# Request for Qualifications
# Sand Spring Run Stream Bank Restoration Project
# RFQ C990000726

**Submittal Date: September 23, 2019**

Monroe County Conservation District

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

R19-0469.P00

Prepared For
Monroe County Conservation District
8050 Running Valley Road
Stroudsburg, PA 18360

Proposed By
Skelly and Loy, Inc.
449 Eisenhower Boulevard, Suite 300
Harrisburg, PA 17111

**Contact: Michael E. Lower, PE, 717-232-0593, mlower@skellyloy.com**

# A. Respondent Information Form

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL
CONSULTANTS

# RESPONDENT INFORMATION FORM
# STATEMENT OF BIDDER QUALIFICATIONS

**1. Company name, bidder email, mail address and all branch office addresses.**

Skelly and Loy, Inc.
449 Eisenhower Boulevard, Suite 300
Harrisburg, PA 17111

Contact: Mr. Michael Lower, P.E., 717-232-0593, mlower@skellyloy.com

**Branch Offices:**
3280 William Pitt Way, Pittsburgh, PA 15238
303 South High Street, Port Matilda, PA 16870
240 Scott Avenue, Suite 5, Morgantown, WV 26508
13701 Maugansville Road, #4, Maugansville, MD 21767
11350 McCormick Road, Executive Plaza II, Suite 706, Hunt Valley, MD 21031

**2. Type of business entity (corporation, non-for-profit, proprietorship, etc.) and Federal Tax Identification Number.**

S Corporation
25-1645583

**3. If company is a corporation, state the date and place of incorporation and give a brief history of company's operations. Please include if your firm is affiliated with Minority, Women, Small or Disadvantaged Business Enterprises.**

Date/Place of Incorporation: January 1, 1991/Pennsylvania

Skelly and Loy was established in 1969 as a partnership to provide engineering services to prospective clients, first concentrating on developing acid mine drainage (AMD) solutions for Pennsylvania's mining industry. Throughout the 1970's, the firm continued with its AMD services and added other services for mining companies such as mining method studies and haul road design. In the 1980's Skelly and Loy began to develop its environmental services repertoire and provided solutions for watersheds, wetlands, waste management/hazardous waste to mining companies, PennDOT, and several other state departments of transportation.

The firm incorporated in 1991 and throughout the decade, Skelly and Loy grew, adding more services such as wastewater treatment and operations, threatened and endangered species studies, noise and air quality studies, and large National Environmental Protection Act related studies, including Environmental Assessments and Environmental Impact Statements. For the next 20+ years, the firm continued to grow and diversify with its services and markets.

Today, Skelly and Loy is a privately owned, mid-sized corporation with 6 Mid-Atlantic offices. The firm provides myriad professional engineering and environmental services to various public and private sector clients throughout the United States and abroad. Skelly and Loy continues to build on its strong foundation and enhances its offering of professional services of mining, civil, and environmental engineering; National Environmental Policy Act (NEPA) compliance studies (EISs, EAs, CEEs, etc.); natural resource management including wetlands, aquatic studies, and wildlife management; environmental, mining, and wastewater permitting; noise and air quality investigations; hazardous waste management investigations and remedial design; industrial hygiene studies; archaeological, cultural, and historical studies and documentation; digital information technology;

and equipment sales, installation, operation, and maintenance of municipal, industrial, commercial, and private water, wastewater, and remediation treatment systems.

Experts with broadly based experience and sound technical skills work closely together to produce the superior work for which the firm is well known. Clients' requirements and desires are always kept foremost by working closely with them to develop the project. The cooperation between Skelly and Loy professionals and clients allows cross-pollination of ideas from many fields of expertise, as well as from the client's own particular insight and experience. In each task undertaken, project personnel are carefully chosen to encompass the full range of disciplines required to completely analyze a problem and provide the best practical solution.

Skelly and Loy is a woman-owned business. The firm is a registered WBE through the City of Philadelphia's Office of Economic Opportunity (#111387) and is also certified through the City of Baltimore's Minority and Women's Business Opportunity Office (#15-359632) and Howard County, Maryland's Equal Business Opportunity Program (#W18-21).

### 4. List directors, officers, owners, managerial employees or partners, and identify the ownership interest of each.

| Owner Name | Role | Percentage Ownership |
|---|---|---|
| Sandra Loy Bell | Chairman of the Board | 61.85% |
| John W. Gunnett, P.G. | President, CEO, COO | 35.20% |
| Gerald Longenecker, P.E. | Executive Vice President, Engineering | 0.99% |
| Sandra Basehore | Executive Vice President, Environmental | 0.99% |
| James France, C.P.A. | Chief Financial Officer | 0.99% |

### 5. Total number of employees and total number of licensed professionals (include an organizational chart, if available).

Total Number of Employees: 152
Professional Engineers: 10
Engineer-in-Training: 7
Professional Geologist: 7
Registered Landscape Architects: 2
Certified Industrial Hygienists: 1
Professional Land Surveyor: 1
Registered Professional Archaeologist: 2

Our company organizational chart is attached to this form.

### 6. Identify locations from which services will be performed.

Services for this project will be performed from our corporate headquarters in Harrisburg, PA.

### 7. Identify or attach license or certificates to perform the work in each jurisdiction where the work will take place.

See attached licenses.

### 8. Has any director, officer, owner or managerial employee had any professional license suspended or revoked? If yes, list the name of the individual, license held and disposition of the issue.

No

**9. Has any director, officer, owner or managerial employee been convicted or the subject of criminal indictment during the past five (5) years? If yes, summarize the matter and its disposition.**

No

**10. Is the company currently involved in bankruptcy or similar proceedings? If yes, explain.**

No

**11. During the past three (3) years, has company been found guilty of any OSHA, EPA or State environmental or safety violation? If yes, describe the nature of the violation and steps taken to remediate the condition(s).**

No

**12. During the past five (5) years, has company been charged with retaliation or discrimination against any employee on the basis of race, ethnicity, national origin, disability, gender or other violation of equal employment opportunities? If yes, summarize each claim and its disposition.**

No

**13. During the past five (5) years, has company been named as a party in any action involving a claim for personal injury or wrongful death arising from performance of work on any project? If yes, summarize the claim and its disposition.**

No

**14. During the past five (5) years, has company been the subject of an investigation or proceedings before the city, state or federal Departments of Labor for any alleged violation of any wage or labor law? If yes, summarize each such instance and its disposition.**

No

**15. Has the company ever been terminated from a project by the Owner? If yes, list the projects on which the bidder was terminated, the nature of the termination (e.g., convenience, suspension, for cause), and the date of said termination.**

No

**16. List the technical and professional staff to be employed on this project; describe general and specific specialties/expertise and overall resources; provide title, role and work resume of each team member, including principals.**

See attached resumes in the Resume tab.

**SKELLY and LOY, Inc.**

| Key Staff Name | Title | Project Role |
|---|---|---|
| Michael Lower, P.E. | Assistant Vice President of Engineering | Project Manager/Project Engineer |
| Gerald Longenecker, P.E. | Executive Vice President, Engineering | QA/QC; Principal-in-Charge |
| Todd Moses | Senior Geomorphologist | Design Specialist |
| Calvin Bush, II, E.I.T. | Water Resources Engineer | Design Engineer |
| Jared Mummert, E.I.T. | Water Resources Engineer | Design Engineer; FGM Survey |
| Daniel Aungst, P.E. | Vice President of AMS of Skelly and Loy, Inc. | Cost Estimating |
| Paul DeAngelo | Associate/Vice President of Environmental Services | Permitting |

**NTM Engineering, Inc.**

| Key Staff Name | Title | Project Role |
|---|---|---|
| Paul DeBarry, P.E., P.H., GISP, D.WRE | Director of Geospatial Technologies and Watershed Management | Project Manager, Technical QA/QC |
| Rachel Tereska, P.E. | Principal, H&H and Permitting Division | Principal-in-Charge, QA/QC |
| Bethany Kavulich, P.E. | Engineer | H&H Modeling |
| Francisco Aguirre, P.E. | Engineer | H&H Modeling |
| Kevin Kozain, P.E. | Engineer | E&S Design |

| Key Staff Name | Title | Project Role |
|---|---|---|
| Edward Lesny, P.E. | Consulting Geotechnical Engineer | Geotechnical Engineer |

**17. Indicate your understanding of the scope of work involved in the project and potential problems to be addressed. Summarize how you will respond to specific phases of the work, identifying any innovative or creative design approaches or strategies that the company proposes.**

The surficial geology of this site appears to consist of a mantle of glacial till/stratified drift comprised mainly of sand, silt and larger stone (Photo 1). Portions of the site also consist of fill material evidently composed of this same material and likely obtained locally. In either case, this very poorly-consolidated, non-cohesive and therefore highly-erodible material will provide a distinct challenge to vegetative stabilization wherever it has become exposed by slope erosion.

***Photo 1. Eroding slope on the north side of the stream (2019-09-11).***

The highly-erosive clear water flow from the pond has left an outlet channel which has self-armored. The coarse lag material comprising the channel appears to be preventing any further down-cutting of this stream. Channel headcuts are absent and the coarsest rock fragments (which are not especially large) are in the process of creating a step-pool channel morphology (Photo 2). These are constructional, not erosional, streambed features. In other words, the streambed is being re-arranged – not eroded – by the range of flows emanating from the pond.

This implies, from a restoration design standpoint, that the removal of the beaver dam (which would likely be soon replaced anyway) is not necessary to stabilize the little valley of the outlet channel. All that is required is to ensure a stable channel near the pond outlet, one with no potential for flow bypassing. In this case, any future breaching of a beaver dam at this location will not have any material effect on the channel downstream.

***Photo 2. The pond outlet channel, showing its armored condition and incipient step-pool morphology (2019-09-11).***

It may be possible to harvest suitable rock for construction of a step-pool channel from the immediate area. Specifically, this would be the larger rock required for construction of the rock steps, or weirs. Existing streambed rock can be used for the pools and tailouts. The conservation district has indicated that this would be acceptable, especially if there is a cost savings.

It appears at this point that it might be possible to harvest suitable rock from the sandstone bedrock outcrops located along the old railroad cut, especially since this will now be used for the construction access route. The ability to harvest structurally sound rock in such proximity to the associated stream work would provide for far less overall environmental impacts for such as small additional disturbance. The heavy construction equipment that would already be necessary on the site (e.g. loader, excavator, haul truck) when supplemented with a hydraulic breaker (hoe ram) attachment could replace a substantial amount of haul truck traffic that would be required otherwise from material source locations all the way to the site staging area. The suitability of the onsite rock outcropping will have to be assessed during the design stage, with this based on factors such as joint spacing and the hardness of the rock, but if suitable will provide for cost savings and ease of construction.

Regardless of where they come from, the rocks used for the constructed step structures will have to be large select rock sized to resist the expected shears and velocities within the restored channel. The margins of this reconstructed channel will have to include hardening or stabilization of the regraded hillside's toe up to any projected maximum flow elevation.

Since the re-constructed channel will have a step-pool morphology, the construction of overly wide streamside benches at the bankfull level (hard to discern in a step-pool channel anyway) is not recommended. Energy dissipation in step-pool systems occurs vertically, within the stepped rocky channel, not on lateral flood-prone zones (as in lower gradient alluvial streams). Any benching along the stream should be associated with benching of the regraded hillside, with the lowest such bench above the projected maximum flood level. Otherwise a large flood, such as that associated with a break in the beaver dam, could cause scour along the slope toe.

It is recommended that the old timber-rail-stone culvert (for the former railroad fill) be removed in its entirety from the stream corridor. It is the bypassing of this structure that triggered the ongoing erosion on the south facing slope seen in Photo 1 in the first place. The retention of these ruins will unnecessarily complicate construction and the old outlet endwall continues to function as a flow-obstructing hard point (Photo 3). Retaining this would only add to any erosion risk associated with a major flood.

***Photo 3. View downstream, with old culvert endwall jutting out into the channel on the right, and the extensively eroding south-facing slope on the left (2019-09-11).***

Along with bank cutting (both within and downstream of the designated project site), the continued erosion of the valley side slopes along the stream is apparently the chief source of the sediment discharged from this area. This appears to be mostly supplied by the surface water erosion and dry raveling of the extensive bare zone comprising the slope on the north side of the outlet stream (Photos 1 and 3).

In this sandy material, naturally hostile to plants, it will be especially important to lower the slope angle as much as possible. Although the provision of lower-angle roadcut slopes shallower than 2:1 is rarely adhered to by highway departments (for cost reasons), lowering of the slope angle will be central to this restoration within this non-roaded and heavily forested natural preserve.

The expense of significant geotechnical boring, probing, and testing of the eroding slopes at this location is probably not necessary because of both the obvious logistical difficulties and the fact that the nature of the surficial materials comprising the main eroding slope is clearly evident (Photo 1). More importantly, the angle deemed geotechnically-stable for these materials after testing is likely to be considerably steeper than what is actually suitable for its successful revegetation. In this case, a detailed geotechnical analysis provides no useful information. Two things will eliminate this site as a significant sediment source: a) the restoring of a slope with a thriving vegetative cover and b) the construction of a channel robust enough to prevent any future undercutting of its toe. To that end, we are suggesting that a limited geotechnical investigation and slope stability analysis be performed at this site. Representative grab samples of the slope soil will be secured and analyzed by the geotechnical engineer. Using conservative assumptions, a slope grading recommendation will be provided to guide the design of the regraded slope contours.

It is also the case that since bedrock is not exposed at the toe of this slope or along the stream channel, and this area is generally accepted as historical fill, it is highly unlikely that bedrock will be revealed when grading back the slope. However, in the event that bedrock was exposed in this process, this exhumed bedrock surface would become the new – now completely stable – valley side slope.

Along with lower slope angle, soil amelioration (soil restoration) will be especially important if a self-sustaining native vegetative cover is to be restored in this area. It is assumed at this point that this plant community target should consist of native forest species generally comparable to that in the surrounding area. Likely candidates

include native pines, scrub oak, sheep laurel, rhododendron and other hardy early seral species (e.g. birch) common to disturbed sites in this region. Although local nursery availability will obviously be critical in determining what native woody plants get installed at this site, regionally-dominant natives especially adapted to acidic, sandy soil conditions will be likely candidates for planting.

Ameliorative soil treatments intended to foster the successful establishment of these plantings will be required and will likely include deep ripping (root zone preparation), organic matter incorporation, and forest floor replacement (heavy mulching). This may well be accompanied by structural measures for moisture and soil retention, such as slope benching and the installation of contour logs partially embedded into the slope. If found suitable for construction, trees removed from the disturbed site can be used for the construction of contour log slope features or mulched on site to alleviate the need for additional sourcing and hauling of foreign materials, and add to cost savings for this project.

At least, limited testing of the local material should also be done to determine nutrient limitations and potential factors influencing nutrient availability. Nitrogen availability, for example, is often exceptionally important to seedling establishment on very harsh sites and this can be heavily influenced by soil chemistry. Any fertilizers used would typically be applied through spot fertilization using a slow release form to minimize leaching. Area-wide fertilization would typically be avoided in this kind of site because of chemical water quality concerns.

Such deliberate efforts to improve soil moisture retention and nutrient and organic matter content on regraded slopes is essential if long-term forest restoration and not just erosion control is the main objective in this area. This will be especially important at this site because the main eroding slope is south facing. This translates to lowered soil moisture content and high summertime soil temperatures that will naturally inhibit plant growth and survival on this slope.

As has been learned in both mined land reclamation and in implementing more restorative treatments to road cuts and fills, sowing newly-constructed slopes with conventional, aggressive erosion control grasses and forbs is likely to only delay eventual reforestation. Restoring a soil cover of particulate organic matter (deep mulching) to regraded slopes provides soil moisture retention and reduces the moisture- and nutrient competition that accompanies a dense herbaceous groundcover. Providing for restoration efforts of this type in the design will limit the need for long-term operation and maintenance of the project site.

Although it was of a much larger scale, Skelly and Loy's First Hollow Run (an Exceptional Value stream with a thriving wild trout population) project completed in 2007 provides an exceptionally useful analog for the Sand Spring Run project. Here, too, a rerouted channel had deeply cut into unconsolidated materials (mine spoils), creating a major sediment source. A unique natural stream channel design approach employing the principles of fluvial geomorphology was used to design the stabilization and restoration of approximately 1,300 feet of First Hollow Run.

First Hollow Run utilized step structures composed in part of very large boulders, labeled "keystones," constructed to create a natural appearing step-pool channel. As in the case of stable self-formed step-pool channels, this design maximizes energy dissipation and overall channel stability. Erosion control blankets and an aggressive planting plan was used to reinforce the stability of the channel margin areas within the highly confined setting of the ravine.

The design for First Hollow Run, along with the design of a similar step-pool channel in West Virginia, precipitated the preparation of a technical paper on a natural channel design approach to steep channels. This paper, entitled "Natural Channel Design of Step-Pool Watercourses Using the 'Keystone' Concept," was presented at a conference of the American Society of Civil Engineers in 2003. The paper describes a practical approach for high gradient streams. As a result of our experience, Skelly and Loy developed a unique FGM protocol for restoring these important components of the fluvial landscape. This design protocol has a wide application in both urban and rural settings, which is exemplified by the provided project examples.

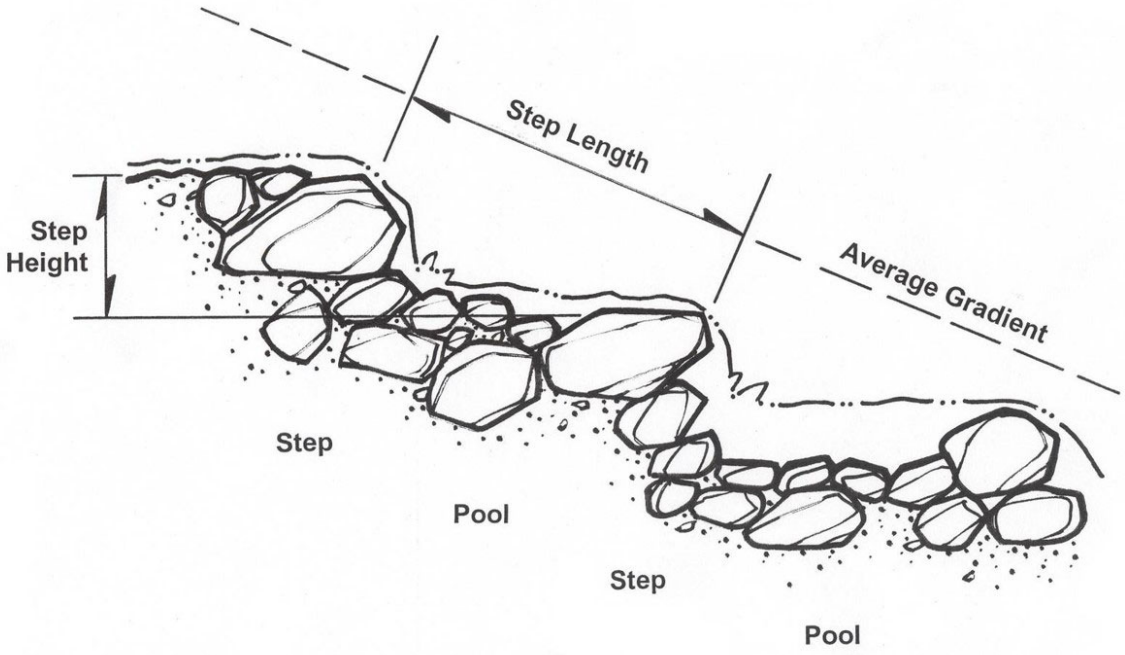



***Figure 1. Characteristics of a step-pool stream channel.***

In addition to Skelly and Loy's expertise in technical practices for a project of this scope, we have become well versed in the realm of stream restoration projects that are funded through cyclical grants, which typically relegates projects of large scopes to phased approaches for grant processes and construction. We have gained significant experience with providing an organized phased approach through our consistent involvement with the Mehoopany Creek Watershed projects which have been ongoing since 2002. Various restoration projects have been completed on the North Branch Mehoopany Creek, Windy Valley Segment of Mehoopany Creek, and most recently the full design and permitting of a five-phase construction plan along Rogers Hollow Segment of Mehoopany Creek, with Phase 1 currently under construction, and Phases 2 and 3 funded for construction in 2020.

Phased projects span extended time periods and require a critical approach to analyzing the components of the project to determine the best possible phasing of the overall project. The goal is to provide construction phases that singularly improve the existing site conditions in achievement of the overall project goals, while providing for ease of transition to following stages that will have minimal impact and require little to no re-work on previously completed stages.

*Photo 4. First Hollow Run (Before)*

*Photo 5. First Hollow Run (After)*

## 18. Describe the nature and level of communications company will maintain with MCCD staff during the various project phases.

Skelly and Loy will maintain contact with MCCD throughout all phases of the design and permitting of the project. Skelly and Loy contact instruments will include email, phone conferences, and as-needed on-site consultation. Although the current scope of work is only for the design and permitting stages of the project, Skelly and Loy prides itself on maintaining involvement in projects from startup and initiation through completion of construction and post-construction monitoring. We have significant experience in grant administration and construction oversight of environmentally sensitive restoration projects, and would be amenable to further coordination with the MCCD in providing our professional services for future stages of this critical watershed project.

## 19. Discuss any special or specific qualifications company has for this project.

Skelly and Loy's corporate experience in the stream restoration field has been a specialization of the firm since its founding in 1969. In the mid 1990's, the Environmental Engineering Service Group was formed within the organization with the specific purpose of developing these services as highly specialized and technically advanced focus market areas. Since that time, the Environmental Engineering Service Group has provided engineering design, permitting, construction oversight and related engineering services in this area to a broad range of clients from the private sector through the county and other local municipal levels on up through state and federal levels. In this time period, Skelly and Loy has gained experience on more than 200 projects specifically related to stream restoration. Specific experience within these areas has included watershed

assessment, stream channel classification, stability, ecological function and value and restoration prioritization, geomorphic regional curve development, floodplain modeling, stormwater retrofitting, design of Best Management Practices, permitting, construction bidding, construction management and post-construction monitoring. Skelly and Loy's corporate staff includes other highly experienced individuals in other related technical discipline areas (e.g., wetland delineation, historic and archaeological resources, threatened or endangered species, hydrogeology, and other capabilities) that are often times required in the course of completing these projects.

