a road shoulder, surveyors should circle only the appropriate selection under the **Road Shoulder Erosion** category.

Three categories (**Surface Erosion, Ditch, Road Shoulder Erosion)** include **Sheet, Rill and Gully** options. In general, these can be differentiated as follows. Sheet Erosion should be selected for areas with bare soil without any small channels or rills cutting through the soil. Areas with Rill Erosion have small rills and channels carved through the soil. Gully Erosion include areas with significant soil movement and larger channels that are wide and deep enough to step into.

Size of Area Exposed or Eroded – Enter the approximate length and width of the site (e.g., 12' x 10'). Surveyors should measure their pace at the beginning of the field session. Site measurements can then be approximated by pacing the eroded area. If there are two discrete eroded areas on a property or road segment, they can either be entered separately (e.g., 12' x 10' and 75' x 5') or lumped together. If the dimensions of two eroded areas are similar, it makes sense to lump them together. For example, if there is erosion in the ditches on both sides of a road that measures 100' in length and each ditch is 4' wide, the **Size of Area Eroded** could be listed at 100 x 8'.

Recommendations – Circle all the possible BMPs that might be able to fix the erosion problems at each site. Circle only items listed under each bold-faced category. The bold-faced categories should not be circled; they are listed to prompt surveyors to think about potential BMPs for each given land use (e.g., culvert, ditch, road shoulder). The recommendations, **Add New Surface Material** and **Install Runoff Diverter** can be circled, but there are also bulleted options under each of these headings if it is clear which sub-option would be most suitable.

Impact – The impact rating is an indicator of how much soil and phosphorus erodes into the lake from a given site. The impact is selected based on the severity and size of erosion and amount of buffer or other filter. Use the point system to help consider these factors and determine the site's impact rating.

Select one choice and corresponding points for each of the categories 'Type of Erosion,' 'Area,' and 'Buffers and Other Filters,' and then add your three selected numbers together for the impact score. Circle the site's impact rating.

For example, a large eroded area with gully erosion and direct flow into the lake would be 9 points and rated as High Impact. A small patch of bare soil undergoing sheet erosion next to the lake without any buffer would be 5 points and rated as Low Impact. Many times, sites do not

clearly fit into these categories, so the survey team discusses the impact rating factors of a site and decides upon the best fit.

If a site has significant deposition in a vegetated area, be sure to confirm if there is likely some sediment/runoff delivery into the lake. If there is not, the erosion site should not be documented as a problem site.

Cost to Fix – The cost rating for each identified erosion site is based on the number and types of recommendations selected at the top of the page. Low Cost ($<500) would be selected for small residential sites that only need a few low cost BMPs such as mulch, runoff diverters, seed/hay, drywells or a small buffer. Most road-related BMPs tend to be more expensive. If heavy equipment is needed to install several recommended BMPs, the project would probably be a High Cost (>$2,500). Medium Cost ($500-$2,500) should be selected for sites falling between these extremes. As with the Impact ratings, many sites do not clearly fit into these categories. Oftentimes, a survey team discusses the impact rating of a site and decides upon the best fit.

Stream Site Form*

Sector # or Reach #_____ Affected waterbody _____

Site #: _____	Date _____	Surveyor Initials _____	Landowner Contacted? Y N	# Photos Taken_____

Location

Describe:	_____ *(house #, road name, # of nearest telephone pole, etc.)*			
GPS:	_ _° _ _ ' _ _.-_" (Latitude)	_ _° _ _ ' _ _.-_" (Longitude)	____ft (Error)	_____ (Waypoint #)
Area affected:	____ ft x ___ ft (Length x width)	_____ ft^2 (Area)	_____ ft (Distance from stream or tributary)	

Land Use: (circle one)

Industrial	Commercial	Residential
Recreational	Municipal	Logging
Agriculture	Construction site	Gravel pit / mining
Undist. forest	Stream channel	Trail or path
State road	Town road	Private road
Other_____		

Issues: (circle all that apply)

Soil Erosion/Sediment
- Bare soil / fields
- Stockpiled soil
- Unstable construction site
- Road surface erosion
- Road shoulder / ditch erosion
- Unstable culvert inlet / outlet
- Livestock trampling of streambank

Bacteria
- Pet waste
- Livestock; poor manure storage
- Waterfowl / wildlife gathering area
- Septic system problem
- Sewer line problem

Nutrients
- Livestock / improper manure storage
- Fertilizer flags / very green lawn
- Pet waste
- Algae mats in stream
- Lawn clippings piled next to stream

Toxics
- Staining around storm drain / spills
- Pesticide flags / manicured lawns
- Drainage from high-use parking lot
- Exposed indust. / comm. activities
- Heavy vehicle traffic
- Dumpster runoff / "juice"

Temperature
- Lack of stream shading
- Riprap on streambanks
- Drainage from large paved area
- Drainage from pond/dammed area

Other Buffer Issues
- Buffer not wide enough
- Poor / degraded buffer
- Concentrated flow path of stormwater through buffer
- Invasive species abundant

Other Issues: _____
_____

Stream Channel
- Channel straightened
- Bank/channel downcutting/incision
- Severe streambank erosion/failure
- Storm drains directly to channel
- Excessive trash
- Excessive build up of sediment
- Floodplain filled in for development
- Remains of old log-drive dam

Culvert / Crossing
- Culvert misaligned
- Hanging culvert (no fish passage)
- Beaver dam blockage of culvert
- Slip-lined culvert

* PURPOSE: For documenting either pollution / habitat problem sites or stream regions with excellent coldwater habitat during stream watershed surveys or stream corridor surveys.

