DEVELOPMENT OF WATERSHED RESTORATION AND PROTECTION PLANS WITHIN THE NEW JERSEY HIGHLANDS REGION

CHESTER, NEW JERSEY

Roxbury Twp } $254,700
Jefferson Twp }
MLCA + Mt. Lake $80,215

APRIL 2023

PREPARED FOR:
HIGHLANDS WATER PROTECTION &
PLANNING COUNCIL
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Benjamin L. Spinelli
Executive Director
Highlands Water Protection and Planning Council
100 North Road (Route 513)
Chester, New Jersey 07930-2322

RE: Develop Watershed Restoration and Protection Plans within the NJ Highlands Region Chester, New Jersey

April 14, 2023

Dear Mr. Spinelli

Princeton Hydro is pleased to submit our proposal in response to the Request for Proposals to Develop Watershed Restoration and Protection Plans within the New Jersey Highlands Region. We understand the New Jersey Highlands Water Protection and Planning Council (Highlands Council) is seeking to develop or update Watershed Protection Plans for one or multiple watersheds within the Highlands region, which can be used to apply for funding from the NJ Department of Environmental Protection for Water Quality Restoration grants under the federal 319(h) grants of the Federal Clean Water Act.

As a mission-driven company employing an equal mix of scientists and engineers who are dedicated to improving our ecosystems, quality of life, and communities for the better, we have restored many miles of rivers, improved water quality in hundreds of ponds and lakes, and enhanced thousands of acres of wetlands in the Mid-Atlantic and Northeast over the last 25 years. Our aquatic ecology, watershed management, and engineering expertise is outlined further in our attached proposal, along with the qualifications of each individual team member.

Princeton Hydro is uniquely qualified and positioned to develop the proposed Environmental Protection Agency (EPA) 9-element plans for Roxbury Township, Jefferson Township, and Mountain Lake Community Association. We have been working with the two municipalities and the non-profit organization on numerous projects involving stream assessment and monitoring, as well as lake management and assessment. Jefferson Township has conducted several projects specific to the health of Lake Hopatcong such as trout habitat studies and has been a willing partner for watershed-based experimental wastewater treatment solutions at its businesses. Roxbury Township has also conducted stream corridor studies and has been a willing partner in grant projects associated with the Musconetcong River. Finally, the Mountain Lake Community Association has had a long-term volunteer monitoring program in place that has been recently enhanced with the guidance of Princeton Hydro specific to harmful algal blooms (HABs) and how to track them more closely. Additionally, our proposed team has developed over 50 watershed plans and we have extensive knowledge on the requirements of the EPA 9-element plan requirements.

We look forward to working with the NJ Highlands Council on the development of the watershed restoration and protection plans for Jefferson & Roxbury Townships and Mountain Lake Community Association. If you have any questions or require additional information to facilitate your review of our proposed scope of services and costs, please contact me directly at cmiko@princetonhydro.com or (p)908-237-5660 (f)908-237-5666.

Sincerely,

Chris Mikolajczyk, CLM
Senior Manager - Aquatics/Senior Aquatic Ecologist
Princeton Hydro, LLC

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UNDERSTANDING OF SCOPE OF SERVICES

Princeton Hydro has been working with municipalities and nonprofit organizations located within the Highlands region for 25 years on water quality improvement projects to achieve the goals within the Highlands Act to restore and protect water resources in the region. Additionally, we have worked in conjunction with New Jersey Highlands Council on both lake management and watershed management dating back to the Fall of 2009, when we authored the ***New Jersey Highlands Region Lake Management and Restoration Plan Guidance*** and the ***New Jersey Highlands Region Stream Corridor Assessment and Protection*** documents. We have a thorough understanding of how the proposed scope of work surrounding the development of watershed protection plans coincides with the Regional Master Plan. Specifically, Chapter4; Part 1 Subpart G (Lake Management) of the Regional Master Plan states:

"The management of lands surrounding lakes is an important issue for the Highlands Region. Overdeveloped, damaged, and poorly managed shoreland areas can result in the degradation of water quality, harm the lake ecosystem, decrease natural aesthetic values, and cause an overall loss of property values for lake communities. Lakes can be harmed by pollutant sources in the watershed area draining to them. Polluted lakes can, in turn, damage downstream streams and rivers. Most existing lake communities are fully built out, predate modern environmental protection requirements, and have limited potential for major land use changes. Some have sewer systems, but many rely on septic systems (or even cesspools) on inadequately sized lots, where direct contamination of the lakes is possible. Past NJDEP studies indicate that nearly every public lake (privately-owned lakes were not evaluated) is experiencing unacceptable contamination, often including excessive bacteria and nutrients. In addition, many lake communities have been evolving from summer communities to year-round communities, and many are experiencing greatly intensified land uses as the original buildings are torn down and replaced by much larger structures. Addressing land uses within lake communities allows for potential opportunities to improve community value, to protect the cultural and historic resources often associated with lake communities, to protect natural resources and enhance and restore the quality of lake environments in the Region, and in some cases, to allow for in-fill development where appropriate."