**Stream Restoration Approach**

Skelly and Loy's approach to the assessment, design, restoration and enhancement of streams using natural stream channel techniques is based on applying principles of fluvial geomorphology (FGM) to restore natural stability to a stream system. Various levels of FGM principles have been successfully applied to both rural and urban environments. By incorporating these principles in project designs, Skelly and Loy's projects have realized the benefits of maximizing channel stability while maintaining natural sediment transport, reduced destructive flooding potential, reduced property loss and damage, enhanced fish and wildlife habitat, and improved stream stability. Using this approach, Skelly and Loy continues to build an enviable portfolio of successfully completed natural stream channel design projects.

**Local, State, and Federal Permitting Expertise**

Skelly and Loy is routinely involved in coordinating with local, state and federal regulatory permitting agencies associated with stream restoration activities, to include general construction permitting requirements. Local permitting typically is at the county level with associated Conservation Districts that handle Erosion and Sediment Pollution Control Plan and Post-Construction Stormwater Management Plan review. In most cases, projects have required coordination at the local municipality level, and is an integral part of the overall Joint Permit requirements. Federal permitting typically is coordinated primarily with the U. S. Army Corps of Engineers and Pennsylvania Department of Environmental Protection as related to both the Section 401 and 404 requirements with additional permit review comments from the PA Fish and Boat Commission, US Fish and Wildlife Service, and other state and federal agencies as required. State permitting efforts have included agencies charged with waterway protection and stream encroachments as well as agencies associated with related issues inclusive of historic/archaeological resources, threatened or endangered species, and erosion control plans (oftentimes also involving county-level governmental entities). Skelly and Loy has successfully completed all levels of permitting efforts on all designed and constructed projects.

## 20. Describe how company will ensure Project performance, quality and consistency through adequate management, supervision and control techniques.

Consistent with our company's Mission Statement and Core Values, Skelly and Loy views its quality management program as a value-added component to its services and final products. In implementing this systems-oriented approach to quality, the goal of Skelly and Loy is to optimize processes to provide quality professional services, highly responsive client service, and technically exceptional final products.

It is the company's management philosophy that each and every employee is responsible and accountable for a quality performance. This philosophy is embraced and practiced by senior management, middle management, and staff members alike. In its leadership role, it is management's responsibility to monitor compliance with the corporate commitment to quality in both its work efforts and resulting products. This monitoring process involves the following activities.

- Assess the effectiveness of quality programs and processes
- Identify potential problems
- Resolve and remedy circumstances before problems occur
- Recommend modifications to improve services and final products
- Verify that independent review processes are in place
- Strengthen quality programs to ensure Skelly and Loy's continued viability

Project Managers are assigned responsibility for the development of and adherence to Project-Specific QA Plans (PSQAP). The Project Manager develops the PSQAP in accordance with guidelines and requirements set forth by the client and the company. Typically, the PSQAP is a component of the Project Work Plan. The Project Manager is responsible for ensuring that corrective actions are taken if required and non-conforming work is handled properly on a project-specific basis.

The Quality Management Process consists of a series of actions including development of policy and guidelines; interaction and communication among employees, client representatives, and reviewing agencies; utilization of process controls and automation/computer technology; commitment of corporate resources; and implementation of review and assurance procedures to ensure that project activities and deliverables achieve client objectives, comply with applicable laws and regulations, and meet industry standards and criteria.

The goals to be met through the implementation of Skelly and Loy's QA/QC process are constant and include the following.

- Monitor effectiveness
- Target problems
- Correct nonconformance
- Improve performance

Skelly and Loy continually strives to achieve these goals by ensuring that the following list of objectives is adhered to during the implementation of the professional and technical services offered by the company as well as the completion of the final products which result from the performance of those services.

- Basic data and assumptions are adequate
- Project activities and deliverables are appropriate, well-coordinated, and correct
- Problems, issues, and opportunities are defined, communicated, and scoped
- Methodology and technology applications are correct
- Correct standards and criteria are used
- State and local regulations and requirements are followed
- Calculations and interpretations are accurate
- Results and recommendations are reliable and reasonable
- Reports are complete, usable, and economically prepared
- Performance is carried out on time and within budget

In regard to retaining subconsultants, Skelly and Loy initiates the QA/QC process by evaluating qualified subconsultants and selecting the most appropriate based on experience, staffing levels, and ability and commitment to achieve project goals and requirements. The subconsultant develops a Work Plan, usually in the form of a proposal, specifying its performance of services. Acceptance of the Work Plan is formalized with the completion of a General Subcontract Agreement Terms and Conditions signed by both parties, which contractually commits them.

As specified in Skelly and Loy's Subcontract Agreement, it is the subconsultant's obligation to become familiar with all available documentation applicable to the services to be provided. It further commits the subconsultant to cooperate, coordinate, and take direction from Skelly and Loy's Project Manager or his designated representative. In addition, the subconsultant is committed to comply with and be subject to the same contractual requirements with respect to Skelly and Loy as Skelly and Loy is subject to with respect to the client under the client's contract. Finally, the subconsultant is required to maintain written records, permit the audit and inspection of such records, and adhere to all applicable laws, ordinances, rules, regulations, and orders.

Skelly and Loy maintains the right to terminate the contract if the subconsultant fails to fulfill its obligation in a timely and proper manner, or if it violates any of the covenants, agreements, or stipulations of the contract. In addition, Skelly and Loy may withhold payment for the purpose of offsetting damages due to negligence or poor performance on the part of the subconsultant.

In addition to these contractual controls, subconsultants, when applicable, are required to accept and implement Skelly and Loy's PSQAP or prepare their own PSQAP and submit it to Skelly and Loy for review and approval to ensure compliance with project requirements. Using the corporate quality process controls and assurance procedures as previously discussed, Skelly and Loy will perform periodic evaluations to ensure subconsultant compliance with the PSQAP. For specific projects, it is the Project Manager's responsibility to ensure that the subconsultant's work is properly reviewed and meets or exceeds the expectations and requirements of the client.

## 21. Describe company's system of monitoring and oversight to ensure maintenance of complete and accurate work, payroll and invoicing records.

Skelly and Loy will ensure financial accountability and cost tracking through our web-based Deltek Vision® accounting system. Skelly and Loy's project managers are responsible for technical and financial performance of a project including the following.

- Client satisfaction
- Technical approach
- Management of the project team
- Reviewing project transactions
- Providing status reports to management and clients
- Maintaining cost budgets and estimates at completions
- Preparing accurate invoices
- Receiving payment for services

The Deltek Vision® accounting system provides up-to-the-minute information to monitor project budgets at the task level and generate financial reports. The capabilities of our Deltek Vision® accounting system for tracking costs, providing reports, and generating invoices are discussed below.

With the Project Billings Summary Report generated by the system, the Project Manager can review the current status of all assigned work orders, including budget information reported at the task level.

Specifically, the following can be reviewed by the Project Manager.

- Status of project costs at the project, task, or subtask level
- Project expenditures by selected category (travel, field equipment, labor, subcontractor, vendor, etc.).
- Expenditure item adjustment
- Project performance in terms of actual costs versus budgets and revenue amounts
- Percent complete.

The Project Billings Summary Report can be accessed 24 hours a day, 7 days a week (via the Internet so that project budgets can be reviewed from any location at any time), and is updated daily or as soon as the expenditure is entered into the system. Project Managers are required to review the information pertaining to their assignments on a weekly basis. If an error is found (e.g., incorrect charges of non-billable items), the Work Order Manager will contact the billing liaison in the accounting department so that adjustments such as the following can be made.

- Transferring an expenditure
- Holding charges
- Changing from billable to non-billable or non-billable to billable charges

This capability allows costs to be tracked and evaluated against the progress of work for a project on a regular basis, allowing the Project Manager to immediately notify and discuss issues with the client.

Invoicing is performed on a monthly basis. Our system will provide draft invoices to our Project Managers which list unbilled labor and expenses for all active work. Our Project Managers will review this information and provide comments to our accounting staff for invoice generation. The following information will be listed on our invoices on a per task basis and checked and verified:

**Labor Charges**

- A separation of labor hours for time spent working the office and in the field.
- The names of the employees who have charged time to the project.
- The billing classification for the employee.
- The number of hours charged to the project.
- The billing rate for the employee.
- Overhead and profit charges.

**Other Direct Costs and Expenses (no mark up)**

- A listing of vehicle usage (days).
- A listing of core and non-core equipment rental charges (days).
- General expense items (ice, field supplies).
- Per diem charges.

**Subcontractor Charges**

- Subcontractor charges.

**Billing Back-up Information**

- A listing of comments for each labor charge billed to the project.
- Receipts (where applicable) for other direct costs and expenses.
- Internal field equipment rental forms.
- Copies of subcontractor invoices.

Hard and electronic copies of our invoices will be provided. Various management reports can be generated by the Deltek Vision® accounting system, all with the ability to be easily exported into an Excel spreadsheet. Once in Excel, reports specifically requested by the client can be prepared.

### 22. Does company have any projects ongoing at the time of the submission of this bid? If yes, list the projects on which the bidder is currently working, the percentage now complete, and the expected dates of completion.

In keeping with Addendum #2, Answer A10, Skelly and Loy is providing this list of select relevant projects in the region.

| Project Title | Percent Complete | Completion Date |
|---|---|---|
| Mehoopany Creek Rogers Hollow Stream Restoration, Phase 1 Construction Management | 25% | November 2019 |
| Oley Creek Sediment Abatement Project, Construction Management | 95% | September/October 2019 |
| Paradise Creek Red Rock Road Stream Restoration, Construction Management | 10% | December 2020 |

### 23. Attach company's most current certified financial statement or, if a certified statement has not been issued within the past 12 months, the company's latest internal financial statement.

See attached.

By: _____
(Signature)

John W. Gunnett, P.G., President, CEO, COO of Skelly and Loy, Inc.
(Print Name, Title and Company)

Dated: 9/20/19

Sworn to before me this 20th day of September, 20 19.

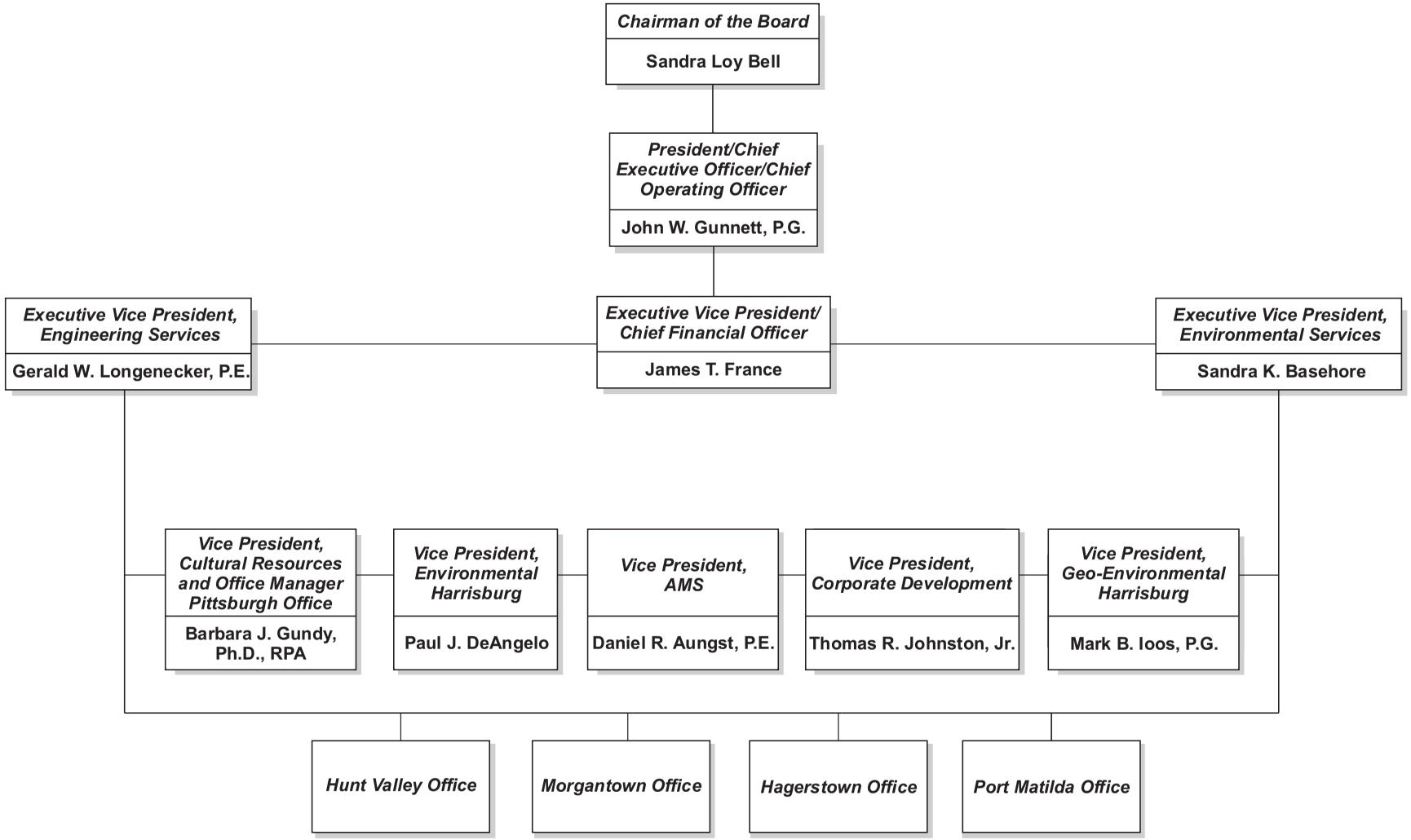
_____
Notary Public

Commonwealth of Pennsylvania - Notary Seal
Amy L. Perez, Notary Public
Dauphin County
My commission expires February 20, 2023
Commission number 1345627
Member, Pennsylvania Association of Notaries

# Attachments to Respondent Information Form

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

# Skelly and Loy, Inc.
# Staff Organizational Chart



COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF STATE

09/27/2018

TO ALL WHOM THESE PRESENTS SHALL COME, GREETING:

I DO HEREBY CERTIFY THAT,

SKELLY AND LOY, INC.

is duly registered as a Pennsylvania Business Corporation under the laws of the Commonwealth of Pennsylvania and remains subsisting so far as the records of this office show, as of the date herein.

I DO FURTHER CERTIFY THAT this Subsistence Certificate shall not imply that all fees, taxes and penalties owed to the Commonwealth of Pennsylvania are paid.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the Seal of the Secretary's Office to be affixed, the day and year above written

Robert Torres

Acting Secretary of the Commonwealth

Certification Number: TSC180927090233-1

Verify this certificate online at http://www.corporations.pa.gov/orders/verify

DISPLAY THIS CERTIFICATE PROMINENTLY • NOTIFY AGENCY WITHIN 10 DAYS OF ANY CHANGE

**Commonwealth of Pennsylvania**
**Department of State**
**Bureau of Professional and Occupational Affairs**
**PO BOX 2649 Harrisburg PA 17105-2649**

19 0847337

**License Type**
**Professional Engineer**

**GERALD W LONGENECKER**
**7756 GREEN HILL ROAD**
**HARRISBURG, PA 17112**

**License Status**
**Active**

**Initial License Date**
**03/20/1985**

**License Number**
**PE034357E**

**Expiration Date**
**09/30/2021**

Acting Commissioner of Professional and Occupational Affairs

Signature

ALTERATION OF THIS DOCUMENT IS A CRIMINAL OFFENSE UNDER 18 PA.C.S.§. 4911

Commonwealth of Pennsylvania Department of State
Bureau of Professional and Occupational Affairs

Professional Engineer

License Number
PE071798

Expiration Date
09/30/2019

Active

MICHAEL EUGENE LOWER
1452 PERRY VALLEY ROAD
Liverpool PA 17045

# OFFICIAL DOCUMENT

READ THE FOLLOWING INFORMATION CAREFULLY CONCERNING YOUR LICENSE:

1. SIGN THE WALLET CARD AND CERTIFICATE WHERE INDICATED.
2. DETACH THE WALLET CARD AND CERTIFICATE AT PERFORATION.

MICHAEL EUGENE LOWER
1452 PERRY VALLEY ROAD
Liverpool PA 17045

**Pennsylvania Licensing System (PALS)**

**Visit our website at: www.pals.pa.gov to renew your license, change your personal or license address, or order duplicate licenses.**

DISPLAY THIS CERTIFICATE PROMINENTLY • NOTIFY AGENCY WITHIN 10 DAYS OF ANY CHANGE

**Commonwealth of Pennsylvania**
**Department of State**
**Bureau of Professional and Occupational Affairs**
**PO BOX 2649 Harrisburg PA 17105-2649**

18 0087586

**License Type**
**Professional Engineer**

MICHAEL EUGENE LOWER
1452 PERRY VALLEY ROAD
Liverpool PA 17045

**License Status**
**Active**

**Initial License Date**
**06/07/2005**

**Expiration Date**
**09/30/2019**

**License Number**
**PE071798**

Commissioner of Professional and Occupational Affairs

Signature

ALTERATION OF THIS DOCUMENT IS A CRIMINAL OFFENSE UNDER 18 PA.C.S.§. 4911

# *SKELLY AND LOY, INC.*
# *AND SUBSIDIARY*

## *YEARS ENDED*
## *DECEMBER 31, 2018 AND 2017*

# Independent Auditors' Report

Board of Directors
Skelly and Loy, Inc. and Subsidiary
Harrisburg, Pennsylvania

## Report on the Consolidated Financial Statements

We have audited the accompanying consolidated financial statements of Skelly and Loy, Inc. and Subsidiary (collectively the Company), which comprise the consolidated balance sheets as of December 31, 2018 and 2017, and the related consolidated statements of operations, shareholders' equity and cash flows for the years then ended and the related notes to the consolidated financial statements.

## Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these consolidated financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation and maintenance of internal control relevant to the preparation and fair presentation of consolidated financial statements that are free from material misstatement whether due to fraud or error.

## Auditors' Responsibility

Our responsibility is to express an opinion on these consolidated financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the consolidated financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risks of material misstatement of the consolidated financial statements, whether due to fraud or error. In making those risk assessments, the auditors consider internal control relevant to the Company's preparation and fair presentation of the consolidated financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements.



210 GRANDVIEW AVENUE, CAMP HILL, PENNSYLVANIA 17011 T: 717.761.7171 F: 717.737.6655
201 GRANITE RUN DRIVE, SUITE 110, LANCASTER, PENNSYLVANIA 17601 T: 717.581.1040 F: 717.581.1042
800.294.7360 www.bssf.com

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

**Opinion**

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and cash flows for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Brown Schultz Sheridan & Fritz

Camp Hill, Pennsylvania
March 21, 2019

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED BALANCE SHEETS – DECEMBER 31, 2018 AND 2017

ASSETS

| | 2018 | 2017 |
|---|---|---|
| Current assets: | | |
| Cash | $ 365,868 | $ 2,157 |
| Accounts receivable, trade, including unbilled | 5,423,940 | 6,975,755 |
| Prepaid expenses | 220,223 | 187,500 |
| Prepaid stock compensation, current portion | 65,236 | |
| Total current assets | 6,075,267 | 7,165,412 |
| Property and equipment: | | |
| Land | 23,404 | 23,404 |
| Building | 97,664 | 97,664 |
| Leasehold improvements | 25,000 | 25,000 |
| Furniture and equipment | 1,332,118 | 1,126,241 |
| Vehicles | 1,373,732 | 1,260,651 |
| | 2,851,918 | 2,532,960 |
| Less accumulated depreciation | 1,856,520 | 1,907,570 |
| Total property and equipment, net | 995,398 | 625,390 |
| Prepaid service contract | 58,218 | 116,437 |
| Deposits | 65,949 | 61,899 |
| Cash surrender value of life insurance | 50,461 | 29,018 |
| Investment, captive insurance corporation | 136,862 | 33,192 |
| Prepaid stock compensation, net of current portion | 78,827 | |
| Total other assets | 390,317 | 240,546 |
| Total assets | $ 7,460,982 | $ 8,031,348 |

See notes to consolidated financial statements.

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED BALANCE SHEETS – DECEMBER 31, 2018 AND 2017

LIABILITIES AND SHAREHOLDERS' EQUITY

| | 2018 | 2017 |
|---|---|---|
| Current liabilities: | | |
| Line of credit | $ 271,987 | $ 1,327,729 |
| Current portion of long-term debt | 166,552 | 181,007 |
| Accounts payable: | | |
| Trade | 379,606 | 1,067,621 |
| Unbilled indirect cost rate adjustments (Note 5) | 576,146 | 488,813 |
| Advanced billings and provision for contract losses | 278,799 | 178,350 |
| Accrued payroll, withheld payroll taxes and benefits | 1,068,941 | 869,137 |
| Other liabilities | 288,454 | 227,274 |
| Total current liabilities | 3,030,485 | 4,339,931 |
| Long-term debt, net of current portion | 629,744 | 792,996 |
| Deferred rent liability | 146,767 | 125,400 |
| Total liabilities | 3,806,996 | 5,258,327 |
| Shareholders' equity: | | |
| Common stock, no par; authorized 10,000 shares, issued 7,505 shares and 7,325 shares, respectively | 7,505 | 7,325 |
| Additional paid-in capital | 579,553 | 528,042 |
| Additional paid-in capital, stock options | 170,879 | 170,879 |
| Retained earnings | 4,054,115 | 3,369,838 |
| | 4,812,052 | 4,076,084 |
| Less treasury stock at cost, 1,285 and 1,465 shares, at December 31, 2018 and 2017, respectively | 1,158,066 | 1,303,063 |
| Total shareholders' equity | 3,653,986 | 2,773,021 |
| Total liabilities and shareholders' equity | $ 7,460,982 | $ 8,031,348 |

See notes to consolidated financial statements.