Recommendations: (circle all that apply)

Soil Erosion/Sediment/Culverts	Soil Erosion/Sediment (cont.)	Nutrients/Bacteria	Temperature
Clean out culvert	Build up road / add surface mat'l	Ag waste management	Establish buffer
Enlarge culvert	Remove grader berms	Fence out livestock from stream	Extend / improve buffer
Install plunge pool	Remove winter sand	Low impact fertilizing	Plant trees & shrubs
Replace culvert	Reshape / veg. Shoulder	Remove pet waste	Seed and mulch
Lengthen culvert	Reshape or crown road	Put in signage / bags for pet owners	Stormwater controls
Stabilize inlet and/or outlet	Pave	Wildlife management	Bioretention cells
Armor ditch with stone or grass	Install runoff diverter	Upgrade septic system	
Install ditch	Plant / improve buffer	Repair sewer line	**Other Buffer Recommendations**
Install turnout		Stencil storm drains	Install level-lip spreader to prevent concentrated flow path
Reshape ditch	**Toxics**		
Stabilize banks	Improve stormwater controls	**Stream Channel / Culverts**	
Install erosion controls (silt fence, etc.)	Stencil storm drain	Re-align, repair, or upgrade culvert	**Other**
Fence out livestock from stream	Low impact turf care	Bank stabilization	_____
	Clean up garbage/dumpster-area	Restore channel	_____

Impact – circle one item from each column and add totals to determine rating

Size / Amount	Pollutants Involved	Transport to Stream	Total Score
Small =1 Medium = 2 Large = 3	Single = 1 Multiple = 2	Limited = 1 Direct flow = 2	

Rating		Cost	
High	6-7 points	High	Greater than $2,500
Medium	5 points	Medium	$500-$2,500
Low	3-4 points	Low	Less than $500

Good habitat features (coldwater seeps, springs, clean spawning gravels, very deep pools, lots of large woody debris, etc.)

Additional comments:

* PURPOSE: For documenting either pollution / habitat problem sites or stream regions with excellent coldwater habitat during stream watershed surveys or stream corridor surveys.

Appendix D

Survey Implementation Plan

[Project Name and Project Number]

This document describes the survey implementation plan (SIP) for the **[name] Watershed Survey** scheduled for the [time period & year]. This project is funded in part by Clean Water Act Section 319/604b grant funds. The survey will follow the "Maine Lake and Stream Watershed Survey Quality Assurance Project Plan" (QAPP) dated May 2020. This SIP is a type of sampling and analysis plan and is considered a part of the QAPP under which project specific activities are carried out. This SIP provides specific information about the survey such as goals and objectives of the survey, when and where the survey will occur, who will be doing the training, deviations from and stipulations not addressed in the QAPP, and related information needed to apply the QAPP to this particular project.

Prepared by:
[Name, Organization, mailing address, phone number]
[Date].

Distribution List

The following individuals will receive a copy of the QAPP, the final SIP, and any revisions made while the grant-funded project #[project number] is active.

[Grantee Name, organization, email address]
[Other Name, organization, email address]
[AA Name], Maine Department of Environmental Protection, [email address]
Survey Technical Leaders

Project and Task Organization

Roles and Responsibilities:

[Insert name, organization, and roles and responsibilities of involved parties, including who will:

- be the overall project coordinator
- be responsible for the survey mailing to landowners
- compile materials for the survey
- do the survey training
- provide technical assistance (include experience/training that qualify technical leaders)
- do any needed follow-up field work
- enter the data from the field sheets
- quality check the data
- prepare the report
- review the report

- do any outreach such as newsletter articles and press releases
- do any other remaining tasks]

Project Definition and Background

Watershed Description:

[Insert short description of watershed land use]

Previous Surveys and Assessments:

[Insert name and date of previous related surveys and assessments, and if the lake or stream has any impairment, a TMDL, or management plan.]

Survey Purpose:

[Insert concise sentence or two about purpose of the survey – i.e. "to identify, document, and prioritize soil erosion and phosphorus pollution sites in the watershed"]

Project and Task Description

Extent of Survey (including justification if the entire watershed or all land uses are not surveyed):

[Describe where the survey will be done, how large the watershed and/or survey area is, what types of land uses will be surveyed, and any reasoning for surveying only certain areas, if appropriate]

Project Framework, Specifics, and Deviations from QAPP:

The survey will generally follow the "Maine DEP Lake and Stream Watershed Survey QAPP" (2020) and the guidance in the "Citizen's Guide to Volunteer Lake Watershed Surveys" (2011). Specifics and deviations from the QAPP are as follows:

- [Insert any deviations, including if a different version of the survey field form will be used]

Schedule:

- [Insert date] - steering committee meeting
- [Insert date] - target date for sending out mailing to landowners
- [Insert date] - survey training day and first day of field work
- [Insert date] - survey of any remaining areas completed by
- [Insert date] - follow-up work completed by
- [Insert date] - summary findings compiled

- [Insert date] - draft report on findings
- [Insert date] - final report complete
- [Insert date] - report distribution
- [Insert any other project timeline dates]

Reports to Management

How Results are Reported and to whom:

Watershed survey results will be compiled into a report by [insert person responsible for this]. The report will be reviewed by [insert person responsible for this]. [Include a brief description of what will be included in the report.]

The final report will be distributed to:
[insert organizations (and name of person if available)]

A short summary sheet will be produced for distribution to local stakeholders, including:
[insert organization or groups, i.e. local towns, local groups, residents, etc.]