Additionally, the New Jersey Highlands Council Master Plan within Policy 1L2 directly addresses lake management as a critical part of watershed management in the region with the goal *"to establish tiers of lake management appropriate to management strategies that help protect lake water quality and community value from the impacts of present and future development,"*

and Objective 1L2a states:

"Lake management programs shall use the following management tiers around all Highlands Region lakes of greater than 10 acres in size: a Shoreline Protection Tier, a Water Quality Management Tier, a Scenic Resources Tier and a Lake Watershed Tier."

Lastly, the Highlands Region Land Use Ordinance, which conforming municipalities pass, include this distinction for waterbodies greater than 10 acres, and the Highlands Region Environmental Resource Inventories for each town report out on acres of lakes greater than 10 acres in size.

The updating and/or development of Environmental Protection Agency (EPA) nine element plans for watersheds within the Highlands, including public and private lakes, as described in the Scope of Work in Section III of the RFP, opens the door to opportunities for project funding through the Clean Water Act 319 pass-through grants. These grants are a critical funding source for the implementation of water quality improvement projects that lead to measurable improvements to water quality impairments.

We have identified three entities, Jefferson Township, Roxbury Township, and Mountain Lake Community Association, all of which we have worked extensively with in the past, who fully support the development of Watershed Restoration and Protection Plans for watersheds and lake sheds within their boundaries and areas of focus. Jefferson Township has provided a letter of support and has pledged $4,480 in in-kind services throughout the plan development process; Mountain Lake Community Association has provided a letter of support and has pledged $20,000 of match in the form of in-kind services provided through their volunteer monitoring program; Roxbury Township has also pledged their support through discussions we have had with them leading up to the proposal submission, with a formal letter of support anticipated to be provided to us shortly. The letters of support can be found in Attachment C.

TECHNICAL APPROACH & PROPOSED WORK PLAN

TOWNSHIP OF JEFFERSON

UNDERSTANDING OF PROJECT

Jefferson Township encompasses approximately 42 square miles, with 70% of this land forested and undeveloped as part of the Highlands Region. The Township contains many private lake communities throughout its borders. The Township also contains the Mahlon Dickerson Reservation, the largest park in the Morris County Park System, which encompasses 3,200 acres of near wilderness and recreational areas, with over 20 miles of multi-use trails, located along Weldon Road in the township. One of the Reservation's outstanding features is Headley Overlook, one of the highest points in the Morris County Park System along with the County-owned Berkshire Valley Golf course. Along the Pine Swamp trail, the highest point in Morris County, at 1,395 feet, can also be found. Due to the increasing threat of water quality issues, including aquatic invasive species (AIS) and harmful algal blooms (HABs), the Township wishes to take a more active role in the management of the surrounding watersheds of these lakes, both public and private. This regional approach to lake management has recently been informally suggested by staff of both the New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Highlands Council (NJHC) and has been implemented in other New Jersey Highland communities such as Ringwood Borough, Rockaway Township, West Milord Township, Byram Township, and Vernon Township. The specific lakes to be included in this program for the Township of Jefferson are as follows:

- Longwood Lake
- Lake Shawnee
- Cozy Lake
- White Rock Lake
- Oak Ridge Lake
- Berkshire Lake
- Lake Swannanoa
- Moosepac Pond

The NJHC Master Plan states within Policy 1L2: "*to establish tiers of lake management appropriate to management strategies that help protect lake water quality and community value from the impacts of present and future development*", and within Objective 1L2a: "*Lake management programs shall use the following management tiers around all Highlands Region lakes of greater than 10 acres in size: a Shoreline Protection Tier, a Water Quality Management Tier, a Scenic Resources Tier and a Lake Watershed Tier.*" Although some of the lakes within these parks may be less than 10 acres in size, they are included in a request for funding due to the potential impacts of the increased threat of aquatic invasive species and harmful algal blooms on the heavily utilized recreational use of these lakes.

PROPOSED SCOPE OF WORK

The proposal to conduct a watershed assessment of the watersheds of the Jefferson Township lakes will entail completion of general objectives based on the nine-elements (A-I) of EPA watershed-based plans. Each task in the proposed Scope of Work coincides with one or more of the nine elements. Specifically, these EPA elements are:

PROPOSED SCHEDULE

TABLE 2 – PROPOSED SCHEDULE FOR ROXBURY TOWNSHIP*

Task	Description	Schedule
1	Historical Data Review	May 2023
2.1	Hydrologic and Pollutant Loading Analysis	October 2023
2.2	Analysis of Pollutant Removal Watershed Techniques	October 2023
3	Collection of Baseline Watershed Water Quality Data	May - July 2023
4	Collection of Lake-Based Water Quality Data	May-September 2023
5	Trophic State Modeling	October 2023
6	MS4 Discussions	October 2023
7	Watershed Restoration and Protection Report	November 2023

*Note, the proposed timeline can be modified based on the project's actual start date.