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED STATEMENTS OF OPERATIONS

YEARS ENDED DECEMBER 31, 2018 AND 2017

| | 2018 | 2017 |
|---|---|---|
| Contract revenues | $ 20,951,852 | $ 21,257,688 |
| Direct contract costs, excluding direct labor: | | |
| Consultant fees | 2,356,580 | 3,035,036 |
| Other direct costs | 1,527,605 | 2,048,325 |
| Net contract revenues, before direct labor | 17,067,667 | 16,174,327 |
| Direct labor | 6,049,642 | 5,799,739 |
| Net contract revenues | 11,018,025 | 10,374,588 |
| Operating expenses | 10,011,474 | 9,577,893 |
| Operating income | 1,006,551 | 796,695 |
| Other income (expense): | | |
| Interest and dividend income | 97,323 | 61,444 |
| Interest expense | (41,221) | (62,406) |
| Gain on disposal of assets | 1,250 | |
| | 57,352 | (962) |
| Net income | $ 1,063,903 | $ 795,733 |

See notes to consolidated financial statements.

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

YEARS ENDED DECEMBER 31, 2018 AND 2017

| | Common stock | | Additional paid-in capital | Additional paid-in capital, stock options | Retained earnings | Treasury stock | Total |
|---|---|---|---|---|---|---|---|
| | Shares | Amount | | | | | |
| Balance, January 1, 2017 | 7,325 | $ 7,325 | $ 528,042 | | $ 2,760,847 | $ (1,303,063) | $ 1,993,151 |
| Net income | | | | | 795,733 | | 795,733 |
| Compensation expense, stock options | | | | $ 170,879 | | | 170,879 |
| Distributions | | | | | (186,742) | | (186,742) |
| Balance, December 31, 2017 | 7,325 | 7,325 | 528,042 | 170,879 | 3,369,838 | (1,303,063) | 2,773,021 |
| Net income | | | | | 1,063,903 | | 1,063,903 |
| Prepaid compensation expense, stock issued | 180 | 180 | 51,511 | | | 144,997 | 196,688 |
| Distributions | | | | | (379,626) | | (379,626) |
| Balance, December 31, 2018 | 7,505 | $ 7,505 | $ 579,553 | $ 170,879 | $ 4,054,115 | $ (1,158,066) | $ 3,653,986 |

See notes to consolidated financial statements.

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED STATEMENTS OF CASH FLOWS

YEARS ENDED DECEMBER 31, 2018 AND 2017

| | 2018 | 2017 |
|---|---|---|
| Cash flows from operating activities: | | |
| Net income | $ 1,063,903 | $ 795,733 |
| Adjustments: | | |
| Depreciation | 323,793 | 246,400 |
| Gain on disposal of assets | (1,250) | |
| Cash surrender value of life insurance | (21,443) | |
| Noncash expense, stock compensation | 52,625 | 170,879 |
| (Increase) decrease in: | | |
| Accounts receivable, trade | 1,551,815 | (1,918,787) |
| Prepaid expenses | 25,496 | 89,726 |
| Deposits | (4,050) | (600) |
| Investment, insurance corporation | (103,670) | |
| Increase (decrease) in: | | |
| Accounts payable: | | |
| Trade | (688,015) | 611,980 |
| Unbilled indirect cost rate adjustments | 87,333 | 648,591 |
| Advanced billings and provision for contract losses | 100,449 | 133,810 |
| Accrued payroll, withheld payroll taxes and benefits | 199,804 | 61,472 |
| Deferred rent | 21,367 | (81,560) |
| Other liabilities | 61,180 | (36,391) |
| Total adjustments | 1,605,434 | (74,480) |
| Net cash provided by operating activities | 2,669,337 | 721,253 |
| Cash flows from investing activities: | | |
| Purchase of property and equipment | (693,801) | (466,854) |
| Proceeds from sale of property and equipment | 1,250 | |
| Net cash used in investing activities | (692,551) | (466,854) |

(continued)

## *SKELLY AND LOY, INC. AND SUBSIDIARY*

CONSOLIDATED STATEMENTS OF CASH FLOWS (CONTINUED)

YEARS ENDED DECEMBER 31, 2018 AND 2017

| | 2018 | 2017 |
|---|---|---|
| Cash flows from financing activities: | | |
| Net borrowings under line of credit | $ (1,055,742) | $ 113,382 |
| Repayments of long-term debt | (177,707) | (180,425) |
| Distributions | (379,626) | (186,742) |
| Net cash used in financing activities | (1,613,075) | (253,785) |
| Net increase in cash | 363,711 | 614 |
| Cash: | | |
| Beginning of year | 2,157 | 1,543 |
| End of year | $ 365,868 | $ 2,157 |
| Supplemental disclosure of cash flow information: | | |
| Cash paid during the year for interest | $ 43,686 | $ 62,573 |
| Supplemental disclosure of noncash investing and financing activities: | | |
| Stock was issued for compensation as described in the footnotes. | $ 196,688 | |

See notes to consolidated financial statements.

## 1. Nature of business and summary of significant accounting policies:

*Nature of business:*

Skelly and Loy, Inc. is primarily an environmental consulting and engineering firm providing professional services in the environmental, engineering and waste management fields. The customer base includes governmental agencies, mining companies, utilities and oil companies and private commercial and industrial facilities. Skelly and Loy, Inc.'s subsidiary AMS of Skelly and Loy, Inc. provides maintenance, operation and installation services, including wastewater systems, electrical and mechanical work. The Company's operations are primarily in Pennsylvania.

*Principles of consolidation:*

The consolidated financial statements include the accounts of Skelly and Loy, Inc. and its wholly-owned subsidiary, AMS of Skelly and Loy, Inc. (collectively the Company). All significant intercompany accounts and transactions have been eliminated in consolidation.

*Receivables:*

The Company provides credit in the normal course of business to customers and performs ongoing credit evaluation of customers' financial condition and generally only requires retainers as collateral from new customers.

Receivables are stated at the amount management expects to collect from outstanding balances. Management provides for probable uncollectible amounts through a charge to earnings and a credit to a valuation allowance based primarily on its assessment of the current status of individual accounts. Balances that are still outstanding after management has used reasonable collection efforts are written off through a charge to the valuation allowance and a credit to receivables.

*Indirect cost rate adjustments:*

The Company calculates adjustments to the indirect cost rate as described in Note 5. Adjustments to the rate affect amounts due to or from customers.

**1. Nature of business and summary of significant accounting policies (continued):**

*Revenue recognition:*

Revenue is recognized predominantly under cost-plus-fee and specific rate contracts, but also under bid rate and fixed-price contracts. Revenues from these contracts are recognized as direct labor hours and reimbursable costs are incurred. Estimated losses on contracts are recognized as they become known. Because of inherent uncertainties in estimating costs, it is at least reasonably possible that the estimates used will change within the near term.

The asset, "Accounts receivable, trade, including unbilled," represents billings as well as revenues earned in excess of amounts billed. The liability, "Advanced billings and provision for contract losses," represents billings in excess of revenues earned and any estimated contract losses.

*Property and equipment:*

Property and equipment are stated at cost less accumulated depreciation. Depreciation is computed primarily on the straight-line method over the estimated useful lives of the assets.

*Investment in captive insurance corporation:*

The Company owns stock in a captive insurance corporation which is carried at cost of $25,000 plus one year's equity of $8,192 and a collateral deposit of $103,670 in 2018. The Company maintains its workers' compensation, general liability and auto insurance with this captive insurance company. In accordance with the terms of the captive's insurance policies, the maximum annual cost is based on the Company's claims experience subject to a potential assessment and the overall claims experience of the captive for all open policy years. The Company's equity position in the captive has not been recorded and could be used to offset future claims.

*Insurance accruals:*

The Company is self-insured for certain employee health insurance claims. Liabilities associated with the risks that are retained by the Company are estimated, in part, by considering historical claims. The estimated accruals for these liabilities could be affected if future occurrences and claims differ from the Company's assumptions. To minimize potential exposure, the Company carries individual stop-loss coverage to provide reimbursement for losses over specified limits per covered individual per year, generally $90,000. As of December 31, 2018 and 2017, the accrual for these liabilities was approximately $239,000 and $175,000, respectively, and is included in other liabilities on the accompanying consolidated balance sheets.

**1. Nature of business and summary of significant accounting policies (continued):**

*Deferred rent liability:*

The Company records rent expense under its operating leases on a straight-line basis. Any excess of rent expense over amounts paid is recorded as a deferred rent liability on the accompanying consolidated balance sheets.

*Sales taxes:*

The Company reports sales tax collected on a net basis; therefore, these amounts are not included in revenues or expenses.

*Advertising:*

The Company expenses advertising as incurred. Total advertising costs were approximately $49,000 and $52,000 for the years ended December 31, 2018 and 2017, respectively.

*Income taxes:*

Skelly and Loy, Inc. is organized as a pass-through entity, and accordingly, its earnings are included in the shareholders' individual tax returns. No federal or state income tax provision is reflected in the financial statements. AMS of Skelly and Loy, Inc. has elected to be taxed as a qualified subchapter-S subsidiary, and as such, its earnings are included in the earnings of Skelly and Loy, Inc.

The Company's policy is to make periodic distributions to the shareholders in amounts sufficient to reimbursement them for estimated tax liabilities resulting from the shareholder's taxable income of the Company. Distributions in the amount of approximately $1,250,000 are expected to be made by April 2019.

*Use of estimates:*

Management uses estimates and assumptions in preparing financial statements in accordance with generally accepted accounting principles. Those estimates and assumptions affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities and the reported revenues and expenses. Actual results could differ from those estimates.

**1. Nature of business and summary of significant accounting policies (continued):**

*Use of estimates:*

Significant estimates used in preparing these financial statements include those assumed in computing the net realizable value of billed and unbilled receivables and the indirect cost rate adjustment as described in Note 5, as well as those assumed in calculating the accrual for employee health insurance claims.

*Recently issued accounting standards:*

Revenue recognition:

Financial Accounting Standards Board Accounting Standards Update (FASB ASU) 2014-09, *Revenue from Contracts and Customers* (Topic 606), with effective dates amended by FASB ASU 2015-14, is effective for the Company's December 31, 2019 year end and identifies specific steps to be applied to properly recognize revenue from customer contracts. Under the standard, revenue recognition is determined using a five-step model which identifies customer contracts, identifies performance obligations in each contract, determines transaction price, allocates transaction price to performance obligations and recognizes revenue when or as the performance obligations are satisfied. The standard permits the use of either the retrospective or cumulative effect transition method. The Company is evaluating the effect that ASU 2014-09 will have on the Company's financial statements.

Leases:

FASB ASU 2016-02, *Leases*, is effective for the Company's December 31, 2020 year end and requires that all leases with terms of more than 12 months be recognized as assets and liabilities on the balance sheet. Recognition of these lease assets and lease liabilities represents a change from previous generally accepted accounting principles (GAAP), which did not require lease assets and lease liabilities to be recognized for operating leases. Qualitative disclosures along with specific quantitative disclosures will be required to provide enough information to supplement the amounts recorded in the financial statements so that users can understand more about the nature of an entity's leasing activities.

**1. Nature of business and summary of significant accounting policies (continued):**

*Recently issued accounting standards:*

Leases:

The Company will be required to recognize and measure leases at the beginning of the earliest period presented using a modified retrospective approach, which includes a number of optional practical expedients that the Company may elect to apply. At adoption, the Company will recognize a right-of-use asset and a lease liability initially measured at the present value of its operating lease payments. The Company is currently evaluating the impacts of adopting this guidance on its financial position, results of operations and cash flows.

**2. Accounts receivable, trade:**

Accounts receivable, trade consist of the following:

| | 2018 | 2017 |
|---|---|---|
| Current: | | |
| Unbilled | $ 2,001,123 | $ 2,276,521 |
| Billed | 3,840,518 | 5,184,946 |
| Retainage | 12,627 | 14,924 |
| | 5,854,268 | 7,476,391 |
| Less allowance for doubtful accounts | 430,328 | 500,636 |
| | $ 5,423,940 | $ 6,975,755 |

Bad debt expense of approximately $77,000 and $30,000 is included in operating expenses for in 2018 and 2017, respectively.

## 3. Line of credit:

Skelly and Loy, Inc. has available a $4,000,000 working capital line of credit with a bank, bearing interest at the lesser of 2 percentage points above the bank's prime rate or 2.5 percentage points above the one-month London Interbank Offered Rate (LIBOR), with a minimum rate of 3%. There was no outstanding balance on the line of credit at December 31, 2018. The outstanding balance on the line was $820,346 at December 31, 2017, bearing interest at 5.125% at December 31, 2018. The 2018 and 2017 balance sheet amounts have been increased by $271,987 and $507,383, respectively, to reflect outstanding checks. The line of credit availability is also reduced by 50% of the outstanding principal balance on the bank term loan described in Note 4.

Substantially all of the Company's assets are pledged as collateral for this line of credit. The agreement requires that the Company maintain a minimum net worth and comply with other requirements.

## 4. Long-term debt and interest expense:

Long-term debt consists of the following at December, 31:

| | | | | 2018 | | 2017 | | |
|---|---|---|---|---|---|---|---|---|
| | | Interest rate | Monthly principal and interest payment | Current portion | Long-term portion | Current portion | Long-term portion | Maturity |
| Bank | (a) | 4.00% | $ 11,905 | $ 108,334 | $ 571,525 | $ 111,041 | $ 676,560 | 2021 |
| Finance company | (b) | 0.00% | 4,852 | 58,218 | 58,219 | 58,219 | 116,436 | 2020 |
| Finance company | (c) | 0.00% | 979 | - | - | 11,747 | - | |
| | | | | $ 166,552 | $ 629,744 | $ 181,007 | $ 792,996 | |

(a) Interest on this term loan is charged at a rate of 2.75% plus one-month LIBOR (5.125% at December 31, 2018). Substantially all of the Company's assets are pledged as collateral for this loan. The agreement requires that the Company maintain a minimum net worth and comply with other requirements.

(b) This unsecured term borrowing was used to finance a software service contract.

(c) Loan satisfied in 2018.

**4. Long-term debt and interest expense (continued):**

Principal repayments on the notes payable, based upon current interest rates, are due as follows:

| | |
|---|---|
| 2019 | $ 166,552 |
| 2020 | 172,560 |
| 2021 | 457,184 |
| | $ 796,296 |

Interest expense totaled $41,221 and $62,406 in 2018 and 2017, respectively.

**5. Indirect cost rate adjustments:**

The Company has many contracts under a cost plus fixed fee arrangement. Under this arrangement, the customer is billed the indirect labor costs using a provisional indirect cost rate. Upon the completion of an audit of the Company's indirect cost rate by the Company's customer, the customer will approve a final indirect cost rate. The Company reimburses the customer if the actual rate is lower than the provisional rate, or invoices the customer for additional revenue if the actual rate is higher than the provisional rate. The Company is awaiting the performance of several customer audits of the indirect cost rate and has accumulated a net increase in unbilled adjustments to the provisional indirect costs billed. The net adjustment to the provisional billings was a liability of approximately $576,000 and $489,000 at December 31, 2018 and 2017, respectively. The timing of billing, collection and repayment of these amounts depends on a variety of factors including timing of completion of jobs in progress, timing of the Company's billing process and timeliness of customer payments.

**6. Stock options:**

In 2015, the Company established a Stock Incentive Plan, allowing stock options to be granted to purchase up to 1,500 shares of common stock. Under this Plan, the Company granted a total of 489 nonstatutory stock options in 2015 to three executive employees. Each option permits the purchase of one share of common stock at an exercise price of $743 per share, which the Company believes approximated fair value at the grant date. Each executive's options are fully exercisable beginning on the grant date and expire at the earlier of August 19, 2025 or the termination of the executive's employment with the Company. None of the options were exercised during 2018 or 2017. Due to complexity of the awards' terms and how those terms relate to the current stock purchase price included in an existing shareholders' agreement, the Company has accounted for these options at their intrinsic value and has recorded compensation expense in the consolidated financial statements for these options. The Company recorded compensation expense of approximately $171,000 in 2017; however, no compensation expense was incurred for 2018.

**7. Stock issued and prepaid stock compensation:**

The Company granted 60 shares of stock to each of three executives. Under the terms of each agreement, one third of the shares vest annually for the release of restrictions and risk of forfeiture on their anniversary date. Vesting is dependent upon the grantees' continuous employment by the Company.

**8. Mandatorily redeemable financial instruments:**

The shareholders' agreement requires the Company to purchase the shares of each shareholder upon death, disability, normal retirement, or termination, at a price to be calculated as indicated in the agreement. Generally accepted accounting principles does not require a liability to be accrued for these mandatorily redeemable financial instruments.

**9. Business and credit concentrations:**

The Company's largest customer (Pennsylvania Department of Transportation, which includes Pennsylvania Turnpike Commission) accounted for 51% and 52% of the Company's contract revenues in 2018 and 2017, respectively, and 44% and 58% of accounts receivable at December 31, 2018 and 2017, respectively.

**10. Rent expense and leasing arrangements:**

The Company leases various facilities under operating lease agreements. The lease for its facility in Harrisburg, Pennsylvania, expires December 2029 and requires approximately $50,000 per month through December 2020, with annual 2% increases for the remainder of the lease.

The lease for its facility in Pittsburgh, Pennsylvania, required approximately $15,900 per month through September 2018, reduced to approximately $15,200 through September 2019, continuing with annual 2% increases through September 2023.

The lease for its facility in Maugansville, Maryland, requires approximately $1,000 per month through January 2021.

The lease for its storage facility in Harrisburg, Pennsylvania, requires approximately $2,500 per month through November 2021.

The lease for its facility in Morgantown, West Virginia, is a month-to-month lease requiring $2,100 per month.

**10. Rent expense and leasing arrangements (continued):**

The lease for its facility in Hunt Valley, Maryland, requires approximately $2,100 per month through September 2019, with an option to renew the lease for an additional five years. The Company is also responsible for certain operating and common area maintenance charges.

The Company is liable under various equipment operating leases.

Future minimum lease payments under all operating leases are approximately as follows:

| | Equipment | Office | Total |
|---|---|---|---|
| 2019 | $ 69,000 | $ 842,000 | $ 911,000 |
| 2020 | | 831,000 | 831,000 |
| 2021 | | 833,000 | 833,000 |
| 2022 | | 819,000 | 819,000 |
| 2023 | | 785,000 | 785,000 |
| thereafter | | 4,100,000 | 4,100,000 |
| | $ 69,000 | $ 8,210,000 | $ 8,279,000 |

Gross rental expense under all leasing arrangements totaled approximately $1,008,000 and $907,000 in 2018 and 2017, respectively.

**11. Retirement plan:**

The Company maintains a tax-deferred savings 401(k) plan. The Company's contribution was approximately $132,000 for 2018 and 2017.

**12. Subsequent events:**

The Company has evaluated subsequent events through March 21, 2019, the date which the financial statements were available to be issued.

# B. Non-Collusion Affidavit

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL
CONSULTANTS

**NONCOLLUSION AFFIDAVIT**

MCCD Project Name: Sand Spring Run Bank Restoration

State of Pennsylvania :
County of Monroe :

I state that I am the President, CEO, COO (Title) of Skelly and Loy, Inc. (Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the prices(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer, or potential proposer.

2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.

3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.

4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.

5. Skelly and Loy, Inc. (Name of Firm) its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to proposing and/or bidding on any public contract, except as follows:
N/A

I state that Skelly and Loy, Inc. (Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied upon by the Monroe County Conservation District (MCCD) in awarding the contract(s) for which this proposal is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the MCCD of the true facts relating to the submission of this proposal.

(Signature)

John W. Gunnett, P.G.
(Signatory's Printed Name)

President, CEO, COO
(Signatory's Title)

SWORN TO AND SUBSCRIBED BEFORE ME THIS 19th DAY OF September, 2019.

Amy L. Perez
Notary Public

My Commission Expires

February 20, 2023

Commonwealth of Pennsylvania - Notary Seal
Amy L. Perez, Notary Public
Dauphin County
My commission expires February 20, 2023
Commission number 1345627
Member, Pennsylvania Association of Notaries

**NONCOLLUSION AFFIDAVIT**

MCCD Project Name: Sand Spring Run Bank Restoration

State of Pennsylvania :
County of Monroe :

I state that I am the President (Title) of NTM Engineering, Inc. (Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the prices(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer, or potential proposer.

2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.

3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.

4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.

5. NTM Engineering, Inc. (Name of Firm) its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to proposing and/or bidding on any public contract, except as follows:

_____

I state that NTM Engineering, Inc. (Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied upon by the Monroe County Conservation District (MCCD) in awarding the contract(s) for which this proposal is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the MCCD of the true facts relating to the submission of this proposal.

(Signature)

Donna Newell, PE, CFM
(Signatory's Printed Name)

President
(Signatory's Title)

SWORN TO AND SUBSCRIBED BEFORE ME THIS 12 DAY OF September, 2019.

Melissa S. Yost
Notary Public

My Commission Expires
Mar. 31, 2022

Commonwealth of Pennsylvania - Notary Seal
MELISSA S YOST - Notary Public
York County
My Commission Expires Mar 31, 2022
Commission Number 1282515

**NONCOLLUSION AFFIDAVIT**

MCCD Project Name: Sand Spring Run Stream Bank Restoration Project - C990000726

State of Pennsylvania :
County of Monroe :

I state that I am the owner (Title) of Edward M. Lesny, P.E. (Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the prices(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer, or potential proposer.

2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.

3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.

4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.

5. Edward M. Lesny, P.E. (Name of Firm) its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to proposing and/or bidding on any public contract, except as follows:

_____

I state that Edward M. Lesny, P.E. (Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied upon by the Monroe County Conservation District (MCCD) in awarding the contract(s) for which this proposal is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the MCCD of the true facts relating to the submission of this proposal.

Edward M. Lesny
(Signature)

Edward M. Lesny
(Signatory's Printed Name)

Owner
(Signatory's Title)

SWORN TO AND SUBSCRIBED BEFORE ME THIS 19th DAY OF September, 2019.

Amy L. Perez
Notary Public

My Commission Expires

February 20, 2023

Commonwealth of Pennsylvania - Notary Seal
Amy L. Perez, Notary Public
Dauphin County
My commission expires February 20, 2023
Commission number 1345627
Member, Pennsylvania Association of Notaries

# C. Statement of Interest

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

449 Eisenhower Boulevard, Suite 300
Harrisburg, PA 17111-2302

E-mail: skellyloy@skellyloy.com
Internet: www.skellyloy.com

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

Phone: 717-232-0593
800-892-6532

Fax: 717-232-1799

September 20, 2019

Ms. Lori Kerrigan
Technical Supervisor
Monroe County Conservation District
8050 Running Valley Road
Stroudsburg, Pennsylvania 18360

Re: Qualifications for Professional Services
Sand Spring Run Stream Bank Restoration Project – C990000726
PA Game Lands 38, Jackson and Pocono Townships, Monroe County, PA; Statement of Interest

Dear Ms. Kerrigan:

Skelly and Loy, Inc. is pleased to submit this statement of interest to Monroe County Conservation District (MCCD) to provide professional services for the Sand Spring Run Stream Bank Restoration Project in Jackson and Pocono Townships, Monroe County, Pennsylvania. Skelly and Loy acknowledges receipt of Addendum #1, dated September 11, 2019 and Addendum #2, dated September 18, 2019.

The budget and description of the scope of services for this project (Design and Permitting) included herein correlates to a range of estimated costs based on certain suggestions, recommendations, and assumptions which are outlined in the attached Submission Requirements F and G.

It is our understanding that after qualified bidders are selected and interviewed, the MCCD Subcommittee and Board of Directors will select a qualified bidder to commence contract negotiation for the scope of services described herein. Based on this we have tailored our cost estimate and corresponding scope to best fit this type of follow-on determination.

Skelly and Loy appreciates the opportunity to work with you to restore Sand Spring Run, a critical headwater stream within the Pocono and Brodhead Creek Watershed. Please contact me if you have any questions concerning this project at 717-232-0593 or mlower@skellyloy.com.

Sincerely yours,

SKELLY and LOY, Inc.

Michael E. Lower, P.E.
Assistant Vice President of Engineering

Enclosures
cc: Calvin Bush
Rebekah Hartt
GWL/R19-0469.P00
File: 5C Statement of Interest (MEL 2019-09-19).docx

# D. Resumes

***Resume Outlining the Respondent's Experience***

Skelly and Loy's corporate experience in the stream restoration field has been a specialization of the firm since its founding in 1969. In the mid 1990's, the Environmental Engineering Service Group was formed within the organization with the specific purpose of developing these services as highly specialized and technically advanced focus market areas. Since that time, the Environmental Engineering Service Group has provided engineering design, permitting, construction oversight and related engineering services in this area to a broad range of clients from the private sector through the county and other local municipal levels on up through state and federal levels. In this time period, Skelly and Loy has gained experience on more than 200 projects specifically related to stream restoration. Specific experience within these areas has included watershed assessment, stream channel classification, stability, ecological function and value and restoration prioritization, geomorphic regional curve development, floodplain modeling, stormwater retrofitting, design of Best Management Practices, permitting, construction bidding, construction management and post-construction monitoring. Skelly and Loy's corporate staff includes other highly experienced individuals in other related technical discipline areas (e.g., wetland delineation, historic and archaeological resources, threatened or endangered species, hydrogeology, and other capabilities) that are often times required in the course of completing these projects.

**Stream Restoration Approach**

Skelly and Loy's approach to the assessment, design, restoration and enhancement of streams using natural stream channel techniques is based on applying principles of fluvial geomorphology (FGM) to restore natural stability to a stream system. Various levels of FGM principles have been successfully applied to both rural and urban environments. By incorporating these principles in project designs, Skelly and Loy's projects have realized the benefits of maximizing channel stability while maintaining natural sediment transport, reduced destructive flooding potential, reduced property loss and damage, enhanced fish and wildlife habitat, and improved stream stability. Using this approach, Skelly and Loy continues to build an enviable portfolio of successfully completed natural stream channel design projects.

**Local, State, and Federal Permitting Expertise**

Skelly and Loy is routinely involved in coordinating with local, state and federal regulatory permitting agencies associated with stream restoration activities, to include general construction permitting requirements. Local permitting typically is at the county level with associated Conservation Districts that handle Erosion and Sediment Pollution Control Plan and Post-Construction Stormwater Management Plan review. In most cases, projects have required coordination at the local municipality level, and is an integral part of the overall Joint Permit requirements. Federal permitting typically is coordinated primarily with the U. S. Army Corps of Engineers and Pennsylvania Department of Environmental Protection as related to both the Section 401 and 404 requirements with additional permit review comments from the PA Fish and Boat Commission, US Fish and Wildlife Service, and other state and federal agencies as required. State permitting efforts have included agencies charged with waterway protection and stream encroachments as well as agencies associated with related issues inclusive of historic/archaeological resources, threatened or endangered species, and erosion control plans (oftentimes also involving county-level governmental entities). Skelly and Loy has successfully completed all levels of permitting efforts on all designed and constructed projects.

**Key Staff**

Skelly and Loy has assembled a team of experienced, licensed professionals to design this project. The staff list and their resumes follow in this section.

**SKELLY and LOY, Inc.**

| Key Staff Name | Title | Project Role |
|---|---|---|
| Michael Lower, P.E. | Assistant Vice President of Engineering | Project Manager/Project Engineer |
| Gerald Longenecker, P.E. | Executive Vice President, Engineering | QA/QC; Principal-in-Charge |
| Todd Moses | Senior Geomorphologist | Design Specialist |
| Calvin Bush, II, E.I.T. | Water Resources Engineer | Design Engineer |
| Jared Mummert, E.I.T. | Water Resources Engineer | Design Engineer; FGM Survey |
| Daniel Aungst, P.E. | Vice President of AMS of Skelly and Loy, Inc. | Cost Estimating |
| Paul DeAngelo | Associate/Vice President of Environmental Services | Permitting |

**NTM Engineering, Inc.**

| Key Staff Name | Title | Project Role |
|---|---|---|
| Paul DeBarry, P.E., P.H., GISP, D.WRE | Director of Geospatial Technologies and Watershed Management | Project Manager, Technical QA/QC |
| Rachel Tereska, P.E. | Principal, H&H and Permitting Division | Principal-in-Charge, QA/QC |
| Bethany Kavulich, P.E. | Engineer | H&H Modeling |
| Francisco Aguirre, P.E. | Engineer | H&H Modeling |
| Kevin Kozain, P.E. | Engineer | E&S Design |

| Key Staff Name | Title | Project Role |
|---|---|---|
| Edward Lesny, P.E. | Consulting Geotechnical Engineer | Geotechnical Engineer |

# MICHAEL E. LOWER, P.E., Assistant Vice President of Engineering

**EDUCATION:**
B.S., Chemical Engineering, 1996, The Pennsylvania State University

**PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS:**
Professional Engineer, PA (#PE071798), MD

**RELEVANT TRAINING:**
Rosgen Level I, “Applied Fluvial Geomorphology” short course, Wildland Hydrology, Pagosa Springs, Colorado, February 2003

Rosgen Level II, “River Morphology and Applications” short course, Wildland Hydrology, Pagosa Springs, Colorado, August 2003

Rosgen Level III, "River Assessment and Monitoring", Lubrecht Forest, August 2004

Rosgen Level IV, “River Restoration and Natural Channel Design”, Elkin, North Carolina, April 2005

“Design and Construction of Coastal Plains Outfalls” Workshop, Millersville, Maryland, sponsored by Anne Arundel County Department of Public Works, February 2007

**YEARS OF EXPERIENCE:**
23 Years

**Natural Stream Channel Design** - For natural stream channel design projects, Mr. Lower completes the required design calculations, contributes to the engineering design report, and develops construction drawings and specifications. In accordance with the 40-step design methodology as presented in “Applied River Morphology” by David Rosgen (1996), Mr. Lower routinely applies natural channel formation principles to provide a stable stream channel, adequate stormwater routing, and improved aquatic habitat. Mr. Lower's designs focus on the restoration of competent stream channels that are able to safely transport naturally occurring sediment loads while minimizing local in-stream bank and channel erosion. Mr. Lower is adept with the most up-to-date engineering and hydrology/hydraulics software programs such as AutoCAD, HEC-RAS, HEC-HMS, WinTR-55, SSA, HY-8, Ohio DNR STREAM Modules (Mecklenburg spreadsheets), and Microsoft Office products. Mr. Lower also has extensive experience in construction inspection and has provided construction oversight on most of the projects he has designed.

## PROJECT EXPERIENCE

**First Hollow Run Stream Restoration Design and Construction Oversight, Carbon County, Pennsylvania** - To design the restoration and stabilization of this very high-gradient Exceptional Value stream channel confined within a 25-foot deep ravine, Mr. Lower and the design team used an innovative step-pool approach that incorporates keystone step structures. This project design led to Mr. Lower being a co-author of a paper entitled Natural Channel Design of Step-Pool Watercourses Using the “Keystone” Concept.

**Slaughterhouse Creek Restoration Project, Carbon County, Pennsylvania** - For this severely eroded section of Slaughterhouse Creek in Jim Thorpe Borough, Mr. Lower and the design team prepared a stream restoration design based upon natural channel design principles. Nearly 550 LF of high-gradient channel was actively and continually eroding following each new storm runoff event. To stave off further erosion and sediment supply to downstream waters, a step-pool stream channel with 25 rock weir structures was designed and built to create a naturalistic series of steps, pools, and riffles. Mr. Lower and the Skelly and Loy team provided engineering and environmental consulting services from concept design through final design, bidding, and construction management.

**Paradise Creek Stream Restoration, Monroe County, Pennsylvania** - Mr. Lower serves as the design engineer for this nearly 2,100 linear foot stream restoration project on Paradise Creek at Red Rock Road. Due to its location within the formerly glaciated region of Pennsylvania, Paradise Creek exhibits a high degree of bedload and is subject to extremely high bank erosion rates due to the glacial soils. The project incorporates in-stream structures to realign the stream to a township bridge structure.

**Corey Creek Multiphased Stream Restoration, Tioga County, Pennsylvania** - To prevent further erosion and avulsion on this segment of a trout fishery in Tioga County, Mr. Lower used natural channel design principles to design a total stream reconstruction project that moved the stream away from erosion points and provide in-stream habitat. Glacial soils necessitated heavy in-stream structure considerations to provide lasting stream stability.

**Mehoopany Creek, Windy Valley Section Stream Restoration, Wyoming County, Pennsylvania** - This project is located within the glaciated terrain region of the NE United States in the Upper Susquehanna River Basin. Project reach length is approximately 5,000 linear feet, incorporated a combination of a

number of natural stream channel design techniques. These techniques involved the use of cross-rock vanes, flood plain sills, rock barbs, boulder bank revetment, channel plugs and historical stream channel reconstruction in order to restore stability to the project stream reach. Mr. Lower served as project engineer for this design and construction inspector during the construction phase of this project.

**North Branch Mehoopany Creek Stream Restoration, Wyoming County, Pennsylvania** - This project entailed completing detailed HEC-RAS modeling analysis of a bridge opening to confirm hydraulic capacity and flood elevations and solve a sediment transport problem. In serving as project engineer for this project, the design for the project include a retrofitted "W" weir rock structure upstream of the bridge which serves to split higher velocity flows around the existing center bridge pier and evenly between the two openings.

**Ellen Run Stream Restoration, Mansfield, Pennsylvania** - Skelly and Loy developed a natural stream channel design, based on geomorphic principles, for this 1,000 foot section of a tributary to the Tioga River. This project is located within the glaciated regions of the Northern Tier and incorporated a combination of in-stream cross rock vanes, reconstruction of channel geometry and bank stabilization using stacked boulder bank revetment. Mr. Lower served as project engineer for this design.

**St. Mary's Villa Dam Removal and Stream Restoration, Upper Dublin Township, Montgomery County, Pennsylvania** - Mr. Lower designed the breach of the existing dam and the stream restoration through the prior impoundment. He also served as the engineer of record for the wetland habitat mitigation feature to meet United States Army Corps of Engineers' permitting requirements and for the Conditional Letter of Map Revision (CLOMR) that was secured from the Federal Emergency Management Agency (FEMA).

**Valley Green Road Stream Channel Stabilization, Philadelphia, Pennsylvania** - Over a half century of piped stormwater discharge exacted its toll on a small unnamed tributary to the Wissahickon Creek. Located within the picturesque Wissahickon Valley Park (part of the celebrated and world renowned Fairmount Park system), extreme erosion was threatening to undermine a heavily used parking area auxiliary to the Valley Green Inn. Mr. Lower and the Skelly and Loy team designed and constructed a step-pool stream channel that stabilized the creek and allowed for restoration of the parking lot. Teaming efforts with Philadelphia Water Department and Friends of the Wissahickon were instrumental to the success of the project.

**Neill Drive Pumping Station Stream Restoration and Infrastructure Protection, Philadelphia, Pennsylvania** - Mr. Lower serves as the engineer of record for this stream restoration and sewer/water protection project along 2,000+ feet of a severely impacted and eroded Schuylkill River tributary. Stream gradients range from a moderate 3% to a severe 11%, requiring specialized step-pool channel architecture. Fluvial geomorphic survey and measurements, hydrologic (HEC-HMS) and hydraulic (HEC-RAS) analyses, geotechnical investigations, wetland delineations, landowner/stakeholder (PPR) meetings, concept and final design, and permitting are within the scope.

**Nesquehoning Creek Levee Stabilization and Stream Improvement, Carbon County, Pennsylvania** - Mr. Lower served as the engineer of record for this nearly 1,000 LF project along Nesquehoning Creek. Past land use practices relocated the main channel of Nesquehoning Creek behind an earthen levee along the side of the valley. Ongoing erosion of this levee has been exacerbating downstream flooding problems due to excessive bedload deposition in the channel. Implementation of this project will rebuild the earthen levee in a more stable configuration further landward to stabilize the streambanks and rebalance sediment transport functions.

**White Deer Creek Stream Restoration, Union County, Pennsylvania** - This challenging project, short in length but long on infrastructure, involved the stabilization of White Deer Creek (designated a High Quality Cold Water Fishery). This project was constrained by two PennDOT bridges, a township bridge, an unused railroad bridge slated for rebuilding, a streamside community park, private property owners, utility lines and roads. The outcome of the natural channel design hinged on the complex hydraulic analysis within the floodplain of the West Branch of the Susquehanna River.

**Bentley Creek, Tioga County, Pennsylvania** - To stabilize this rapidly evolving stream system, Mr. Lower and the design team have employed a wide array of bank treatments and bioengineering techniques along with highly concentrated sections of natural channel reconstruction. This mitigation project for PennDOT reduced the rate of erosion within the project limits, reduced the sediment load to the Tioga River and promoted sediment transport through a portion of Bentley Creek which is periodically maintained by the local municipality.

# GERALD W. LONGENECKER, P.E., Executive Vice President of Engineering, QA/QC and Project Liaison

**EDUCATION:**
M.S., Agricultural Engineering, 1980, The Pennsylvania State University

B.S., Agricultural Engineering, 1979, The Pennsylvania State University

**PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS:**
Professional Engineer, PA (#PE034357E), WV, MD, NJ, DE, TN, NC, NM

**RELEVANT TRAINING:**
Rosgen Level I, "River and Stream Classification/Fluvial Geomorphology Stream Restoration" Short Course, Dave Rosgen, Professional Hydrologist, 1996

Rosgen Level II, "River Morphology and Applications" Short Course, Dave Rosgen, Professional Hydrologist, Pagosa Springs, Colorado, 1997

Rosgen Level III, "River Assessment and Monitoring" Short Course, Dave Rosgen, Professional Hydrologist, Pagosa Springs, Colorado, 1997

Rosgen Level IV, "River Restoration and Natural Channel Design" Short Course, Dave Rosgen, Professional Hydrologist, Pagosa Springs, Colorado, 1997

**YEARS OF EXPERIENCE:**
38 Years

A licensed Professional Engineer, Mr. Longenecker has 38 years experience dealing with the regulatory approval process in the environmental consulting field. This experience has been gained through the management and technical participation in a broad range of projects including stream restoration, watershed assessments, stormwater management, solid waste handling, industrial and sanitary wastewater treatment, dam safety, water resources engineering, and wetland-related evaluations. As Executive Vice President of the firm, Mr. Longenecker directs all Corporate Engineering Services.

## PROFESSIONAL EXPERIENCE

**Natural Stream Restoration** - Completed approximately 100 projects using fluvial geomorphology (FGM) methodologies and natural stable channel techniques for stream restoration and relocation. Stream designs have incorporated pools, runs, and riffles into the stream bottom to enhance aquatic life and dissipate energy. Stabilization designs have included cross rock weirs, rock vanes and restoration techniques consisting of streambank grading, fencing, and establishment of riparian buffer zones. Directed the classification of miles of stream using FGM to identify locations for stabilization and restoration. Provided training sessions to introduce Department of Transportation (DOT) personnel to FGM principles in both Pennsylvania and New York. Served as Project Manager for mitigation projects throughout the Northeast and MidAtlantic states.

## PROJECT EXPERIENCE

**South Branch Mehoopany Creek, Windy Valley Section Stream Restoration, Wyoming County, Pennsylvania** - This project is located within the glaciated terrain region of the NE United States in the Upper Susquehanna River Basin. Project reach length is approximately 5,000 linear feet, incorporated a combination of a number of natural stream channel design techniques. These techniques involved the use of cross-rock vanes, flood plain sills, rock barbs, boulder bank revetment, channel plugs and historical stream channel reconstruction in order to restore stability to the project stream reach. Mr. Longenecker served as project manager, lead engineer and construction inspector for this project.

**North Branch Mehoopany Creek Stream Restoration, Wyoming County, Pennsylvania** - The overall project included the restoration of more than 3,800 linear feet of actively eroding and unstable stream channel. The design included the relocation for a stream reach approximately 1,165 linear feet in length and restoration of the stream channel in its original location for an additional 2,695 feet. The reach is just north of State Route 87 and northwest of the town of Forkston, Pennsylvania, just upstream of the confluence with the main stem of Mehoopany Creek. The goal of this project was to make this a more stable C4 type stream, according to the Rosgen Classification of Natural Rivers. Mr. Longenecker served as project manager, lead engineer and construction inspector for this project.

**First Hollow Run Stream Restoration Design and Construction Oversight, Carbon County, Pennsylvania** - To design the restoration and stabilization of this very high gradient Exceptional Value stream channel confined within a 25-foot deep ravine, Mr. Longenecker and the design team used an innovative step-pool approach that incorporates keystone step structures. The project was constructed in two phases and the entire project site was heavily planted with native trees and shrubs following completion of the channel restoration work. The project was completed in 2007.

# GERALD W. LONGENECKER, P.E., Executive Vice President of Engineering, QA/QC and Project Liaison

**Valley Green Road Stream Channel Stabilization, Philadelphia, Pennsylvania** - Over a half century of piped stormwater discharge exacted its toll on a small unnamed tributary to the Wissahickon Creek. Located within the picturesque Wissahickon Valley Park (part of the celebrated and world renowned Fairmount Park system), extreme erosion was threatening to undermine a heavily used parking area auxiliary to the Valley Green Inn. Mr. Longenecker and the Skelly and Loy team designed and constructed a step-pool stream channel that stabilized the creek and allowed for restoration of the parking lot. Teaming efforts with Philadelphia Water Department and Friends of the Wissahickon were instrumental to the success of this design-build project. Mr. Longenecker provided management and oversight during the construction phase, which was completed in Fall 2013.

**Ellen Run Stream Restoration, Mansfield, Pennsylvania** - Skelly and Loy developed a natural stream channel design, based on geomorphic principles, for this 1,000 foot section of a tributary to the Tioga River. This project is located within the glaciated regions of the Northern Tier and incorporated a combination of in-stream cross rock vanes, reconstruction of channel geometry and bank stabilization using stacked boulder bank revetment. Mr. Longenecker served as project manager and lead engineer for this project.

**Corey Creek Multiphased Stream Restoration, Tioga County, Pennsylvania** - Corey Creek is a tributary to the Tioga River in Pennsylvania's Northern Tier Region, an area where surficial geology and geomorphic characteristics reflect both past glacial episodes and past land use practices. Restoration activities within this watershed were designed and implemented in a phased approach as grant funding became available. Natural stream restoration techniques where used to provide increased stream channel stability and viable habitat for naturally reproducing indigenous trout species. Mr. Longenecker served as project manager, lead engineer and construction inspector for this project.

**Slaughterhouse Creek Restoration Project, Carbon County, Pennsylvania** - For this severely eroded section of Slaughterhouse Creek in Jim Thorpe Borough, Skelly and Loy prepared a stream restoration design based upon natural channel design principles. Nearly 550 linear feet of high gradient channel was actively and continually eroding following each new storm runoff event. To stave off further erosion and sediment supply to downstream waters, a step-pool stream channel with 25 rock weir structures was designed and built to create a naturalistic series of steps, pools, and riffles. Mr. Longenecker and the Skelly and Loy team provided engineering and environmental consulting services from concept design, through final design, bidding, and construction management. Construction was completed in 2011.

**Nesquehoning Creek Levee Stabilization and Stream Improvement, Carbon County, Pennsylvania** - Mr. Longenecker served as Project Manager for this nearly 1,000-linear-foot project along Nesquehoning Creek. Past land use practices relocated the main channel of Nesquehoning Creek behind an earthen levee along the side of the valley. Ongoing erosion of this levee has been exacerbating downstream flooding problems due to excessive bedload deposition in the channel. Implementation of this project will rebuild the earthen levee in a more stable configuration further landward to stabilize the streambanks and rebalance sediment transport functions.

**Neill Drive Pumping Station Stream Restoration and Infrastructure Protection, Philadelphia, Pennsylvania** - Mr. Longenecker serves as principal-in-charge and QA/QC reviewer for this stream restoration and sewer/water protection project along 2,000+ feet of a severely impacted and eroded Schuylkill River tributary. Stream gradients range from a moderate 3% to a severe 11%, requiring specialized step-pool channel architecture. Fluvial geomorphic survey and measurements, hydrologic (HEC-HMS) and hydraulic (HEC-RAS) analyses, geotechnical investigations, wetland delineations, landowner/stakeholder (PPR) meetings, concept and final design, and permitting are within the scope.