MOUNTAIN LAKE COMMUNITY ASSOCIATION

UNDERSTANDING OF PROJECT

Mountain Lake is located in the northwestern portion of Warren County and is within the New Jersey Highlands Preservation Area. Mountain Lake is a public 122-acre natural glacial, yet eutrophic / meso-eutrophic water body located in Liberty Township that has frequently experienced nuisance densities of cyanobacterial Harmful Algal Blooms (HABs). The Mountain Lake Community Association and Watershed Advisory Group (MLCA), an IRS non-profit since 2004, have been very proactive in improving and protecting the water resources of Mountain Lake, which is an important and substantial headwater system for the Pequest River and ultimately the Upper Delaware River. In the 1990s and early 2000s, the MLCA developed several small studies which monitored water quality and suggested general watershed-based measures to control the nutrients causing the nuisance cyanobacteria blooms that plague Mountain Lake. While these efforts have suggested general recommendations for improvements in water quality, HABs still periodically plagued the lake. Thus, the MLCA is partnering with Princeton Hydro to develop a comprehensive Lake and Watershed Management Plan based on the USEPA nine minimum components of watershed plans through this RFP issued by the Highlands Council.

Additionally, due to increasing concerns regarding the water quality and associated algae blooms in Mountain Lake, the MLCA began the development of a comprehensive volunteer water quality sampling program in 2021. This volunteer-based effort consistently supplements the data that is collected as the result of previous HABs. The collection of consistent yearly water quality data assists the MLCA in shaping future management recommendations and efforts for restoring and maintaining Mountain Lake's limnological state.

In early 2021, Princeton Hydro reviewed the 2021 water quality monitoring program proposed by the MLCA, as well as the sampling equipment currently possessed by the MLCA, and assisted in developing a sampling plan for a successful community volunteer water quality monitoring program. The program was also assisted by the New Jersey Department of Environmental Protection (NJDEP).

The 2021 monitoring program involved the collection of water quality and nutrient (phosphorus) data for three sites on the Lake. Data collected by volunteers on Mountain Lake was collected using monitoring protocols recommended by Princeton Hydro, as based on NJDEP protocol. Specifically, the 2021 monitoring program consisted of the following:

- In situ (real-time) water quality measurements of dissolved oxygen, temperature, pH, and water clarity,
- Collection of discrete water quality samples for the laboratory analysis of total phosphorus, and
- Collection of cyanobacteria samples and fluorometer data.

The overarching objective of a water quality monitoring program is to use the data in a proactive manner to maximize the lake's recreational usage, aesthetic attributes, and ecological status and function. The monitoring program is focused on the collection of seasonal water quality data from Spring to Fall, commonly referred to in the Northeast as "the growing season."

Other historical studies have also been conducted on Mountain Lake. Namely *Nonpoint source loading and phosphorus modeling for Mountain Lake* in 2001 (Aquatic Analysts/Aqua-Link), water quality studies in 1997 (Amy S Greene) and 1999 (Aquatic Analysts), and finally a watershed study in 1992 (Warren County Soil Conservation District).

The lack of a complete and comprehensive Lake and Watershed Plan can create difficulties in both short and long-term management. This is especially true in assessing the impacts that can be attributed to altered hydrology, climate variations, pollutant loading, internal nutrient generation, and general trophic state analyses. This project aims to update the existing characterizations of these studies, as well as identify the steps necessary for restoration and future management. The result of this project will be a Lake and Watershed Management Plan based on the nine minimum components of watershed plans by the USEPA.

PROPOSED SCOPE OF WORK

The proposal to conduct a lake and watershed management plan for Mountain Lake will entail completion of general objectives based on the nine-elements (A-I) of EPA watershed-based plans. Each task in the proposed Scope of Work coincides with one or more of the nine elements. Specifically, these EPA elements are:

- (A) Project Summary, Historical Data Review, Identification of Causes and Sources of Pollution (Task 1)
- (B)Estimate Load Reductions Expected from Management Measures (Task 3)
- (C)Description of Management Measures and Description of the Critical Areas in which those Measures will be Implemented (Task 3)
- (D)Estimate amount of Technical and Financial Assistance, Associated Costs, and/or the Sources and Authorities that will be Relied upon to Implement the Plan (Tasks 3 and 7)
- (E)Information and Education Component to Enhance Public Understanding of the Project and Encourage Participation (Task 7)
- (F)Schedule for Implementation of Management Measures (Task 7)
- (G)Description of Interim Measurable Milestones for Determining whether Management Measures are being Implemented (Task 6 and 7)
- (H)Evaluation Criteria of the Management Measures (Task 6)
- (I)Monitoring Component (Tasks 2, 4 and 5)

TASK 1 - REVIEW OF ALL HISTORICAL BACKGROUND DATA

In addition to the2001 "Nonpoint source loading and phosphorous modeling for Mountain Lake", 1997 and 1999 water quality studies, and the 1992 watershed study, historical data will be obtained from the MLCA, as well as

other regulatory agencies (such as NJDEP, USACE, and USGS). This information should be reviewed in advance of implementing the watershed assessment outlined below. By doing so, a capitalization on established water quality trends and issues raised through any past sampling and evaluation of the relative success of any past restoration can be accomplished. The streams within the watershed that feed the lake will also include a similar review.