# TODD A. MOSES, Geomorphologist/Senior Restoration Specialist

**EDUCATION:**
M.A., Physical Geography/ Geomorphology, 1982, University of Colorado

B.A., Geography/Natural Resources, 1978, California State University at San Francisco

**YEARS OF EXPERIENCE:**
37 Years

Mr. Moses brings multifaceted training and long experience to environmental management and conservation projects. In addition to expertise in natural resources assessment, site and regional conservation planning, and ecological restoration, his 26 years of hands on environmental construction experience that has proven invaluable to the development of practical (constructible) designs that consistently meet project goals. A key professional focus encompasses environmental improvements in intensively altered suburban and urban landscapes. Interventions in such settings emphasize 1) methods for attractively and reliably stabilizing and renaturalizing developed area watercourses and hillsides and 2) infiltration-based green stormwater infrastructure (GSI) approaches to stormwater management (SWM). Mr. Moses has worked for both public and private clients in Pennsylvania, Maryland, New York, North Carolina, West Virginia, Oregon, Washington, Colorado, Idaho, and Alaska.

**Stream Corridor Restoration** - Mr. Moses has been instrumental in the design, permitting and construction of well over 250 stream corridor rehabilitation and stabilization projects since commencing this work (as a designer) with the restoration of the downtown reach of Boulder Creek in Boulder, Colorado, in 1986 (one of the first urban stream restoration projects in this country). Consistent with the Natural Stream Channel Design approach, all work was informed by fluvial geomorphic principles and the existing cultural and geomorphic circumstances of the watershed. Project types include incised channel restoration (especially floodplain recoupling), step-pool channel reconstruction, channel daylighting, fish-passage restoration at road-stream crossings and structural in-stream habitat improvement. Field supervision of construction has been provided for all project types. Working on both the eastern seaboard and in the western U.S., most of his projects have required coping with the water and sediment flows and erosive conditions associated with constrained urban environments. As such, developing and applying attractive but robust environmental stabilization practices along stormwater-impacted urban stream corridors, especially within parks and other public open spaces, is a particular specialty. Utilizing detailed knowledge of vegetation/soil interactions, Mr. Moses also specializes in biogeomorphically based planting plans for riparian zone revegetation tailored to site setting. He has presented and published on stream corridor restoration and biotechnical slope stabilization in conference proceedings, trade magazines and peer-reviewed journals and has conducted professional training workshops on these topics in both Pennsylvania and the western U.S.

## PROJECT EXPERIENCE

**Paradise Creek Watershed and Stream Corridor Prioritization Assessment, Monroe County, Pennsylvania -** Mr. Moses completed the watershed assessment for this rapidly growing area at the urban/rural interface in the Pocono Mountains. He identified and prioritized degraded stream corridor sites and provided site-specific environmental rehabilitation prescriptions. He provided a detailed discussion of selected watershed and SWM BMPs appropriate for maintaining water quality and quantity in this area of rapid rural sprawl. The project was completed in February 2012.

**Ellen Run Stream Restoration, Mansfield, Pennsylvania** - Skelly and Loy developed a natural stream channel design, based on geomorphic principles, for this 1,000 foot section of a tributary to the Tioga River. This project is located within the glaciated regions of the Northern Tier and incorporated a combination of in-stream cross rock vanes, reconstruction of channel geometry and bank stabilization using stacked boulder bank revetment. Mr. Moses served as design specialist and fluvial geomorphologist for this project.

# TODD A. MOSES, Geomorphologist/Senior Restoration Specialist

**North Branch Mehoopany Creek Stream Restoration, Wyoming County, Pennsylvania** - The overall project included the restoration of more than 3,800 linear feet of actively eroding and unstable stream channel. The design included the relocation for a stream reach approximately 1,165 linear feet in length and restoration of the stream channel in its original location for an additional 2,695 feet. The reach is just north of State Route 87 and northwest of the town of Forkston, Pennsylvania, just upstream of the confluence with the main stem of Mehoopany Creek. The goal of this project was to make this a more stable C4 type stream, according to the Rosgen Classification of Natural Rivers. Mr. Moses served as design specialist and fluvial geomorphologist and construction inspector during the construction phase of this project.

**Corey Creek Multiphased Stream Restoration, Tioga County, Pennsylvania** - Corey Creek is a tributary to the Tioga River in Pennsylvania's Northern Tier Region, an area where surficial geology and geomorphic characteristics reflect both past glacial episodes and past land use practices. Restoration activities within this watershed were designed and implemented in a phased approach as grant funding became available. Natural stream restoration techniques where used to provide increased stream channel stability and viable habitat for naturally reproducing indigenous trout species. Mr. Moses served as design specialist and fluvial geomorphologist and construction inspector during the construction phase of this project.

**South Branch Mehoopany Creek, Windy Valley Section Stream Restoration, Wyoming County, Pennsylvania** - This project is located within the glaciated terrain region of the NE United States in the Upper Susquehanna River Basin. Project reach length is approximately 5,000 linear feet, incorporated a combination of a number of natural stream channel design techniques. These techniques involved the use of cross-rock vanes, flood plain sills, rock barbs, boulder bank revetment, channel plugs and historical stream channel reconstruction in order to restore stability to the project stream reach. Mr. Moses served as design specialist and fluvial geomorphologist and construction inspector during the construction phase of this project.

**Slaughterhouse Creek Restoration Project, Carbon County, Pennsylvania** - A naturalistic step-pool channel was designed to replace the steep, stormwater-incised reach of this headwater stream in Jim Thorpe Borough. Mr. Moses was a key member of this design team, which produced a plan incorporating a total of 25 naturalistic (keystone) rock weir grade control structures within 550 feet of channel. Mr. Moses developed the initial concept design and assisted with final design, bidding and construction management.

**Nesquehoning Creek Levee Stabilization and Stream Improvement, Carbon County, Pennsylvania** - Mr. Moses led the initial project team selecting the first phase (highest priority) project site on this very long degraded stream. More than a mile of the stream was historically relocated and confined along one bank with an earthen levee. Ongoing erosion of this levee (along with the levee itself) has been exacerbating downstream flooding problems by causing bedload deposition in the channel. Implementation of the designed project (~1000 feet of stream) will rebuild the earthen levee in a more stable and natural configuration. Mr. Moses provided design details for instream and riparian habitat improvements.

**Valley Green Road Stream Channel Stabilization, Philadelphia, Pennsylvania** - Over a half century of piped stormwater discharge exacted its toll on a small unnamed tributary to the Wissahickon Creek. Located within the picturesque Wissahickon Valley Park (part of the celebrated and world renowned Fairmount Park system), extreme erosion was threatening to undermine a heavily used parking area auxiliary to the Valley Green Inn. Mr. Moses assisted the team to design and construct a step-pool stream channel that stabilized the creek and allowed for restoration of the parking lot. Teaming efforts with Philadelphia Water Department and Friends of the Wissahickon were instrumental to the success of the project.

**Philadelphia Water Department (PWD), Philadelphia, Pennsylvania** - Key stream-related tasks performed by Mr. Moses for the PWD over the last 13 years have included problem site assessments related to utility and stream interactions (and GSI opportunities) at more than 70 sites within the City. These detailed evaluations address (1) existing conditions and restoration opportunities and constraints; (2) apparent future risk; (3) project prioritization; and (4) suggested concept-level stabilization approach. He also assisted the engineer of record in numerous PWD stream restoration designs intended to protect threatened sewer and water infrastructure (these include many of the sites first identified in his assessments). Mr. Moses has been Skelly and Loy's principal liaison with the Watershed Restoration Team (WRT), providing on-the-ground construction assistance to PWD's Waterways Conveyance Supervisors on construction projects undertaken specifically by the WRT. Working throughout the City, the WRT tackles smaller restoration jobs involving stream and gully erosion around PWD infrastructure at imminent risk of failure. The Skelly and Loy team provides permitting and design services, and Mr. Moses provides construction assistance and oversight for these projects. This work with the WRT commenced in 2005 with reconstruction of a segment of Wise's Mill Run within Wissahickon Valley Park.

# CALVIN F. BUSH, II, E.I.T., Water Resources Engineer

**EDUCATION:**
B.S., Civil Engineering, 2014, Rose-Hulman Institute of Technology

United States Army Chemical School, Ft Leonard Wood, MO (Graduated Commandant's List December 2010)

United States Army Military Intelligence School, Fort Huachuca, AZ (Graduated March 2007)

**PROFESSION REGISTRATION AND CERTIFICATIONS:**
Engineer-in-Training, PA (#ET021877)

**RELEVANT TRAINING:**
Rosgen Level 1, Applied Fluvial Geomorphology

Rosgen Level 2, River Morphology and Applications

Rosgen Level 3, River Assessment and Monitoring

Rosgen Level 4, River Restoration and Natural Channel Design

PennDOT H&H and Permitting Procedures

PennDOT Stormwater Control Measures (SCM) Visual Inspections

PennDOT SCM Conditions Assessment Inspections

**YEARS OF EXPERIENCE:**
14 Years

A certified Engineer-In-Training, Mr. Bush has 13 years of professional experience. This experience includes technical participation in a broad range of projects including stormwater management, stream restoration, fluvial geomorphology surveying, construction monitoring, water resources engineering, and a variety of military operations and assignments.

## PROFESSIONAL EXPERIENCE

**Stream Restoration Projects** - Mr. Bush has been actively involved in numerous stream restoration projects. He participates in many levels of the projects, from initial site assessments and fluvial geomorphological surveying to design and permitting completion. Mr. Bush is adept with the most up-to-date engineering and hydrology/hydraulics software programs such as AutoCAD, HEC-RAS, HEC-HMS, and HY-8.

**Hydrologic and Hydraulic Engineering** - Mr. Bush provided technical assistance with the design and permitting of numerous projects with Skelly and Loy, Inc. Projects included, but are not limited to, wetland drainage analysis, stormwater management facility designs, scour protection assessments and hydraulic analyses of stream restoration projects. Mr. Bush has utilized both traditional calculations and software, such as HEC-RAS, HY-8, HEC-HMS and AutoCAD extensions, in order to complete engineering reports and provide assistance to project engineers.

**Erosion and Sediment Pollution Control Design** - As an employee of Skelly and Loy, Inc., Mr. Bush regularly prepares compliant erosion and sediment pollution control plans for projects in a wide range of complexity. Past and current projects include stream restorations and relocations, green stormwater infrastructure retrofits, and sediment abatement projects.

## PROJECT EXPERIENCE

**St. Mary's Villa Dam Removal and Stream Restoration, Upper Dublin Township, Montgomery County, Pennsylvania** - Mr. Bush assisted with the hydraulic analysis for a dam removal and stream restoration project on Honey Run in Upper Dublin Township. He also assisted in completion of the HEC-RAS modeling consisting of replication of the FEMA detailed model and construction of existing and proposed conditions models. Floodway analyses were also included. The resultant 100-year floodplain and floodway extents were mapped and provided to FEMA for the CLOMR submission.

**Neill Drive Pumping Station Stream Restoration and Infrastructure Protection, Philadelphia, Pennsylvania** - Mr. Bush serves as the design engineer for this stream restoration and sewer/water protection project along 2,000+ feet of a severely impacted and eroded Schuylkill River tributary. Stream gradients range from a moderate 3% to a severe

11%, requiring specialized step-pool channel architecture. Fluvial geomorphic survey and measurements, hydrologic (HEC-HMS) and hydraulic (HEC-RAS) analyses, geotechnical investigations, wetland delineations, landowner/stakeholder (PPR) meetings, concept and final design, and permitting are within the scope.

**Mehoopany Creek Rogers Hollow Stream Restoration, Wyoming County, Pennsylvania** - A section of Mehoopany Creek is targeted for restoration efforts of the stream channel and adjacent floodplain. Mr. Bush completed natural fluvial geomorphic restoration design of a section of realigned channel and adjacent floodplain. The design included natural boulder bank revetments and truncated rock vanes. Mr. Bush utilized HEC-RAS for analysis of existing and post-construction flood elevations. This project will provide a restored floodway and natural channel to maintain stream corridor alignment without negatively impacting adjacent landowners.

**Interstate 83 Mill Creek Stream Restoration, York County, Pennsylvania** - This project involves the realignment and restoration of Mill Creek within PennDOT's project area for Interstate 83 Exit 18 Interchange construction. Mr. Bush performed construction observation of the stream restoration portion of the project to ensure the stream mitigation portion is constructed in accordance with the plans and specifications. Mr. Bush performed mid-construction surveys of the stream restoration project using global positioning system survey equipment to ensure stream and protection features were constructed to the designed elevation and alignment.

**Stream Restoration and Floodplain Expansion, Philadelphia, Pennsylvania** - This project involved the daylighting and realignment of a section of Walton Run, a Tributary to Byberry Creek, which was causing localized flooding of area commercial enterprises. Mr. Bush utilized HEC-RAS 5.0.3 modeling software for a detailed two-dimensional floodplain analysis of existing and post-construction conditions for the project as well as HEC-HMS to analyze the hydrology of the project location. Mr. Bush designed the grading of the daylighted channel and the floodplain expansion basin for this project.

**TMDL Outfall Restoration, Baltimore, Maryland** - The purpose of this project is to restore and improve existing stormwater outfalls to meet Maryland State Highway Association objective's to improve water quality treatment based on the state's required sediment/nutrient reduction and impervious area treatment goals. Mr. Bush is aiding in the design and analysis of stormwater conveyance systems, including pipe and drop structure sizing and placement.

**Paxtang Parkway Watershed Restoration, Dauphin County, Pennsylvania** - An unnamed tributary of Spring Creek was encroaching into the embankment of several sites along the Paxtang Parkway, part of the Capital Area Greenbelt system. Mr. Bush analyzed geomorphic data of the separate sites and utilized this information in a natural stream channel design for the affected areas. Design work included the restoration of a stormwater conveyance channel, which required hydrologic and hydraulic analysis of contributing stormwater system and scour pool analysis and design. The restoration efforts will provide a more stable channel while eliminating erosion of the embankments along the parkway.

# JARED D. MUMMERT, E.I.T., Water Resources Engineer

**EDUCATION:**
B.S., Environmental Systems Engineering, 2017, The Pennsylvania State University

**PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS:**
Engineer-In-Training, PA (#????)

**RELEVANT TRAINING:**
PennDOT Stormwater Control Measures Condition Assessment Inspection

PennDOT Stormwater Control Measures Visual Screening Inspection

PennDOT Highway Drainage Design

**YEARS OF EXPERIENCE:**
2 Years

As a certified Engineer-In-Training, Mr. Mummert serves as a Water Resources Engineer for the Environmental Engineering Service Group. He has two years of experience in the engineering design and consulting field. His experience includes technical participation in a broad range of projects including stream restoration, water resources engineering, green stormwater infrastructure, fluvial geomorphological surveying, topographic surveying, and erosion and sediment pollution control design.

## PROFESSIONAL EXPERIENCE

**Stream Restoration Projects** - Mr. Mummert has been actively involved in several stream restoration projects that utilize the Rosgen Natural Channel Design method. He assists with many levels of the projects including; fluvial geomorphological surveying, data reduction, design, and post-construction monitoring.

**Erosion and Sediment Pollution Control Design** - Mr. Mummert has designed and completed multiple erosion and sediment pollution control plans. These designs utilized the Pennsylvania Department of Environmental Protection's best management practices manual and have been included in permit applications.

**Green Stormwater Infrastructure** - Mr. Mummert has designed several green stormwater infrastructure systems. These systems, including pervious pavement and tree-trenches, seek to incorporate stormwater management within urban environments via subsurface infiltration and controlled release.

## PROJECT EXPERIENCE

**Neill Drive Pumping Station Stream Restoration and Infrastructure Protection, Philadelphia, Pennsylvania** - Mr. Mummert serves as the design engineer for this stream restoration and sewer/water protection project along 2,000+ feet of a severely impacted and eroded Schuylkill River tributary. Stream gradients range from a moderate 3% to a severe 11%, requiring specialized step-pool channel architecture. Fluvial geomorphic survey and measurements, hydrologic (HEC-HMS) and hydraulic (HEC-RAS) analyses, geotechnical investigations, wetland delineations, landowner/stakeholder (PPR) meetings, concept and final design and permitting are within the scope.

**Arsenal Boulevard Area Sewer Improvements, Phase 1, Dauphin County, Pennsylvania** - Mr. Mummert conducted the initial fluvial geomorphology survey of an unnamed tributary to Asylum Run that was experiencing bank degradation. He also assisted with the topographic survey of the UNT's banks and surrounding areas. After completing the surveys, Mr. Mummert reduced the survey data using Mecklenburg spreadsheets. He used the reduced data to apply the Rosgen natural channel design method for bank stabilization. Mr. Mummert designed a series of step-pool channels to convey stormwater that was causing

significant erosion to a steep gully on part of the site. He also designed the erosion and sediment pollution control plan for this project and the accompanying sewer replacement project.

**Rapid Bridge Replacement Project P3 (Public-Private Partnership), Pennsylvania Department of Transportation, Multiple Projects, Pennsylvania** - Mr. Mummert has completed multiple revisions to stream relocation and Erosion and Sediment Pollution Control plans to assist the prime contractor in meeting critical project deadlines. Mr. Mummert had direct involvement on over a dozen bridge crossings. Project involvement ranged from minor corrections resulting from review comments to complete redesigns of Erosion and Sediment Pollution Control and stream relocation plans.

**Hollywood Street Green Streets Project, City of Philadelphia Water Department, Philadelphia, Pennsylvania** - This Green Streets Green Stormwater Infrastructure (GSI) project on Hollywood Street in Philadelphia will provide 0.7 greened acres-inches of stormwater runoff storage volume. This project consisted of replacing nearly 6,000 sf of impervious roads in Philadelphia with permeable asphalt. Mr. Mummert designed an infiltration trench consisting of stone and check dams that was capable of storing and infiltrating stormwater from Joyce street and its surrounding 17,634 sf drainage area. He also created a geotechnical plan to assist geologists with infiltration rate and geotechnical testing.

**PennDOT Emergency Culvert Replacement, Heidelberg Township, York, Pennsylvania** - This project involved the emergency replacement of a culvert in York County that had been rendered impassible by a flash flooding event. Within 48 hours, Mr. Mummert visited the site, ran hydraulic and hydrologic calculations, sized a new culvert, and prepared a set of plans that PennDOT Maintenance were able to use to reconstruct the collapsed road and culvert.

**Interstate 83 Mill Creek Stream Restoration, York County, Pennsylvania** - This project involves the realignment and restoration of Mill Creek within PennDOT's project area for Interstate 83, Exit 18 Interchange construction. Mr. Mummert performed construction observation of the stream restoration portion of the project to ensure the stream mitigation is constructed in accordance with the plans and specifications. Mr. Mummert performed mid-construction surveys of the stream restoration project using global positioning system survey equipment to ensure stream and protection features were constructed to the designed elevation and alignment.

**Paxtang Parkway Watershed Restoration, Dauphin County, Pennsylvania** - An unnamed tributary of Spring Creek was encroaching into the embankment of several sites along the Paxtang Parkway, part of the Capital Area Greenbelt system. Mr. Mummert performed construction observation of the stream restoration portion of the project to ensure the stream is constructed in accordance with the plans and specifications. Mr. Mummert performed mid-construction surveys and survey stakeout for the stream restoration project using global positioning system survey equipment to ensure stream features were constructed to the designed elevation and alignment.

# DANIEL R. AUNGST, P.E., Construction Value Engineering

**EDUCATION:**
B.S., Environmental Engineering, 2001, The Pennsylvania State University

**PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS:**
Professional Engineer, PA (#PE078654)

**RELEVANT TRAINING:**
Rosgen Level I, "Applied Fluvial Geomorphology" Short Course, Asheville, NC, February 2004

Rosgen Level II, "River Morphology and Applications" Training, In-House Training at Skelly and Loy, Inc.

Rosgen Level III, "River Assessment and Monitoring" Training, In-House Training at Skelly and Loy, Inc.

Rosgen Level IV, "River Restoration and Natural Channel Design" Training, In-House Training at Skelly and Loy, Inc.

**YEARS OF EXPERIENCE:**
19 Years

Mr. Aungst has extensive experience in the development and implementation of site-specific solutions for stream, gully, wetland, and trail restoration projects. For design-build projects, Mr. Aungst assists with the design and permitting phase and manages the construction phase. Mr. Aungst also provides engineering oversight and technical support in the field during the construction phase of these projects.

**Design** - In order to support design efforts, Mr. Aungst has applied fluvial geomorphic (FGM) and natural stream channel design principles to define the characteristics, dimensions, pattern, and profile of numerous stream and gully systems. He has participated in reference reach selection, regional curve development utilizing USGS gauge calibrations, and field data collection efforts. Mr. Aungst has evaluated the collected field data and provided technical input for the design of channel reconstructions, in-stream grade-control and habitat structures, stream bank stabilization measures, and ADA-accessible fishing decks. In addition, Mr. Aungst has performed extensive field survey work contributing to the development of profiles, cross sections, and topographic information. Mr. Aungst has also developed Best Management Practices (BMPs) and conceptual restoration designs for many stream and watershed projects. He has completed erosion and sediment (E&S) control plans, technical specifications, design calculations, construction drawings, and final reports.

**Construction** - Mr. Aungst has managed Skelly and Loy's in-house construction team during the implementation phase of numerous stream, gully, and trail restoration projects, many of which have been completed utilizing a design/build approach. In addition to overseeing on-site construction personnel and contracts/budgets, Mr. Aungst provides cost estimating, on-site engineering oversight, regulatory and landowner coordination and technical assistance during construction of these projects.

## PROJECT EXPERIENCE

**Paradise Creek Watershed and Stream Corridor Project Prioritization Assessment, Monroe County, Pennsylvania** - Mr. Aungst collected exhaustive geomorphic field data and assisted with the preparation of a comprehensive watershed assessment for this rapidly growing area at the urban/rural interface in the Pocono Mountains. As part of this effort, Mr. Aungst identified and prioritized degraded stream corridor sites and provided site-specific environmental rehabilitation prescriptions. He also provided a detailed discussion of selected watershed and SWM BMPs appropriate for maintaining water quality and quantity in this area of rapid rural sprawl. Following coordination with project stakeholders, Mr. Aungst and the design team prepared detailed design plans and permit applications for submission to the PA DEP and USACOE.

**First Hollow Run Stream Restoration Design and Construction Oversight, Carbon County, Pennsylvania** - To design the restoration and stabilization of this very high gradient Exceptional Value stream channel confined within a 25-foot deep ravine, Skelly and Loy devised an innovative step-pool approach that incorporated keystone step structures and FGM/natural channel design principles. The project was constructed in two phases and the entire project site was heavily planted with native trees and shrubs following completion of the channel restoration work. Mr. Aungst and the Skelly and Loy team provided engineering and environmental consulting services from concept design, through final design, bidding, and construction management.

# DANIEL R. AUNGST, P.E., Construction Value Engineering

**Slaughterhouse Creek Restoration Project, Carbon County, Pennsylvania** - For this severely eroded section of Slaughterhouse Creek in Jim Thorpe Borough, Skelly and Loy prepared a stream restoration design based upon natural channel design principles. Nearly 550 linear feet of high gradient channel was actively and continually eroding following each new storm runoff event. To stave off further erosion and sediment supply to downstream waters, a step-pool stream channel with 25 rock weir structures was designed and built to create a naturalistic series of steps, pools, and riffles. Mr. Aungst and the Skelly and Loy team provided engineering and environmental consulting services from concept design, through final design, bidding, and construction management.

**South Branch Mehoopany Creek, Windy Valley Section Stream Restoration, Wyoming County, Pennsylvania** - This project is located within the glaciated terrain region of the NE United States in the Upper Susquehanna River Basin. Project reach length is approximately 5,000 linear feet, incorporated a combination of a number of natural stream channel design techniques. These techniques involved the use of cross-rock vanes, flood plain sills, rock barbs, boulder bank revetment, channel plugs and historical stream channel reconstruction in order to restore stability to the project stream reach. Mr. Aungst served as a principal field investigator for site assessment and fluvial geomorphic data collection and also provided construction oversight during the construction phase of this project.

**North Branch Mehoopany Creek Stream Restoration, Wyoming County, Pennsylvania** - The overall project included the restoration of more than 3,800 linear feet of actively eroding and unstable stream channel. The design included the relocation for a stream reach approximately 1,165 linear feet in length and restoration of the stream channel in its original location for an additional 2,695 feet. The reach is just north of State Route 87 and northwest of the town of Forkston, Pennsylvania, just upstream of the confluence with the main stem of Mehoopany Creek. The goal of this project was to make this a more stable C4 type stream, according to the Rosgen Classification of Natural Rivers. Mr. Aungst served as a principal field investigator for site assessment and fluvial geomorphic data collection and also provided construction oversight during the construction phase of this project.

**Ellen Run Stream Restoration, Mansfield, Pennsylvania** - Skelly and Loy developed a natural stream channel design, based on geomorphic principles, for this 1,000-foot section of a tributary to the Tioga River. This project is located within the glaciated regions of the Northern Tier and incorporated a combination of in-stream cross rock vanes, reconstruction of channel geometry and bank stabilization using stacked boulder bank revetment. Mr. Aungst served as a principal field investigator for site assessment and fluvial geomorphic data collection.

**Corey Creek Multiphased Stream Restoration, Tioga County, Pennsylvania** - Corey Creek is a tributary to the Tioga River in Pennsylvania's Northern Tier Region, an area where surficial geology and geomorphic characteristics reflect both past glacial episodes and past land use practices. Restoration activities within this watershed were designed and implemented in a phased approach as grant funding became available. Natural stream restoration techniques where used to provide increased stream channel stability and viable habitat for naturally reproducing indigenous trout species. Mr. Aungst served as a principal field investigator for site assessment and fluvial geomorphic data collection and also provided construction oversight during the construction phase of this project.

**Nesquehoning Creek Levee Stabilization and Stream Improvement, Carbon County, Pennsylvania** - Nearly 11,000 linear feet of Nesquehoning Creek was strategically assessed by Mr. Aungst and the Skelly and Loy team for the purpose of implementing stream restoration measures to reduce downstream sediment supply and to improve aquatic habitat. A 1,100 linear foot segment of Nesquehoning Creek was identified as the most severely and actively eroding segment, and concept designs were prepared to communicate the restoration approach to the property owners and regulatory agencies. Following coordination with project stakeholders, Mr. Aungst and the design team prepared detailed design plans and permit applications and obtained the necessary permits and regulatory approvals. Construction of the initial phase of this project was completed utilizing a design-build approach with our in-house construction group, with Mr. Aungst serving as the construction project manager.

**Valley Green Road Stream Channel Stabilization, Philadelphia, Pennsylvania** - Over a half century of piped stormwater discharge exacted its toll on a small unnamed tributary to the Wissahickon Creek. Located within the picturesque Wissahickon Valley Park (part of the celebrated and world-renowned Fairmount Park system), extreme erosion was threatening to undermine a heavily used parking area auxiliary to the Valley Green Inn. Mr. Aungst and the Skelly and Loy team designed and constructed a step-pool stream channel that stabilized the creek and allowed for restoration of the parking lot. Teaming efforts with Philadelphia Water Department and Friends of the Wissahickon were instrumental to the success of this design-build project. Mr. Aungst provided management and oversight during the construction phase, which was completed in Fall 2013.

# PAUL J. DEANGELO, Associate/Vice President of Environmental Services

**EDUCATION:**
M.S., Environmental Pollution Control, 2005, The Pennsylvania State University

B.S., Environmental Biology, 1991, Millersville University

**PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS:**
USACE, Baltimore District, Certified Wetland Delineator, MD

**RELEVANT TRAINING:**
Rosgen Level I, "Applied Fluvial Geomorphology" (short course), Dave Rosgen

Problem Area Wetland Delineations, U.S. Army Corps of Engineers, Baltimore District, 1997

Aquatic Entomology, Shippensburg University of Pennsylvania, 1998

Aerial Photography Interpretation, U.S. Army Corps of Engineers, Baltimore District, 2000

Environmental Aquatic Chemistry - Penn State, 2003

**PUBLICATIONS:**
*Comparison of Acidity Load Capacity between North Bald Eagle Creek and Buffalo Run,* Masters Thesis (2005), The Pennsylvania State University

**YEARS OF EXPERIENCE:**
29 Years

For 29 years, Mr. DeAngelo has been performing professional ecological services for environmental assessments in compliance with the National Environmental Policy Act and for United States Army Corps of Engineers (USACE) Section 404 and PA DEP Chapter 105 permit authorizations. The focus of his career has been on Aquatic Ecosystems, Wetland Delineations, Wetland Mitigation Designs, Terrestrial Resources, and 404-105 Permit Authorizations. Mr. DeAngelo oversees technical aspects of wetland and aquatic resource projects and has served as Project Manager and/or Principal Investigator on more than 300 projects throughout Pennsylvania and the eastern United States. He has provided expert testimony regarding aquatic assessments and water quality in testifying before the Environmental Hearing Board.

## PROFESSIONAL EXPERIENCE

**Section 404 & State Wetland and Waterway Encroachment Permitting** - Mr. DeAngelo's experience includes the strategic development and technical approach associated with the preparation and authorization of Section 404 and PA DEP Chapter 105 Permit Application packages. His experience centers on the Environmental Assessment, 404(b)1 Alternatives Analysis, and the Mitigation Design requirements of permitting. His project experience includes land development projects requiring wetland fills and watercourse crossings, transportation projects involving wetland and waterway crossings, minor driveway crossings, pond creations, watershed improvements, and mountain top mining permit assessments. The diversity of permitting projects across several different regulatory districts and PA DEP regions provides a wealth of experience for streamlining the permitting approaches needed for obtaining permit approvals. His permitting experience includes a continual maintenance of the federal 404 and state regulatory environment for providing his clients with current permitting issues and concerns related to their respective projects.

**Wetlands Studies** - As the lead investigator for the evaluation of wetland habitats and aquatic ecosystems, Mr. DeAngelo has supervised and completed numerous wetland delineation studies in Pennsylvania and Maryland. These studies include the Corridor O Project, S.R. 2001, Sections 401 and 402 in the Delaware Water Gap National Recreation Area, I-99/U.S. Route 220 improvements project, Covington Industrial Park, Pike County Economic Development, Conewago Industrial Park, and numerous bridge replacement (i.e., S.R. 030, 0196, S.R. 3007, S.R. 4011) and rehabilitation projects.

He is experienced in using the 1987 Army Corps of Engineers' Manual for Identifying and Delineating Wetlands and the 1989 Federal Manual for Delineating Wetlands. In the identification and delineation of wetland habitats, his assignments involve plant identification for the characterization of vegetative communities, examination of soil characteristics, and identifying indicators of hydrology. Mr. DeAngelo has received his Provisional Certification for Identifying and Delineating Jurisdictional Wetlands from the USACE, Baltimore District (USACE Wetland Delineator Certification Program, Baltimore District, Certification No. WDCP94MD0310147B).

In addition to field investigations, Mr. DeAngelo is experienced with conducting field views for the USACE for the Jurisdictional Wetland Determinations for establishing the jurisdictional limits of wetlands and waters and defining significant nexus. Furthermore, Mr. DeAngelo is experienced in conducting wetland functional assessments utilizing the methods described in the USACE

Wetland Evaluation Technique (WET): Volume II: Methodology (Operational Draft Technical Report Y-87) and the USACE, New England Division's Descriptive Method.

Mr. DeAngelo's experience includes wetland mitigation site selection and design. His site selection experience includes soil suitability, groundwater monitoring and flow modeling, and surface water drainage modeling. He has been involved in numerous wetland mitigation designs approved by the USACE and PA DEP.

**Aquatic Ecosystems** - Mr. DeAngelo's experience includes evaluating the physical, chemical, and biological conditions of aquatic ecosystems, specifically lotic systems (streams). His experience in evaluating the chemical conditions includes proper water sampling, flows measurement and modeling techniques, and Water Quality Assessment. His experience in evaluating the biological conditions includes performing kick-net sampling techniques to characterize the macroinvertebrate community and electrofishing sampling techniques to characterize the fin fish community. In addition, Mr. DeAngelo has utilized the aquatic assessment techniques outlined in the 1989 EPA Rapid BioAssessment Protocols for Streams and Rivers Manual. Mr. DeAngelo has had extensive exposure to Acid Mine Drainage Assessment studies in the coal mining regions of the eastern United States. Mr. DeAngelo's Masters Thesis focused on Water Quality Modeling in the Comparison of Acidity Load Capacity between North Bald Eagle Creek and Buffalo Run. His professional work efforts have also focused on water quality monitoring and assessing pollution loading associated with lotic systems.

## PROJECT EXPERIENCE

**Paradise Creek Watershed and Stream Corridor Project Prioritization Assessment, Monroe County, Pennsylvania** - Skelly and Loy collected exhaustive geomorphic field data and prepared a comprehensive watershed assessment for this rapidly growing area at the urban/rural interface in the Pocono Mountains. As part of this effort, degraded stream corridor sites were identified and prioritized and given site-specific environmental rehabilitation prescriptions. Skelly and Loy provided a detailed discussion of selected watershed and SWM BMPs appropriate for maintaining water quality and quantity in this area of rapid rural sprawl. Following coordination with project stakeholders, Skelly and Loy prepared detailed design plans and permit applications. Mr. DeAngelo developed the permit application which is currently under review by the PA DEP and USACOE.

**Ellen Run Stream Restoration, Mansfield, Pennsylvania** - Skelly and Loy developed a natural stream channel design, based on geomorphic principles, for this 1,000 foot section of a tributary to the Tioga River. This project is located within the glaciated regions of the Northern Tier and incorporated a combination of in-stream cross rock vanes, reconstruction of channel geometry and bank stabilization using stacked boulder bank revetment. Mr. DeAngelo served as the lead permit biologist for this project.

**Corey Creek Multiphased Stream Restoration, Tioga County, Pennsylvania** - To prevent further erosion and avulsion on this segment of a trout fishery in Tioga County, Skelly and Loy used natural channel design principles to design a total stream reconstruction project that moved the stream away from erosion points and provide in-stream habitat. Mr. DeAngelo provided environmental permitting services for the project.

**South Branch Mehoopany Creek, Windy Valley Section Stream Restoration, Wyoming County, Pennsylvania** - This project is located within the glaciated terrain region of the NE United States in the Upper Susquehanna River Basin. Project reach length is approximately 5,000 linear feet, incorporated a combination of a number of natural stream channel design techniques. These techniques involved the use of cross-rock vanes, flood plain sills, rock barbs, boulder bank revetment, channel plugs and historical stream channel reconstruction in order to restore stability to the project stream reach. Mr. DeAngleo served as the biologist for the project.

**Nesquehoning Creek Levee Stabilization and Stream Improvement, Carbon County, Pennsylvania** - Mr. DeAngelo served as a permit biolioist for this nearly 1,000 LF project along Nesquehoning Creek. Past land use practices relocated the main channel of Nesquehoning Creek behind an earthen levee along the side of the valley. Ongoing erosion of this levee has been exacerbating downstream flooding problems due to excessive bedload deposition in the channel. Implementation of this project will rebuild the earthen levee in a more stable configuration further landward to stabilize the streambanks and rebalance sediment transport functions.

# Paul A. DeBarry, MS, PE, PH, GISP, D.WRE

## Director of Geospatial Technologies and Watershed Management

NEWELL TERESKA & MACKAY ENGINEERING

## Professional Experience

Mr. DeBarry is NTM's Technical Director of Geospatial Technologies and Watershed Management, responsible for watershed analyses, hydrologic and hydraulic (H&H) studies, geographic information systems (GIS), and stormwater management plans. Mr. DeBarry has served as project manager, chief engineer, and GIS specialist in developing over 30 Act 167 Phase II Watershed Stormwater Management Plans in Pennsylvania. Additionally, he is an adjunct lecturer for Pennsylvania State University's Engineering & Surveying Department at the Wilkes-Barre campus and has taught various short courses on GIS, H&H, stormwater management, and low impact development (LID). Mr. DeBarry is a member of many national and state organizations, through which he helps establish stormwater policies and procedures. He also served as chair of the ASCE Task Committee on GIS Modules and Distributed Watershed Models, with results published by ASCE, and held the position of past chair on the ASCE Surface Water Hydrology Committee. His related project experience includes:

**Monroe County Act 167 Stormwater Management Plans (3), Monroe County, PA—*Project Manager*** responsible for developing the Brodhead Creek (including Marshalls), McMichael Creek (including Pocono), and Tobyhanna Creek Watershed Plans in Monroe County. Performed hydrologic modeling using HEC-HMS; developed GIS data, standards and criteria development, and a model ordinance; and conducted Watershed Plan Advisory Committee meetings.

**Berks County Act 167 Stormwater Management Plans (4), Berks County, PA—*Project Manager*** responsible for developing the Tulpehocken Creek, Sacony Creek, Maiden Creek, and Tributaries to the Schuylkill River Watershed Plans in Berks County, Performed hydrologic modeling using HEC-HMS; developed GIS data, standards and criteria development, and a model ordinance; and conducted Watershed Plan Advisory Committee meetings.

**Monroe County Wellhead Protection Plan, Monroe County Planning Commission Monroe County, PA—*Engineer/GIS Coordinator*** to develop a countywide Wellhead Protection Plan for Monroe County, consisting of several separate water supply regions and numerous on-lot septic systems, as well as private on-lot water supplies. Responsibilities included generating GIS layers pertinent for developing protection areas for wellhead and surface water supply areas throughout the county. Specific information developed for this project included environmentally-sensitive regions produced by joining environmental parameters, such as soil permeability, topography, and current land use. Additional responsibilities included converting the hard copy water supply area map to digital GIS coverages and converting a database of coordinate locations for wellheads obtained from the PA DEP to GIS coverage.

**Total Years of Experience: 37**

**Education:**

BS, Environmental Resource Management, The Pennsylvania State University, 1980

MS, Civil Engineering, University of Virginia, 1982

**Licenses/Certifications:**

Professional Engineer:
PA No. PE-037306E, 1988
NJ No. 24GE03372300, 1989
DE No. 18665, 2013
MD No. 47212, 2015

Professional Hydrologist, American Institute of Hydrology, No. 02-H-1570, 2001

Certified Geographic Information Systems Professional, No. 00036527, 2005

ASCE Diplomate, Water Resources Engineer, 00432, 2008

Certified PennDOT Instructor, 2008

*Key Qualifications:*

- *Author, **Watersheds: Processes, Assessment and Management***
- *Technical Advisory Committee/ Instructor, DEP **Stormwater BMP Manual***
- *Contributing Author, **Urban Hydrology***
- *Author/Instructor, **ASCE Regional Stormwater Management and Low Impact Development (LID)** courses*
- *Adjunct Lecturer, **Land Development Design**, Penn State University, Wilkes-Barre*
- *Co-Instructor, **Computational Methods in Stormwater Management**, Penn State University, University Park*
- *Contributing Author, **Advanced Water Distribution Modeling** "GIS Chapter"*
- *Contributing Author, **Handbook of Hydrology***
- *Co-Author, **Modules and Distributed Models of the Watershed***
- *Co- Project Manager and Author, PennDOT **Drainage Manual***

**I-80 Reconstruction Open End, PennDOT District, 5-0, Monroe County, PA—*Project Manager*** for the H&H analysis for the proposed structures. Hydraulic modeling was performed for the existing condition and two (2) proposed alternatives for each of the four (4) bridges (Pocono, Little Pocono, McMichael and Brodhead). In addition, there was potential for floodplain encroachment with road widening from the crossing of Pocono Creek downstream where the Pocono Creek parallels I-80 and the SR 209 interchange to the West Main Street interchange, a distance of approximately 3,300 feet. Therefore, additional existing and two alternatives analysis for this 3,300 foot section of Pocono Creek was also be included in the conceptual hydraulic models, and were compiled into an H&H memo. Responsible for project management, H&H set up, computations, agency meetings and QA/QC.

**Tacony Creek Stream Corridor Restoration - Reaches 4 & 5, Philadelphia Water Department, Philadelphia, PA—*Project Manager*** for the H&H analysis for this project to restore and enhance the Tacony Creek Park's ecosystem. The project boundaries extend along the Tacony Creek Park corridor from Cheltenham Avenue on the upstream extent down to Castor Avenue on the downstream extent. Tacony Creek is an impaired, urban stream, subject to frequent combined sewer overflows and a flashy hydrologic regime.

**Sandy Run and Benton Brook Stream Corridor Restoration, Philadelphia Water Department, Philadelphia, PA—*Project Manager & Chief Engineer*** for the H&H analysis for this project to restore and enhance the Sandy Run and Benton Brook's ecosystems. NTM was responsible for the hydrologic analysis and proposed conditon hydraulic modeling using the HEC-HMS and HEC-RAs models respectively.

**Cobbs Creek Stream Corridor Restoration, Philadelphia Water Department, Mt. Moriah, Philadelphia, PA—*Project Manager & Chief Engineer*** for the H&H analysis for this project to restore and enhance the Cobbs Creek ecosystems and repair the streambank where critical infrastructure was being exposed due to streambank erosion and channel incision. NTM was responsible for the hydrologic analysis using the HEC-HMS model, and existing and proposed conditon hydraulic modeling and sedimemt transport analysis utliizing the HEC-RAS model.

**Engineering & Construction Services, PennDOT, District 5-0, Monroe County, PA—*Project Manager*** responsible for H&H design, analysis, and reports for the SR 0447 bridge in Monroe County. NTM also provided QA for the SR 0191 and SR 0611 bridges in Monroe County.

**Engineering & Construction Services, PennDOT, District 5-0, Monroe County, PA—*Project Manager*** responsible for H&H design, analysis, and reports for the SR 0534 bridge in Carbon County, SR 1010 bridge in Monroe County, and the SR 4022 culvert in Schuylkill County.

**Annual Dam Inspections, Pennsylvania Department of Environmental Protection (PA DEP), Bradford, Monroe, Luzerne, Pike, and Wayne Counties, PA—*Project Manager*** who performed 51 annual private dam and four public annual dam inspections under the PA DEP Dam Safety Program. Tasks included field inspection and report writing for submission and approval to the PA DEP. Reported deficiencies and designed solutions for the deficiencies. (1990-2009)

**Dam Break Analysis and Inundation Area Mapping, Pennsylvania Department of Environmental Protection (PA DEP), Monroe, Luzerne, Pike, and Wayne Counties, PA—*Project Manager*** for 15 dam break analyses on 11 private and four public dams under the PA DEP's Dam Safety Program. The scope of work included developing hydrologic models (HEC-1 or HEC-HMS), dam break simulations for the spillway design flood (SDF) (½ PMF or PMF) and sunny day events, survey and field work coordination for topography and structures downstream, and plotting of inundation areas downstream of the dams. (1990-2009)

**GIS Base Map and Water Distribution Modeling, East Stroudsburg University (ESU), East Stroudsburg, PA—*Project Manager*** on development of ESU's campus base map. Utilizing aerial photography and planimetrics, additional field information such as signs, manholes, inlets, stormwater basins, etc. were added and/or verified to the aerial to develop a base map for master planning and infrastructure inventory and database management. Utilizing water system design drawings, the entire ESU campus and East Stroudsburg Borough water system was created in the Kentucky Pipe (KYPipe) computer model. The entire mapping network was then utilized to deter construction conflicts and updated as new improvements were installed.