Task 1 Deliverable: A memo describing the findings of the historical data review. Additionally, all the findings will be incorporated into the final watershed management plans.

TASK 2 - BATHYMETRIC SURVEY

A bathymetric survey is the mapping of water depth and the amount of accumulated unconsolidated sediment (top of sediment to bottom of sediment) in a water body or water course. The data from this survey can be modeled to produce topographic contours of water depth and statistics such as mean depth and volume of water and unconsolidated sediment.

Princeton Hydro will set a benchmark adjacent to the lake with a Leica GS14 survey grade GPS unit, and calculate the surface water elevation before the start of the survey with a site level and Philadelphia rod. The bathymetric survey will be conducted utilizing two methods. These methods include a calibrated sounding rod as well as a dual frequency echo sounder with GPS. The calibrated sounding rod method will be employed to survey shallow areas (12 inches of water or less) and in areas where the bottom sediment composition is not conducive for echo sounding. The dual frequency sounder (Knudsen Engineering model 1612 Echosounder) uses a high frequency and low frequency to discern the top of sediment from the bottom of sediment. Locations of sounding data will be recorded with a Leica GPS unit. Data will be collected along predetermined transects that run from shoreline to shoreline in an East-West fashion at one hundred-fifty-foot intervals.

Once field work is complete, the sounder data will be edited with Hypack Max, a software that enables the editing of raw sounder data. The raw data will also be checked for any apparent errors in the data, such as double reflections and/or aquatic vegetation interference. Once all raw data has been registered in NAVD88 elevations and edited for accuracy, the data will be exported from the Hypack Max software and into ArcGIS.

Finally, data from the 2022 survey will be compared to the electronic data from any previous bathymetric surveys and sedimentation rates, if any, will be developed.

Task 2 Deliverable: Conduct a bathymetric survey of Mountain Lake, determine water depths, water volume and volume of unconsolidated sediment. Provide maps and cross-sections of each

TASK 3 - WATERSHED MODELING: HYDROLOGIC AND POLLUTANT LOADS

HYDROLOGIC AND POLLUTANT LOAD ANALYSIS

The objective of this task will be to model the watershed hydrologic and nutrient loading properties to the lake. The hydrologic and pollutant loading data will enable the MLCA to identify and target the primary sub-watersheds or stormwater discharge areas requiring the greatest load control and evaluate the feasibility of managing these loads. This will aid the MLCA in selecting, prioritizing, and implementing nutrient and sediment load management efforts, thus ensuring that future restoration practices are directed to the watershed projects having the greatest overall benefit to the long-term management of surface water quality.
Watershed pollutant loading and hydrology will be modeled using the MapShed model and its web-based counterpart, Model My Watershed, both versions of the GWLF model and its various descendants. This model is

described as a good mid-level model and recommended for use by the USEPA. The model will be applied to describe system hydrology and pollutant loading within the watershed and constituent sub-watersheds of each system. Hydrology and pollutant loading are inextricably linked and thus are calculated in parallel within the model. The pollutants to be modeled include total phosphorus, total nitrogen, and sediment, while the hydrology will include estimates of precipitation, evaporation, runoff, evapotranspiration, groundwater flux, and ultimately streamflow or discharge.

The model works by applying loading coefficients, essentially the quantity of a pollutant produced per unit area, to specific land cover types and land areas. The hydrology module operates similarly. A series of algorithms modifies these results according to weather data, soils, and slopes among many other factors. The model then simulates daily loads over a 30-year period using actual climate records and averages the results over time for monthly and annual outputs. Furthermore, the program allows the user to make modifications to the inputs for septic system function, the number of animals, population density, and many other factors that change pollutant loads and hydrology.

ANALYSIS OF THE POLLUTANT REMOVAL THROUGH THE IMPLEMENTATION OF WATERSHED BASED MANAGEMENT

A field-based watershed assessment conducted by both an aquatic scientist and green infrastructure engineer will allow for identification of those sub-watersheds having the greatest impact as well as those sub-watersheds having the most manageable (correctable) loads. Using this data, a list of BMPs and Green Infrastructure practices can be provided to the MLCA that could effectively manage the pollutant loads generated by each major sub-watershed specific pollutant load. Emphasis should be given to bioretention-type systems that can be implemented on a lot-specific or regional scale. Such BMPs have a high capacity for the removal of nutrients. An examination and discussion of the water quality benefits of restoring and/or creating wetland buffers, riparian buffers, and lakefront aquascape shorelines will also be performed. Where possible, based on inspections of the watershed or information contained in reports made available, the report should identify examples of site-specific locations where wetland buffers, riparian buffers, and lakefront aquascaping could potentially be implemented as part of future watershed management efforts.

Task 3 Deliverables: Watershed Delineation and Land Use maps, as well as full nutrient and hydrologic models. Additionally, all of the measurements and statistics calculated as part of the models will be incorporated into the final watershed management plans. Additionally, a list and description of BMPs and Green Infrastructure techniques that can be utilized as based on the full nutrient and hydrologic models. Additionally, the full list will be incorporated into the final watershed management plans.

TASK 4 - IN-LAKE WATER QUALITY MONITORING

A single growing season (May - October) investigation and assessment of the water quality of the Lake will be performed. This would entail monthly water quality sampling being conducted at the lake for a total of six (6) sampling events. Samples will be collected at a minimum of two stations (final station locations to be determined in concert with the MLCA). During each event and at each station, in-situ water quality data consisting of real-time measurement of dissolved oxygen, temperature, pH, and specific conductivity will be conducted. Princeton Hydro is certified by NJDEP (#10006) in these parameters. These measurements are to be recorded in profile (surface to bottom). At each of these sampling stations, the lake's clarity (Secchi disk transparency) will also be measured.

At a station established in the approximate center (or at its deepest point should that not be in the center of the lake) and at the inlet end of the lake, discrete whole water samples will be collected at a depth 0.5 meters below the surface of the lake and 0.5 meters above the bottom of the lake. All these samples will then be submitted to an NJDEP-certified water testing lab (#18630) for the analysis of total phosphorus (TP), soluble reactive phosphorus (SRP), nitrate nitrogen (NO3-N), NH3 nitrogen (N as ammonia), Chlorophyll a, and total suspended solids (TSS). Collecting surface and deep samples for phosphorus and nitrogen-based nutrients, in conjunction with in-situ

data profiles, will allow for the determination of internal loading, if any, within each lake. Internal loading is a process that occurs in lakes when nutrients, such as phosphorus. are introduced into the water from the lake sediment due to a lack of oxygen. Along with external loading, internal loading can lead to lake eutrophication and can serve as a source of nutrients for plants and algae.

At the same deep-water station, zooplankton and phytoplankton samples should also be collected via net tow and analyzed for species composition, dominant organism, and relative density.

Additionally, during each of the six (6) sampling events, a general survey of aquatic vegetation and/or algae growth (planktonic or filamentous) will be conducted. These surveys will provide the MLCA with an objective understanding of the amount and distribution of SAV and algae occurring throughout the lake over the course of the growing season.

Task 4.0 Deliverable: Field collected data as based on baseline in-lake conditions. Additionally, the data will be incorporated into the final watershed management plans.

TASK 5 - VISUAL WATERSHED ASSESSMENT AND MONITORING

BASELINE

The MapShed model will be used to quantify the current existing pollutant load. However, the model is only capable of providing pollutant loads on a sub-watershed basis. The first element of an EPA nine-point plan includes identification of the causes and sources of pollutant loading; therefore, a detailed field-based survey of the watershed will be conducted using a the NJDEP Bureau of Freshwater & Biological Monitoring Stream Habitat Assessment Protocol and associated form https://www.nj.gov/dep/wms/bfbm/download/habitat.pdf.

Stream visual assessments provide a more comprehensive assessment of the watershed, including channel conditions and bank stability, general ecological conditions, and the presence of stormwater infrastructure and invasive plant species at a series of visual assessment stations distributed throughout the watershed. For this project, both tributaries will be assessed once during the growing season.

The NJDEP promotes the use of stream visual assessments to evaluate the health of streams and watersheds. The additional goals and objectives outlined by CWP/NJDEP are also relevant to the Mountain Lake field work and will be incorporated into the final report:

- generate maps and data on existing conditions for stakeholder education and recruitment;
- provide basic data to identify problem sites; and
- provide initial data to choose sites for more detailed analysis or more detailed assessments

In addition, using the modeling data calculated, at a minimum and weather permitting, three (3) watershed-based baseflow (no rain in the previous 72 hours) stream monitoring events will be conducted within the lake's two primary major sub-watersheds with regards to pollutant and hydrologic loading. During these monitoring events, both in-situ and discrete water quality data will be collected. Discrete water quality samples will be collected at each site and analyzed for TP, SRP, NO3-N and TSS.

All attempts will be made to sample during dry conditions and storm conditions will be avoided. Overall, the data collected through this sampling effort will be used as part of the analyses and the preparation of the deliverables associated with the Lake and Watershed Management Plan.

STORM

Using the modeling data calculated as part of Task 3, at a minimum, three (3) watershed-based stormwater stream and runoff (catch basin, storm drain, etc.) monitoring events will be conducted within the two major sub-watersheds, as well as up to three select stormwater runoff locations with regards to pollutant and hydrologic loading for the lake.

During this stormwater monitoring, at a minimum, at least 0.5" of precipitation should be expected to fall to allow for a consistent composite sample to be collected over the course of the storm event. These five (5) discrete water quality composite samples should then be analyzed for total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS).

Task 5.0 Deliverable: Collection of lake tributary based data. Visual, physical, chemical, and biological samples will be collected.

TASK 6 - FINE-TUNING OF HYDROLOGIC AND POLLUTANT LOAD MODELS

Overall, modeling is used to provide estimates of the water budget terms and the pollutant loads, but it does not replace sampling. After the results of the watershed monitoring conducted as part of Task 6 are obtained, the model will be re-visited and fine-tuned for total phosphorus, total nitrogen, and total suspended solids based on field collected laboratory data.