# Rachel L. Tereska, MS, PE

Principal, H&H and Permitting Division

## Professional Experience

Ms. Tereska is a principal of NTM Engineering and a civil engineer who specializes in water resources engineering. Her background includes performing hydrologic and hydraulic (H&H) studies, developing and presenting engineering technical training courses, and conducting collegiate research. As a designer and engineer, she has developed H&H reports for various PennDOT, NYSDOT, and MEDOT bridge and culvert replacement projects. Ms. Tereska conducted PennDOT's first 2D hydraulic model analysis using the Surface Water Modeling System (SMS) software, has since performed five other PennDOT 2D analyses, and is proficient with HEC-RAS, TUFLOW, HY-8, PEAKFQ, EFH-2, and WMS. She has given several technical presentations on the use of 2D modeling to PennDOT's H&H Coordinators and Managers and the American Society of Highway Engineers (ASHE) Harrisburg Section, Association of State Floodplain Managers (ASFPM), Floodplain Manager's Association (FMA), and FHWA National Hydraulic Engineering Conference. Her related project experience includes:

**Total Years of Experience: 18**

**Education:**

MS, Civil Engineering, The Pennsylvania State University, 2001

BS, Civil Engineering and Environmental Engineering, The Pennsylvania State University, 2000

**Licenses/Certifications:**

Professional Engineer:
PA No. PE-071266, 2004
DE No. 15661, 2008

Certified PennDOT Instructor, 2007

*Key Qualifications:*

- *Over 18 years of specialized water resources experience with focus on hydrologic studies, hydraulic modeling, bridge scour analysis, and waterway permitting*
- *Instructor for PennDOT H&H Series – six technical training courses*
- *Performs complicated 2D hydraulics modeling with SMS TUFLOW software*
- *Performed HEC-RAS analyses for bridges and culverts in NY, ME, and PA*
- *Instructed Professional Engineering Review Courses in GA, PA, and VA*
- *Served as research assistant at Pennsylvania State University, studied stream restoration techniques, and developed monitoring criteria for restoration sites*

**SR 2001 Section LEE over Trout Creek, PennDOT District 5-0, Salisbury Township, Lehigh County, PA—Engineer** for a fast-track bridge replacement project for a bridge damaged and closed after Tropical Storm Lee in September 2011. NTM completed transportation, bridge, H&H, E&S, utility coordination, waterway permitting, and assembly of final project documents for the design of this 117-inch by 79-inch corrugated aluminized steel pipe arch. Responsible for a detailed H&H analysis of Trout Creek in the vicinity of the proposed SR 2001 bridge replacement.

**Stone Arch Bridge Program in LVTS, PennDOT District 5-0, Lehigh and Northampton Counties, PA—Quality Assurance (QA) Reviewer** for NTM's H&H and waterway permitting services for SR 2023 Section B (North 3rd Street) over Bushkill Creek in Easton, Northampton County. The H&H and waterway permitting for the SR 2023 three-span stone arch rehabilitation over Bushkill Creek was challenging due to the project's location in a FEMA regulatory floodway, the proposed reduction in the hydraulic opening due to the use of a liner, and backwater influence from the Delaware River. The SR 2023 project required a Joint Permit Application and close coordination with regulatory agencies, the City of Easton, and Lafayette College. Ms. Tereska reviewed the final HEC-RAS, H&H Report, and Joint Permit Application.

**SR 0329 Cementon Bridge Replacement, Lehigh and Northampton Counties, PennDOT District 5-0—Project Manager** for NTM's H&H and waterway permitting services on this project. The project includes replacing a historic 575-foot four-span steel truss type structure over the Lehigh River along SR 0329, going from Cementon in Lehigh County into the Borough of Northampton in Northampton County. Reviewed the H&H for the Alternatives Analysis, proposed conditions, and temporary conditions, and scour analysis. Responsible to lead the agency coordination for the waterway permit and oversee the Joint Permit Application.

**Statewide H&H Services Contract, PennDOT Bureau of Project Delivery, Statewide, PA—Project Manager/Engineer** for NTM's contract to provide statewide H&H and permitting support services and to serve as a water resources expert for all PennDOT Engineering Districts. The NTM Team has the ability to provide all

necessary support services for H&H and permit development including: survey, H&H analysis, scour analysis and countermeasure design, erosion and sediment control plan development, and environmental evaluation.

**SR 4026 Mohrsville Bridge over Schuylkill River, PennDOT District 5-0, Berks County, PA—Project Manager** for the water resources to replace an existing four-span bridge on an upstream alignment. The site is located in a FEMA floodway, and this Schuylkill River reach is designated as a navigable river, state scenic river, and water trail. Oversaw the H&H for the alternatives study and H&H report and led the waterway permitting efforts.

**SR 0100 Passmore Bridge over West Branch Perkiomen Creek, PennDOT District 5-0, Berks County, PA—Project Manager** for the water resources to replace an existing two-span bridge with a two-span integral abutment structure. NTM performed the H&H and prepared the Joint Permit Application. This project involves modeling a complicated temporary conditions scenario that includes a temporary bridge, cofferdams, and causeway.

**SR 0209 McCall Bridge over Lehigh River, PennDOT, District 5-0, Carbon County, PA—Project Manager** responsible for the water resources engineering for this project to rehabilitate the existing 16-span structurally-deficient bridge. NTM performed the hydrologic study, hydraulic model, and scour analysis for the existing bridge and completed an H&H report for the proposed rehabilitation and temporary in-stream construction measures. NTM's services also include the PA DEP GP-11 waterway permit.

**SR 0422 Reconstruction, PennDOT District 5-0, Berks County, PA—Project Manager** for NTM's H&H, permitting, and stormwater services for a large corridor project near Reading, which will reconstruct the SR 0422 highway from the Warren Street Bypass to Perkiomen Avenue.

**Central Susquehanna Valley Transportation (CSVT) 2D Model, PennDOT District 3-0, Northumberland and Union Counties, PA—*Engineer*** for the H&H analysis and permitting support of a new 4,500-foot bridge over the West Branch Susquehanna River. A 2D hydraulic analysis was performed to model the flooding impacts of the proposed piers. NTM was responsible for the hydraulic modeling and scour analysis for a new bridge crossing over the West Branch Susquehanna River. NTM also coordinated efforts with the FHWA and FEMA for the FEMA CLOMR. Additionally, NTM provided reviews of the NPDES permit package and permitting coordination with various agencies. NTM provided additional support as needed related to the reevaluation of the FEIS for the project. Responsible for the QA of the 2D model and CLOMR H&H Report.

**SR 2004 over Cedar Run, PennDOT District 2-0, Clinton County, PA—*Engineer*** who performed the 2D Finite Element Surface-Water Modeling System (FESWMS) hydraulic analysis in the Surface Water Modeling System (SMS) software for replacing the two-span bridge over Cedar Run in Lamar Township. This was the first PennDOT project to use a 2D model. The 2D was necessary due to multiple bridges and wide, shared floodplain between Cedar Run and Fishing Creek in the project site's vicinity. Completed the hydraulic modeling, scour analysis, H&H report, and Joint Permit Application.

**SR 2006 over Mackey Run, PennDOT District 2-0, Centre County, PA—*Project Manager*** for the water resources to replace an existing bridge over Mackey Run with a depressed, box culvert in a new location. A portion of Mackey Run was realigned downstream of the new crossing. The vicinity's complicated flooding pattern required a detailed 2D hydraulic analysis, performed with the TUFLOW model in the state-of-the-art Surface Water Modeling System (SMS) software. The 2D model was necessary to model the confluence of Mackey Run and Cedar Run, to determine the structure and channel relocation's hydraulic impacts, and to ensure that the flood-prone properties near the site would not be subject to additional flooding. Reviewed the H&H modeling and report and Joint Permit waterway application.

# Kevin R. Kozain, PE, CPESC

Senior Engineer

NEWELL TERESKA & MACKAY ENGINEERING

## Professional Experience

**Total Years of Experience: 19.5**

**Education:**

BS, Civil Engineering Technology, University of Pittsburgh, 1999

**Licenses/Certifications:**

Professional Engineer:
PA No. PE-075052-E, 2007

Certified Professional in Erosion and Sediment Control, 4855, 2008

Certified PennDOT Instructor, 2013

*Key Qualifications:*

- *Over 19 years of stormwater management, erosion and sediment control, transportation, highway, geometric design, and land development experience*
- *Multidisciplinary civil engineering and stormwater design and land development experience*
- *Internal auditor for an ISO 9001 engineering quality program from 2003 through 2007*

Mr. Kozain serves as project manager and senior engineer on Pennsylvania transportation improvement projects. His responsibilities include but are not limited to designing erosion and sediment (E&S) controls and drainage and stormwater mangement systems; performing NPDES and waterway permitting and hydrology and hydraulic (H&H) analysis; and developing traffic control and construction phasing plans. Mr. Kozain is proficient in performing designs according to PennDOT and PA DEP design standards and also offers a background in land development design and traffic engineering. Mr. Kozain has provided calculations, construction plans, and specifications for grading and drainage, erosion and sedimentation control, stormwater management, highway geometry, pavement, and signage and has coordinated project designs with clients, utility owners, and project review agencies. His related project experience includes:

**Specialty Stormwater Services, PennDOT Bureau of Project Delivery, Highway Division, Harrisburg, PA—*Engineer*** for as-needed engineering to help PennDOT make programmatic decisions regarding drainage, stormwater management, and erosion and sediment control. Assignments have included developing Department-wide guidance on regulatory compliance, QA reviewing of stormwater designs, assisting Districts with NPDES permitting, and participating in Pro Team or VEACTT meetings to help find the most cost-effective solutions for stormwater design. Collaborated with several Districts on large projects to reduce or eliminate costly and maintenance-intensive stormwater management facilities from preliminary designs.

**SR 1005 over Pine Mountain Run, PennDOT District 5-0, Monroe County, PA—*Engineer*** for NTM's services for this project performed under a Maintenance Environmental Services Open End. NTM provided an H&H analysis, GP-7 waterway permitting, a preliminary roadway plan and profile, and Erosion and Sediment Pollution Control Plans (E&SPC) for the SR 1005 dual-elliptical concrete culvert replacement carrying Pine Mountain Run in Middle Smithfield Township. The design included correcting the existing roadway profile to achieve proper cover above the dual culverts.

**PA 901 Section 01B Replacement over Branch of Schuylkill River, PennDOT District 5-0, Schuylkill County, PA—*Engineer*** for the design of the PA 901 Section 01B bridge replacement over a Branch of the Schuylkill River in North Manheim Township. NTM is responsible for project management, field view, public involvement, environmental services, survey, drainage and stormwater management design, cross-sections, line and grade, typical sections, pavement design, geotechnical, roadway, right-of way, H&H and waterway permitting, traffic, safety, railroad coordination, utilities, and constructability reviews. In conjunction with the PA 901 bridge replacement, NTM performed an Alternatives Analysis to evaluate three alignments for the SR 3005 (Beckville Road) bridge replacement project, which is immediately upstream from the PA 901 crossing. Alternatives were evaluated to determine the level of various impacts, including right-of-way, social, and environmental, along with overall project complexity, constructability, and cost, while meeting the identified project purpose and need.

**SR 2047 over Monocacy Creek, PennDOT District 5-0, Berks County, PA—*Engineer*** responsible for the QA review of roadway plans and assembling final project documents for a project to replace an existing bridge superstructure that carries SR 2047 over Monocacy Creek. The superstructure replacement included investigation

and ultimately the recommendation of a prefabricated superstructure to expedite construction. NTM received an **"Exceeds Expectations"** score from PennDOT for work on this project.

**I-84 Section 449 Reconstruction, PennDOT District 4-0, Pike County, PA—*Assistant Project Manager/Engineer*** responsible for permitting and stormwater management designs for PennDOT's reconstruction of Interstate 84 from Exit 34 to milepost 40 in Blooming Grove and Dingman Townships. NTM is responsible for the drainage design, E&SPC Plan, NPDES permit, PCSM Plan, and H&H design of the McConnell Creek Bridges and waterway permitting for the entire project corridor.

**SR 0407 Section 250 North Abington Road Bridge over an Unnamed Tributary to Lackawanna Lake, PennDOT District 4-0, Lackawanna County, PA—*Engineer*** for the approach roadway design, traffic maintenance and protection design, drainage design, and cost estimating for the preliminary and final designs for the SR 0407 Section 250 North Abington Road Bridge over an Unnamed Tributary to Lackawanna Lake project in North Abington Township, Lackawanna County. NTM is performing structural design, roadway design, H&H analyses, and E&S design for the replacement of this existing bridge. Configuration of roadway geometry and water surface elevations enabled a reinforced concrete box culvert with a smaller vertical clearance to be proposed, which was a cost savings to PennDOT when compared to a bridge. Served as the lead roadway engineer and was also responsible for the erosion control permitting.

**SR 2001 over Trout Creek, PennDOT District 5-0, Salisbury Township, Lehigh County, PA—*Engineer*** for NTM's services to complete a fast-track bridge replacement project. NTM completed transportation, bridge, H&H, E&S, utility coordination, waterway permitting, and assembly of final project documents for the design of this 117-inch by 79-inch corrugated aluminized steel pipe arch. Utility conflicts, lack of time for temporary construction easements, and an accelerated schedule were notable challenges.

**Luzerne County Pilot Bridge Replacement Projects, PennDOT District 4-0, Luzerne County, PA—*Engineer*** for NTM's water resources services under a new Commonwealth pilot program to "fast track" local bridge replacement projects. The program fully funds replacing seven bridges and three bridge removals. The design activities will be completed in 2013 with construction planned for 2014. NTM performed structural design, H&H analyses, waterway permitting, and erosion and sediment control design for the T-404 over Little Wapwallopen Creek and T-451 over Shickshinny Creek bridge replacement projects. For additional cost savings during construction, the same size reinforced concrete box culverts will be used to replace the existing T-404 and T-451 stone arch bridges. NTM also performed the H&H and waterway permit for the T-486 over Harveys Creek bridge replacement project. Within four months of notice to proceed, NTM received TS&L and H&H approval and submitted the E&S and waterway permits for approval.

**I-81 Sections 511-I4R Reconstruction, PennDOT District 4-0, Susquehanna County, PA—*Engineer*** for drainage analysis and the post-construction stormwater management design for NTM's services to design 9.41 miles of interstate from Mile Marker 223.8 (Interchange 223) in New Milford Borough to the Pennsylvania/New York state line. NTM tasks included field surveys of the drainage features and culverts, coordination with the camera crew for inspection of culverts and storm sewers, evaluation of conditions results, tabulation of the conditions spreadsheet, report writing, and calculation of flows to each inlet and culvert.

**Erosion and Sediment Control Design Course, PennDOT Bureau of Project Delivery, Harrisburg, PA—*Contributing Developer/Assistant Instructor*** who helped develop this course that thoroughly examines erosion and sediment (E&S) pollution control concepts and design procedures as they apply to PennDOT construction projects. The course provides the designer/engineer with the guidance and direction to evaluate the Department's E&S design options by addressing a broad range of issues related to design. The *PennDOT Drainage Manual*, PA DEP's *E&S Manual*, and other documents relevant to E&S are highlighted. The changes to 25 Pa. Code 102 and how they affect PennDOT plans are also discussed.

# Bethany A. Kavulich, MS, PE, CPESC

**Engineer**

NEWELL TERESKA & MACKAY ENGINEERING

## Professional Experience

**Total Years of Experience: 11**

**Education:**

MS, Civil Engineering, Villanova University, 2012

BS, Civil Engineering, Missouri University of Science and Technology, 2007

**Licenses/Certifications:**

Professional Engineer:

PA No. PE-081128, 2013

Certified Professional in Erosion and Sediment Control, 7549, 2013

*Key Qualifications:*

- *Specializes in H&H design and waterway permitting*
- *Performed detailed modeling and GIS mapping for Act 167 Stormwater Management Plans*
- *Has performed quality assurance reviews and software testing under a PennDOT Bureau of Project Delivery Bridge Quality Assurance Division open-end contract*

Ms. Kavulich is a design engineer who specializes in hydrologic and hydraulic (H&H) design and waterway permitting for bridge and culvert projects. Her professional career features PennDOT and Philadelphia Water Department projects, including H&H analysis and modeling and preparation of H&H reports, erosion and sediment control (E&S) plans, and PA DEP waterway permits. Ms. Kavulich is proficient utilizing various water resources engineering software, such as HEC-RAS, HY-8, WMS, HEC-HMS, SWMM, AutoCAD, and MicroStation. She received her Master's of Science in civil engineering from Villanova University, where Ms. Kavulich focused on water resources design. She is also a Certified Professional in Erosion and Sediment Control. Her related project experience includes:

**I-80 Reconstruction Open End, PennDOT District, 5-0, Monroe County, PA—*Engineer*** for the H&H analysis for the proposed structures. Hydraulic modeling was performed for the existing condition and two (2) proposed alternatives for each of the four (4) bridges (Pocono, Little Pocono, McMichael and Brodhead). In addition, there was potential for floodplain encroachment with road widening from the crossing of Pocono Creek downstream where the Pocono Creek parallels I-80 and the SR 209 interchange to the West Main Street interchange, a distance of approximately 3,300 feet. Therefore, additional existing and two alternatives analysis for this 3,300 foot section of Pocono Creek was also be included in the conceptual hydraulic models, and were compiled into an H&H memo.

**Tacony Creek Stream Corridor Restoration - Reaches 4 & 5, Philadelphia Water Department, Philadelphia, PA—*Engineer*** for the H&H analysis to restore and enhance the Tacony Creek Park's ecosystem. The project boundaries extend along the Tacony Creek Park corridor from Tabor Road on the upstream extent down to East Wyoming Avenue on the downstream extent. Tacony Creek is an impaired, urban stream. Responsibilities included hydraulic modeling existing and proposed conditions utilizing the HEC-RAS program.

**Sandy Run and Benton Brook Stream Corridor Restoration, Philadelphia Water Department, Philadelphia, PA—*Engineer*** for the H&H analysis for this project to restore and enhance the Sandy Run and Benton Brook's ecosystems. NTM was responsible for the hydrologic analysis and proposed conditon hydraulic modeling using the HEC-HMS and HEC-RAs models respectively.

**Poquessing Creek Act 167 Stormwater Management Plan, Philadelphia Water Department, Philadelphia, PA—*Designer*** involved with the development of an Act 167 Plan for Poquessing Creek in Philadelphia, in conjunction with Temple University's Ambler Campus. Project tasks included data collection, GIS mapping and analysis, watershed modeling utilizing the SWMM model, problem and obstruction analysis, public presentations, and ordinance preparation.

**Wissahickon Creek Act 167 Stormwater Management Plan, Philadelphia Water Department, Philadelphia, PA—*Engineer*** involved with the development of an Act 167 Plan for Wissahickon Creek in Philadelphia, in conjunction with Temple University's Ambler Campus. Project tasks included Hydrologic Modeling System (HMS) model calibration.

**Quantifying the Function Credit Gain (FCG) Using the Function-Based Aquatic Resource Compensation Protocol, Philadelphia, PA—*Designer*** for quantifying the Function Credit Gain (FCG) associated with project study areas as part of a prime's team for the Cathedral Run and Wises Mill Run stormwater management projects and the Wises Mill Run and Gorgas Run stream restoration projects. Created GIS-based stream assessment reach (SAR) and wetland assessment area (AA) map figures and prepared AA or SAR maps for each of the four project sites.

**Statewide H&H Services Contract, PennDOT BOPD, Statewide, PA—*Engineer*** for NTM's contract to provide statewide H&H and permitting support services and to serve as a water resources expert for all PennDOT Engineering Districts. The NTM Team has the ability to provide all necessary support services for H&H and permit development including: survey, H&H analysis, scour analysis and countermeasure design, E&S plan development, and environmental evaluation.

**Public Private Partnership (P3) Early Completion Bridges, PennDOT, Multiple Districts, Multiple Counties, PA—*Engineer*** for NTM's services under multiple prime contracts for P3 design support in Districts 5-0, 10-0, and 12-0 and H&H review assistance in Districts 4-0 and 5-0. NTM completed tasks for 11 Early Completion Bridges in four months. NTM services included H&H reports, waterway permit applications, TS&L, E&S Plans, Line and Grade Submissions, Safety Review Submissions, utility plans, and QA reviews of H&H reports.

**NEPA Region Bridge Group 1, PennDOT District 5-0, Multiple Counties, PA—*Designer*** for NTM's H&H services for a bridge group in Carbon, Monroe, and Schuylkill Counties. NTM performed the H&H analyses and reports for SR 0534 Section 04B over Swamp Run in Kidder Township, Carbon County; SR 1010 Section 01B (Snow Hill Road) over Stony Run in Price Township, Monroe County; and SR 4022 Section 02B (Helffenstein Road) over Little Mahantango Creek in Eldred Township, Schuylkill County.

**SR 0209 McCall Bridge over Lehigh River, PennDOT District 5-0, Carbon, County, PA—*Designer*** for this project to rehabilitate the existing 16-span structurally-deficient bridge. NTM performed the hydrologic study, hydraulic model, and scour analysis for the existing bridge and completed an H&H report for the proposed rehabilitation and temporary in-stream construction measures. NTM's services also include the PA DEP GP-11 waterway permit.

**SR 2007 Harrity Road over Pohopoco Creek, PennDOT District 5-0, Carbon County, PA—*Designer*** for this project to replace the existing two-span bridge with a new single-span bridge on an upstream alignment. NTM prepared the H&H analysis and developed the H&H report in accordance with PennDOT's *Design Manual 2*, "Chapter 10." The firm also obtained the Joint Permit from PA DEP. Responsible for performing the H&H analysis and developing the H&H report and Joint Permit application.

**Design Management & Support, PennDOT District 5-0, Multiple Counties, PA—*Designer*** for a contract to provide project management and review assistance for three District 5-0 bridge projects—SR 4007 Hoch Road over Hokendauqua Creek, SR 1019 and Cedar Crest Boulevard over Cedar Creek. Responsible for QA reviews of H&H report and permit application submissions.