Additionally, using new and historic data collected from the lake, internal phosphorus loading can be estimated using standard limnological metrics and then incorporated into the overall load for the lake/watershed. The basic input parameters for this analysis are the lake's volume, maximum depth, average depth, any seasonal dissolved oxygen and temperature profiles, and hydrologic data. The final step within this task will be to analyze the hydrologic data generated in conjunction with the external and internal pollutant loads to compute the existing trophic state (eutrophic, oligotrophic, mesotrophic) of the lake. All data will also be compared to all applicable NJDEP Surface Water Quality Standards, both lake and stream.

Task 6.0 Deliverable: Update and fine tune the modeling from Task 3 using data from Tasks 5 and 6.

TASK 7 - AUTHOR FINAL LAKE AND WATERSHED MANAGEMENT PLAN

Once all the laboratory data have been received, a Lake and Watershed Management Plan will be authored in accordance with the USEPA Nine Elements. The report will discuss the data and observations compiled during the monitoring and compare these data to established USEPA/NJDEP trophic state standards and surface water quality thresholds. The report will also cover any water quality issues that were observed or measured, especially the results of the phosphorus and nitrogen loading and the in-situ data. The report will also review the results and findings of the field data, and the relationships of the modeled data relative to any historical data provided by the MLCA, or other agency.

The report will include an identification of which watershed management techniques and measures are best suited for immediate or long-term implementation. For each specific recommended technique, a preliminary cost estimate (as based on the availability of data) for the implementation of the specified measure will be generated. Also, an identification of regulatory constraints affecting each of the recommended watershed-based management measures will be discussed and, for each, a list of anticipated NJDEP permits, as well as any other anticipated regulatory agency permits that may be required, will be discussed. The specific projects and overall recommendations will be ranked in order of priority from a nutrient load point of view, as well as a suggested timeframe, such as within the next 5 years, 10 years, and 20 years.

Task 7.0 Deliverable: Final watershed management plan.

PROPOSED SCHEDULE

TABLE 3 – PROPOSED SCHEDULE FOR MOUNTAIN LAKE COMMUNITY ASSOCIATION*

Task	Description	Schedule
1	Historical Data Review	May 2023
2	Bathymetric Survey	May 2023
3	Watershed Modeling/Analysis of Pollutant Removal Watershed Techniques	Oct 2023
4	Collection of Lake-Based Water Quality Data	May - Oct 2023
5	Visual Watershed Assessment and Monitoring	May - Oct 2023
6	Fine Tuning of Watershed Pollutant Model	Oct 2023
7	General Watershed Assessment Report	Nov 2023 - Jan 2024

*Note, the proposed timeline can be modified based on the project's actual start date.

STATEMENT OF QUALIFICATIONS

Princeton Hydro, LLC is a small business enterprise that was formed in 1998 with the specific mission of providing integrated ecological and engineering consulting services. Offering unparalleled expertise in natural resource management, water resources engineering, geotechnical design and investigation, and regulatory compliance, our staff provides a full suite of services throughout the Mid-Atlantic and New England states. We have offices in Trenton, New Jersey; Sicklerville, New Jersey; South Glastonbury, Connecticut; Bowie, Maryland; Exton, Pennsylvania; and Colorado Springs, Colorado. Our multidisciplinary team has the skill sets necessary to conduct highly comprehensive assessments; develop and design appropriate, sustainable solutions; and successfully bring those solutions to fruition.

At Princeton Hydro, we are committed to improving our ecosystems, quality of life, and communities for the better. Our passion and commitment to the integration of innovative science and engineering drive us to excel on behalf of every client. We take great pride in our reputation of delivering comprehensive, cost-effective ecosystem-based solutions. Our engineers and scientists have in-depth knowledge of urban, coastal, riverine, floodplain, and wetland environments. Our 50+ technical personnel and eleven administrative staff include individuals with academic training and real-world project experience – many with advanced degrees and/or professional licenses – in hydrology and hydrogeology, green stormwater management, aquatic and wetland ecology, coastal resiliency, geotechnical investigation, wetland and stream restoration, fishery biology, population and community ecology dynamics, stakeholder engagement, environmental planning, and environmental risk analysis. The unique skills and cumulative expertise of our highly experienced staff are reflected in the creative nature of Princeton Hydro's award-winning projects.

Our experience and qualifications particularly suited for the development of the EPA nine element (9E) watershed-based plans are evidenced by our successful completion of projects such as the Lake Hopatcong Watershed Implementation Plan (NJ), the Greenwood Lake Watershed Implementation Plan (NJ-NY), the Manalapan Lake / Brook Watershed Implementation Plan (NJ), Tibbetts Pond Restoration and Management Plan

(NJ), Pequabuck River Watershed Based Plan (NJ), Lehigh University Stormwater Management Plan (PA), Harveys Lake Stormwater Implementation Plan (PA), Core Creek / Lake Luxembourg Watershed Implementation Plan (PA), and other watershed management plans including the Mill River Restoration & Watershed Management Plan (CT). Combined, our team has worked on over 50 watershed plans, including those similar in scope to the three included in this proposal, and have the expertise to develop comprehensive, technically sound plans to address impairments. Public input, feasibility analysis, and cost estimates are standard components of the 9E Plans Princeton Hydro develops, and our team of scientists and engineers work in tandem to address all required elements.

We are aware of and incorporate the public's input throughout the Plan development process, understanding the needs and priorities of the communities within the watersheds. Princeton Hydro's variety of clients often include non-profit entities and local municipalities, whose project budgets and schedules are often restricted due to grant funding, so we are particularly attentive to and skilled at staying within a project's budget and schedule.

SERVICE DESCRIPTIONS

WATERSHED MODELING AND TMDL ANALYSIS

Princeton Hydro has significant experience conducting water quality sampling, monitoring, and modeling. In many of our TMDL-related projects, we have provided technical assistance and input on developing sampling analysis plans used to fill critical data gaps needed to finalize the TMDL. For example, for the TMDLs for Lake Hopatcong and Lake Musconetcong (the Upper Musconetcong River Watershed, NJ), Princeton Hydro developed sampling plans and addressed data gaps needed to link the TMDL to specific pollutant reduction goals associated with the Restoration Plans. A considerable amount of data had to be collected for Lake Musconetcong to address its existing data gaps. This necessitated water quality sampling, plankton collection, identification and analysis, fishery sampling, and submerged aquatic vegetation (SAV) surveys. Since much of our monitoring and modeling work is associated with TMDL-based Watershed Implementation Plans (WIPs) and/or are funded through federal and/or state grants, Princeton Hydro's projects adhere to strict quality control and assurance of all forms. This ensures all collected or model-generated data are accurate and representative and can be confidently used by state agencies. In New Jersey, we have prepared 33% of all the New Jersey Department of Environmental Protection's (NJDEP) approved Watershed Protection Plans.

POLLUTANT MODELING

Princeton Hydro routinely analyzes the loading of phosphorus, nitrogen, and sediment in watershed, stream, and lake management projects. Our team of ecologists and GIS professionals utilize various loading models including AVGWLF/Mapshed, UAL, and BasinSim to compute loadings and project changes based on land use alteration or implementation of best management practices.

STATISTICAL ANALYSIS

Princeton Hydro has extensive experience with the analysis of large water quality and biological datasets, such as statewide lake databases. Our Environmental Scientists and Aquatic Ecologists successfully and thoroughly perform technically complex, comprehensive analyses using tools such as permutation multivariate analyses of variance (perMANOVA) and Principal Component Analysis. We were contracted by the Pennsylvania Department of Environmental Protection to perform these analyses to develop nutrient thresholds for lakes, reservoirs, and ponds. Our track record of maintaining long-term clients also allows us to track water quality developments using analytical methods on datasets spanning 30 years. We routinely access, utilize, analyze, and

interpret large-scale hydrology datasets in excess of 30,000 records developed internally and by agencies such as the United States Geological Survey.

STAKEHOLDER ENGAGEMENT & PUBLIC OUTREACH

At Princeton Hydro, our technical experts are trained in effective science communication and our communications team members are trained scientists. This combination allows our team to communicate science and engineering concepts, as well as complex topics such as risk, vulnerability, and flood hazard, with the public, NGOs, technical experts, natural resource managers, regulators, and government agencies. Our community outreach efforts often involve working with clients and project partners to initiate an open dialogue early in the project planning process that is proactive, engaging, and inclusive. We have found that public engagement makes the scientific and engineering components of a project more accessible, increasing the public's understanding of restoration and awareness of local environmental concerns.

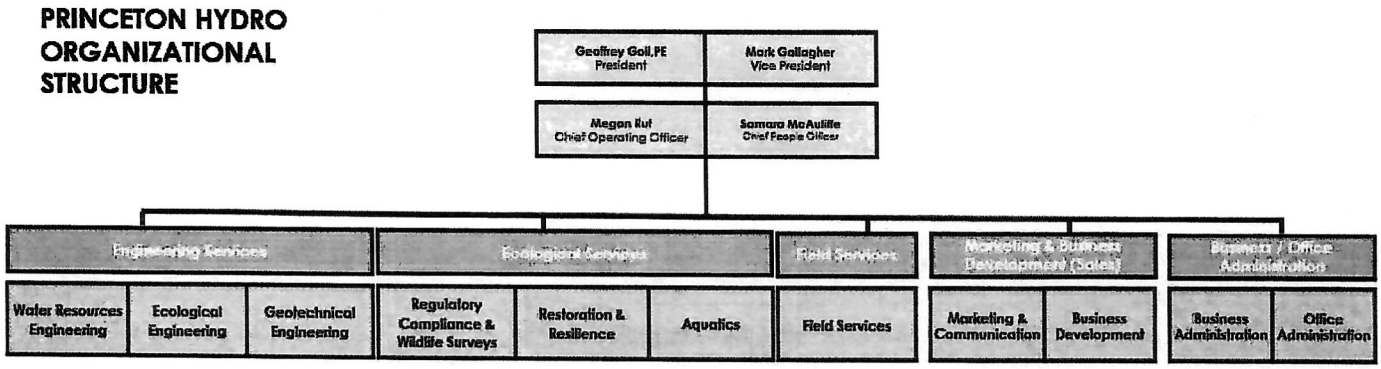
Princeton Hydro makes public education an integral part of many of our projects and programs. Conducting public meetings, preparing fact sheets, and developing public education programs are essential components of many of our studies. Several Princeton Hydro personnel have extensive experience with public education and involvement. This experience includes teaching courses at the university level, as well as educational activities associated with project work. Princeton Hydro personnel are active members in a variety of professional societies that cover a wide range of disciplines and regional environmental interest groups. These include Society for Ecological Restoration, North American Lake Management Society, American Water Resources Association, Society of Wetland Scientists, Association of State Floodplain Managers, Mid-Atlantic Exotic Pest Plant Council, and the United States Green Building Council.

DESIGN OF STORMWATER CONTROL MEASURES AND BEST MANAGEMENT PRACTICES

Stormwater management is a particular field within which Princeton Hydro routinely successfully blends the capabilities of our wetland scientists, environmental engineers, and aquatic ecologists to resolve even complicated stormwater quality management problems. Well before "green infrastructure" and "living stormwater solutions" were part of the stormwater management lexicon, Princeton Hydro was designing and implementing stormwater projects that mimicked the ecological properties and functionality of riparian, floodplain, and wetland ecosystems. As a result, Princeton Hydro has long supported the use of bioretention and created wetland systems for the management of stormwater quality and quantity. Our team of wetland scientists, environmental engineers, and aquatic ecologists has collectively designed numerous stormwater basins and pre-treatment systems. We have combined the use of various hydrologic and watershed-pollutant loading models with our knowledge and experience of the functions of wetland, riparian, and floodplain ecosystems to deliver ecologically-sound solutions for stormwater management.

ORGANIZATIONAL CHART

Below is a high-level organizational chart for Princeton Hydro.



WORK EXAMPLES

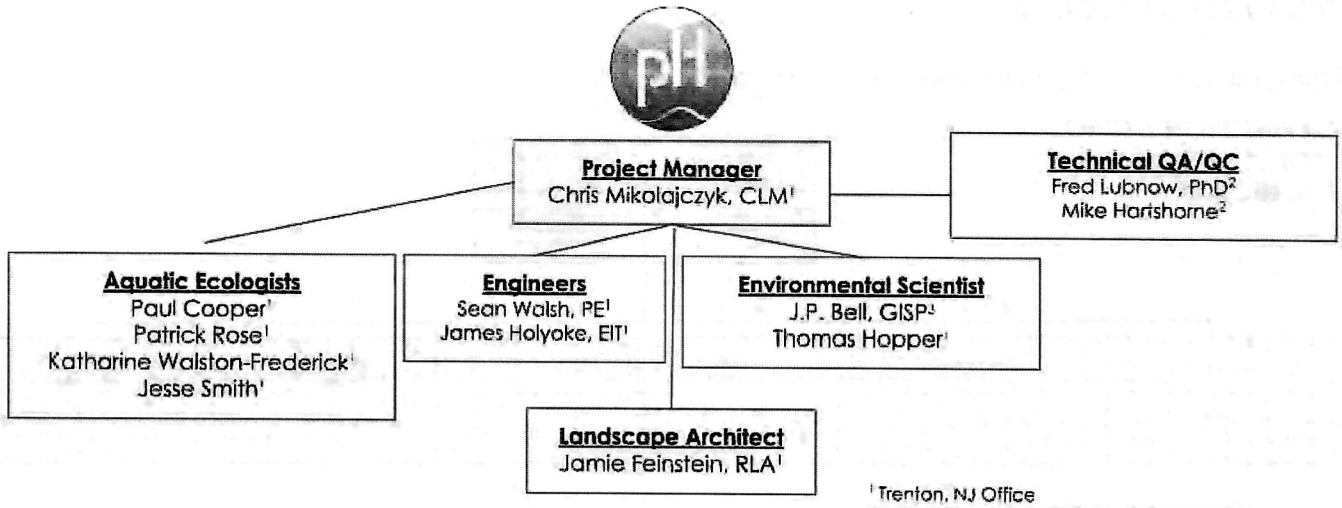
Princeton Hydro has provided full project summaries for the following projects in Attachment A:

1) Borough of Ringwood Lakes & Watershed Management Assessment
2) New Jersey Highlands Council Lake & Stream Corridor Guidance
3) Rockaway Township Lakes & Watershed Assessment
4) Township of West Milford Lakes & Watershed Assessment
5) Lake Hopatcong Trout Habitat and Tagging Study
6) Field Assessment and Engineering for Musconetcong River Projects

The summaries contain the name and address of the client; year(s) during which the work was performed; contract amount; and details of the work conducted.

STAFFING PLAN

The below outline shows all personnel who will work on executing the Scope of Services. We have included full resumes for Team members in Attachment B.



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