# Francisco J. Aguirre, MS, PE, CBSI

Engineer

NEWELL TERESKA & MACKAY ENGINEERING

## Professional Experience

**Total Years of Experience: 11**

**Education:**

BS, Civil Engineering, Villanova University, 2008

MS, Civil Engineering, Villanova University, 2012

**Licenses/Certifications:**

Professional Engineer:

PA No. PE081740, 2014

Certified Bridge Safety Inspector, 2008

*Key Qualifications:*

- *Specializes in H&H design and waterway permitting*
- *Instructor for PennDOT H&H Course: Introduction to Hydraulics and HEC-RAS*
- *Performed QA reviews and software testing under a PennDOT Bureau of Project Delivery BQAD contract*
- *Performs complicated 2D hydraulics modeling with SMS TUFLOW software*
- *Fluent in Spanish*

Mr. Aguirre is an engineer who specializes in hydrologic and hydraulic (H&H) design and waterway permitting for bridge and culvert projects. Mr. Aguirre received his Master's of Science in civil engineering at Villanova University with a focus on water resources and structures design. He is proficient with HEC-RAS, TUFLOW, HY-8, PEAKFQ, and WMS. Mr. Aguirre has been involved with NTM's 2D hydrologic modeling for several PennDOT projects, includeing the Central Susquehanna Valley Transportation (CSVT) project. He also spoke at the 2012 National Hydraulic Engineering Conference in Nashville, Tennessee, where he co-presented the "CSVT Susquehanna River Bridge – Using a Calibrated 2D Hydraulic Model to Assess Impacts in a Floodway" seminar. His related project experience includes:

**I-80 Reconstruction Open End, PennDOT District, 5-0, Monroe County, PA—*Engineer*** for the H&H analysis for the proposed structures. Hydraulic modeling was performed for the existing condition and two (2) proposed alternatives for each of the four (4) bridges (Pocono, Little Pocono, McMichael and Brodhead). In addition, there was potential for floodplain encroachment with road widening from the crossing of Pocono Creek downstream where the Pocono Creek parallels I-80 and the SR 209 interchange to the West Main Street interchange, a distance of approximately 3,300 feet. Therefore, additional existing and two alternatives analysis for this 3,300 foot section of Pocono Creek was also be included in the conceptual hydraulic models, and were compiled into an H&H memo.

**PA 447 Bridge, PennDOT District 5-0, Monroe County, PA—*Designer*** for the Spruce Cabin Run bridge replacement project in which NTM provided TS&L studies and H&H analysis. The existing SR 0447 bridge, constructed in 1957, was structurally deficient and the proposed structure provided increased load carrying capacity and standard roadway widths. NTM recommended replacing the single-span, adjacent box beam bridge with a single-span, pre-stressed concrete spread box beam, splayed beam layout bridge. The detailed H&H analysis of Spruce Cabin Run in the vicinity of the proposed SR 0447 bridge was performed and three hydrologic methods were considered. HEC-HMS was also used to approximate the upstream dam's impacts on the calculated flows. Evaluated the use of integral and conventional abutments for this 90′-0″ bridge at a 45° skew to Spruce Cabin Run.

**Germantown Flood Relief Capital Improvement Project, Philadelphia Water Department, Philadelphia, PA – *Design Engineer*** that is evaluating the existing EPA Stormwater Management Model (SWMM) for input data accuracy, including a comparison against Geographic Information System (GIS) data sets. NTM's evaluation includes a detailed check of the conduit attributes, analysis of storage curves, surcharge, and summary of trunkline constrictions throughout the model. NTM also created a summary of parameters within SWMM and the GIS data sets. NTM is utilizing findings from an analysis of the existing SWMM and GIS data to develop the 1D and 2D SWMM model tunnel and storage tank alternatives. NTM is also evaluating the boundary condition of the existing Germantown SWMM model using past experience with the Tookany/Tacony-Frankford SWMM watershed.

**Introduction to Hydraulics and HEC-RAS, PennDOT Bureau of Project Delivery—*Assistant Instructor*** for a customized course that focuses on the hydraulics of natural channels and culvert and bridge hydraulics.

**Hydrologic and Hydraulic (H&H) Policies & Procedures Services, PennDOT Bureau of Project Delivery (BOPD), Bridge Quality Assurance Division (BQAD), Harrisburg, PA—*Designer*** for a contract to assist PennDOT with H&H policies and procedures, which involves coordinating with the Chief and Assistant Chief Bridge Engineers, all PennDOT Central Office bureaus, the FHWA, contractors, engineering districts, and various outside technical agencies to make recommendations regarding complex H&H engineering decisions. Assignments have included quality assurance (QA) reviews of H&H and waterway permit submissions that include bridges, culverts, channel changes, and floodplain encroachments and software testing.

**Statewide H&H Services Contract, PennDOT Bureau of Project Delivery, Statewide, PA—*Engineer*** for NTM's contract to provide statewide H&H and permitting support services and to serve as a water resources expert for all PennDOT Engineering Districts. The NTM Team has the ability to provide all necessary support services for H&H and permit development including: survey, H&H analysis, scour analysis and countermeasure design, E&S plan development, and environmental evaluation.

**Public Private Partnership (P3) Early Completion Bridges, PennDOT, Multiple Districts, Multiple Counties, PA—*Engineer*** for NTM's services under multiple prime contracts for P3 design support in Districts 5-0, 10-0, and 12-0 and H&H review assistance in Districts 4-0 and 5-0. NTM completed tasks for 11 Early Completion Bridges in four months, with all permits submitted to PA DEP by July 3. NTM is also working on two additional P3 Early Completion Bridges, which were added after the initial 11 sites, and those additional projects will be completed by August 29. NTM services included H&H reports, waterway permit applications, TS&L, E&S Plans, Line and Grade Submissions, Safety Review Submissions, utility plans, and QA reviews of H&H reports.

**SR 0422 Reconstruction, PennDOT, District 5-0, Berks County, PA—*Engineer*** for NTM's H&H, waterway permitting, and stormwater management services as part of a team for a large corridor project near Reading, which will reconstruct and widen the SR 0422 highway from the Warren Street Bypass to Perkiomen Avenue. The improvements will widen the roadway to accommodate three travel lanes in each direction between the Warren Street Bypass and Lancaster Avenue; reconstruct four lanes between Lancaster and Perkiomen Avenues; reconstruct and widen to accommodate three lanes in each direction of the US 422 over Thun Trail Bridge; realign and reconstruct the Penn Street and Lancaster Avenue interchanges; realign the US 422 EB ramp from the Warren Street Bypass and the US 422 WB Ramp to the Warren Street Bypass; reconstruct the Wyomissing Boulevard and I-176 interchanges; and reconstruct and complete the Neversink Road interchange.

**SR 0329 Cementon Bridge Replacement, Lehigh and Northampton Counties, PennDOT District 5-0—*Engineer*** providing H&H analysis services on this project. The project includes replacing a 575-foot four-span steel truss type structure over the Lehigh River along SR 0329, going from Cementon in Lehigh County into the Borough of Northampton in Northampton County. There are heavy traffic volumes along this corridor with 17,000 vehicles per day with 4% trucks.

# E. Qualifications of Firm

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL
CONSULTANTS

# First Hollow Run Stream Restoration Design and Construction Oversight
# Carbon County, Pennsylvania

**Client**
Carbon County Conservation District

**Estimated Project Value**
Total: $625,000
Firm Responsibility: $183,292

**Completion Date**
2007

**Key Components**
Mine Site Reclamation; Exceptional Value Stream; Fluvial Geomorphology; Natural Channel Design "Keystone Concept"; Construction Assistance and Construction Oversight

**Reference Contact**
Mr. Chris Storm
Carbon County Conservation District
5664 Interchange Road
Lehighton, PA 18235
P: 610-377-4894, ext. 4
F: 610-377-5549

The First Hollow Run design project addresses the restoration and stabilization of approximately 1300 feet of extremely steep stream channel. This reach of First Hollow Run, which is listed as an Exceptional Value (EV) stream and supports a wild trout population, is located just west of Nesquehoning Borough in Carbon County, Pennsylvania. First Hollow Run and Second Hollow Run were historically joined and relocated to accommodate mining activities in this region. Subsequent to relocation, First Hollow Run underwent serious downcutting, becoming an extremely steep and deeply entrenched stream, and creating a ravine almost 100 feet across and as much as 30 feet deep.

A unique natural stream channel design approach employing the principles of fluvial geomorphology (FGM) was used to design the stabilization and restoration of First Hollow Run. The very high gradient of the stream valley (approximately 11%) necessitated the design of a step-pool stream channel (Rosgen A-type stream), typical of steep mountain valleys. Step structures composed in part of very large boulders, labeled "keystones", were constructed to create a natural-appearing step-pool channel. As in the case of stable self-formed step-pool channels, this design maximizes energy dissipation and overall channel stability. Erosion control blankets and an aggressive planting plan is intended to reinforce the stability of channel margin areas within the highly confined setting of the ravine (the photo below shows the site shortly after construction, before woody plants were installed). The design of First Hollow Run, along with the design of a similar

step-pool channel in West Virginia, precipitated the preparation of a technical paper on a natural channel design approach to steep channels. This paper, entitled “Natural Channel Design of Step-Pool Watercourses Using the 'Keystone' Concept,” was presented at a conference of the American Society of Civil Engineers in 2003. The paper describes a practical design approach appropriate for high gradient streams. As a result of our experience, Skelly and Loy, Inc. has developed a unique FGM protocol for restoring these important components of the fluvial landscape. This design protocol has wide application in both urban and rural settings.

Skelly and Loy prepared bid documents and managed the bidding process for the client. The firm also aided in the selection of the construction contractor and worked cooperatively alongside the contractor to complete various components of the construction effort. During construction, Skelly and Loy provided oversight and direct construction assistance to ensure adherence to the design specifications and to quickly resolve any unforseen circumstances.

# Slaughterhouse Creek Restoration Project
# Carbon County, Pennsylvania

**Client/Owner**
Borough of Jim Thorpe

**Project Value**
Total: $212,000
Firm Responsibility: $63,000

**Completion Date**
June 2011

**Key Components**
Gully and Stream Stabilization and Enhancement; Step-Pool Channel Design; Permitting; Construction Bid Document Preparation; Construction Oversight

**Reference Contact**
Mr. Kim Mazur
Entech Engineering, Inc.
4 South Fourth Street
Reading, PA 19603
P: 610-373-6667

Recent urban development within this small (0.3-square-mile), steep drainage basin within the Borough of Jim Thorpe in Carbon County resulted in the conversion of a stream that could reportedly be “stepped across” into a huge gully better described as a ravine. Originating at a culvert outlet and roughly 500 feet long, the ravine was as much as 35 feet wide and 12 feet deep. The somewhat lower-gradient section of stream at the downstream end of this ravine was previously veneered with undersized riprap by a private landowner. This older (and inadequate) treatment is already unravelling and will need replacement in the future.

Channel incision was eventually slowed by partial self-armouring, as large rock was left as an immobile 'lag' in the streambed. However, this process, along with the naturally non-cohesive soils in this area, promoted extreme lateral channel enlargement. Rapid channel widening undermined and toppled many trees within the wooded area traversed by the stream, with this fallen wood blocking the channel in many places, further exacerbating stream erosion.

Most of this channel supports only ephemeral flow (the channel dries up between snowmelt and rain events), with perennial flow commencing at a small spring near its downstream end. Enlarging progressively after it was relocated several decades ago, truly spectacular erosion of the stream reportedly commenced with the intense storm of June 2006, when nearly 13 inches of rain were reported in this area. This 2006 storm occurred soon after significant new development in the upstream contributing area, which must have further accelerated runoff, helping to trigger the staggering erosion associated with this storm. It appears that no less than 5,000 cubic yards of sediment were eroded from this channel by this event.

The principal objective of this PA Department of Environmental Protection-funded project was to stop accelerated erosion and private property loss along the

stream, which is bordered on one side by existing single-family residences and on the other by planned future residential development. By reducing sediment delivery to downstream areas, the project also vastly improved water quality, benefitting Robertson Run, a wild trout stream to which this creek is tributary. This also has reduced downstream flooding associated with sediment accumulation at road crossings.

Overall stream gradient in this area is about 6.5%. Applying Natural Stream Channel Design principles appropriate for such a steep stream, the channel was stabilized by creating a boulder-controlled step-pool channel. This step-pool channel morphology corresponds to the geomorphic channel configuration expected in a stable A2 Rosgen natural stream type.

The design involved installation of 25 closely spaced boulder weirs (channel-spanning grade control structures) along the realigned and redimensioned stream channel. Because the ravine and new design channel have a sinuous channel pattern, heavy boulder bank revetments (including stacked rock walls in places) were constructed along smoothly curving outside channel bends.

than the discharge associated with even the largest possible storm or snowmelt event, the ravine could be backfilled by several feet to construct the new channel. This allowed cost savings through a balanced cut and fill since material acquired from lowering the steep ravine sideslopes to a more stable angle could be utilized to fill the bed of the ravine.

Initial stabilization of the lowered earthen banks bordering the rock-lined channel was accomplished using biodegradable erosion control blanket and shade-tolerant ground cover grasses. Native woody riparian vegetation was also installed for riparian zone enhancement.

In addition to design and permitting, Skelly and Loy, Inc. assisted Entech Engineering (the Borough Engineer) in developing contractor bid documents. Skelly and Loy also provided oversight during construction of the channel structures. As is the case in so many of these projects, this on-site guidance provided to the contractor was vital in preventing the kinds of mistakes commonly made by contractors inexperienced with this type of environmental construction.

# Paradise Creek Stream Restoration at Red Rock Road
# Paradise Township, Monroe County, Pennsylvania

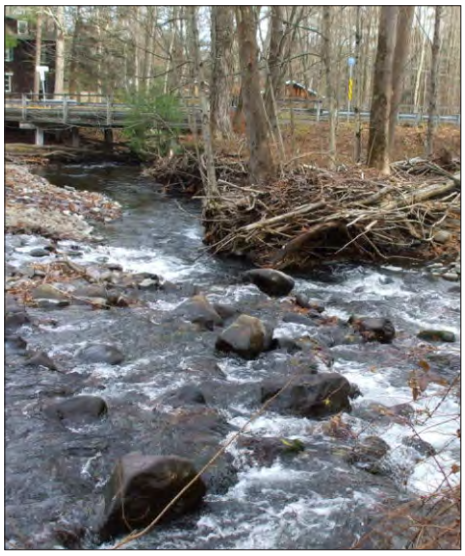
**Client/Owner**
Paradise Township

**Estimated Project Value**
Total: $830,200
Firm Responsibility: $220,000

**Completion Date**
Ongoing

**Key Components**
Stream Restoration; Watershed Assessment; Design; Cost Estimation; Bid Documents; Construction Oversight; Grant Assistance; Wetlands Delineation; Bog Turtle Habitat Assessment; Pennsylvania Natural Diversity Inventory (PNDI); Pennsylvania Historical and Museum Commission (PHMC); Infrasture Protection

**Reference Contact**
Ms. Reda Briglia
Township Secretary
5912 Paradise Valley Road
Cresco, PA 18326
P: 570-595-8840



This high-quality reach of Paradise Creek, a Class A Wild Trout Stream, is enjoyed by many anglers and notable historic figures including U.S. Presidents Calvin Coolidge and Teddy Roosevelt and celebrity Annie Oakley, who frequented the historic Henryville House during fly-fishing excursions. The stream channel north and south of the Red Rock Road bridge crossing is highly unstable and eroding, and the intensity and extent of the erosion threatens the bridge and adjacent properties as the streambanks are being undermined and transported to downstream waters.

The severity of the erosion and the high bedload directly correlate to the geographic location of the stream in the formerly glaciated region of Pennsylvania. The lateral location of the stream channel north of the Red Rock Road bridge dramatically vacillated almost 150 feet in one six-year period studied by Skelly and Loy, Inc. during the firm's 2012 Watershed and Stream Corridor Restoration Prioritization Assessment for Paradise Creek. Ongoing major movement of the stream channel, severe bank erosion, high sediment yields, and elevated risk of the road and bridge damage made the Red Rock Road reach the highest priority site for stream restoration.

Skelly and Loy performed the design and permitting required to restore a 2,100-foot segment of Paradise Creek and will provide construction oversight to ensure successful implementation.

The segment of interest extends 700 feet upstream and 1,400 downstream of the Red Rock Road bridge, south of Paradise Valley Road near the junction of State Route (S.R.) 0940 and S.R. 0191. In addition to regrading a new channel and floodplain, the restoration design of Paradise Creek includes the installation of in-stream grade control to enhance sediment transport and create riffle/pool habitat diversity and boulder bank revetments with multi-log vane deflectors along outer bend (concave) banks for channel stabilization.

The in-stream structures include strategic placement of a w-weir upstream of the bridge and a rock

cross vane below the bridge to realign the active channel upstream of the bridge so that it enters the crossing more directly, thereby preventing additional threat to the bridge foundation. Functional floodplain reconstruction will both reduce bank shear stresses and provide floodflow attenuation during overbank flow events. The introduction of pools along with the reduction of sediment supply will enhance habitat for fish and other wildlife within the corridor.

Skelly and Loy shepherded the project from design through permits and secured authorizations and clearances from various agencies to allow the restoration to proceed to the construction phase. Reviews, clearances, authorizations, and approvals were obtained from the following:

- Joint Permit from the Pennsylvania Department of Environmental Protection and United States Army Corps of Engineers
- Erosion and Sediment Pollution Control Plan approval from Monroe County Conservation District
- United States Fish and Wildlife Service Approval
- PNDI Environmental Review
- Wetland Delineation
- Bog Turtle Habitat Assessment
- PHMC Clearance

Skelly and Loy is preparing the bid documents, including bid schedule, construction cost estimates, and advertisement verbiage. The firm will assist in contractor evaluation and selection and will provide construction oversight and management services.

In addition to the original assessment, design, permitting and construction oversight, Skelly and Loy provided key assistance in acquisition and management of three Growing Greener Grants. The most recent grant (for $693,596.00) will substantially finance construction activity for the restoration project.

# Corey Creek Multiphased Stream Restoration
# Tioga County, Pennsylvania

**Client**
Corey Creek Watershed Association

**Project Value**
Total: $402,711
Firm Responsibility: $102,711

**Completion Date**
June 2009

**Key Components**
Natural Stream Channel Design Approach; Multi-Phased Joint Permit Package; Geomorphic Surveys; Glaciated Terrain

**Reference Contact**
Mr. Jim Hufnagle
Corey Creek Watershed Association
RR #1, Box 643
Mansfield, PA 16933
P: 570-662-3360

The Corey Creek watershed, which is tributary to the Tioga River, extends to the east from the Borough of Mansfield in Pennsylvania's Northern Tier region. The surficial geology and geomorphic characteristics of this basin reflect both past glacial episodes and past land use practices, which continue to exert a strong influence on existing stream processes and landforms. Not only are the alluvial soils in the watershed coarse textured and therefore naturally erodible, but basin streams have been directly impacted by channelization and riparian zone disturbances. These factors combine to make Corey Creek highly unstable in a number of areas. The assessment of the Corey Creek watershed recently completed by the Tioga County Conservation District highlighted five stream reaches as priority areas for restoration. Using Growing Greener funds, the Corey Creek Watershed Association engaged Skelly and Loy, Inc. to develop stream restoration designs employing a natural stream channel design approach for three of these five priority areas.

Skelly and Loy's work on Corey Creek represents a multiphased stream restoration project that addresses problems in several locations within the watershed. A multiphased joint permit package addressing work in all prioritized reaches is a key part of this effort. The first phase design work targets a cropland-bordered area of actively migrating channel which has been responsible for significant sediment yield to downstream areas (known as Priority Site B). The recently completed restoration design for this site hinges on the reconstruction of over 1,300 feet of channel, the creation of a broad flood-prone zone, and an extensive riparian zone revegetation effort. The design hydrologically isolates the two major cutbanks responsible for most of the sediment yield from this reach.

Skelly and Loy's design efforts on Corey Creek have included detailed geomorphic surveys of the existing priority work reaches and nearby reference reaches. Regional curves previously developed by Skelly and Loy for another project in the vicinity provided a significant cost benefit to the Corey Creek Watershed Association. The remaining work on this project will involve an assessment of the impacted reaches within the watershed to determine a prioritization of remaining restoration activities and completion of restoration construction activities on the highest priority sites. Finally, in addition to completing design and permitting tasks, Skelly and Loy is actively assisting the watershed association in its efforts to discover and develop a variety of funding sources. It is hoped that these can be used to augment state funds for the construction of the projects.

# South Branch Mehoopany Creek, Windy Valley Section Stream Restoration
# Wyoming County, Pennsylvania

**Client**
Mehoopany Creek Watershed Association

**Estimated Project Value**
Total: $2,000,000
Firm Responsibility: $300,000

**Project Completed**
Ongoing

**Key Components**
Growing Greener Grants; Glaciated Terrain; Historic Channel Alignment; Cross Rock Vane and Other Grade-Control Structures; Bank Stabilization; Habitat Enhancement Structures; Construction Oversight

**Reference Contact**
Mr. Rusty Bennett
Mehoopany Creek Watershed Association
Post Office Box 73
Mehoopany, PA 18629
P: 570-833-4332

The project site is on the South Branch of Mehoopany Creek in the Upper Susquehanna River Basin (direct tributary to the Susquehanna River) in Wyoming County along State Route (S.R.) 3001, approximately ¾ mile south of S.R. 0087 near the town of Forkston, Pennsylvania. The watershed is located within the glaciated terrain region of NE United States and has been highly affected by past glaciations. Because of this, the soils in the watershed tend to be coarse-textured and highly erosive. The erosive nature of the soil, combined with past land uses, has caused the channel of the Mehoopany Creek to be highly unstable in localized sections of the watershed.

Skelly and Loy completed a comprehensive watershed assessment in 2003 and identified the Windy Valley area as a high priority reach for immediate restoration intervention activities to address threats to public infrastructure and the safety of area residents caused by channel instabilities and active stream channel migrations that were occurring. Lack of available funding postponed the initiation of these restoration activities until a series of hurricanes and tropical storms moved through the area. In the wake of these extreme recent events, Skelly and Loy was successful at obtaining a series of grants which provided adequate funding to complete the design, permitting, and the initial construction phase work for this 5,000 linear feet Windy Valley project site. The permitting phase was completed with the Joint Permit from the Pennsylvania Department of Environmental Protection (PA DEP)/U.S. Army Corps of Engineers issued in early 2010. The initial construction phase efforts were completed in the Fall of 2010 with additional phases being constructed as additional grant funding became available.

Restoration efforts in the project area are based on using a natural stream channel approach which incorporates fluvial geomorphic principles. In order to provide protection of area residents, personal property and public infrastructure, the objectives of the work effort include channel relocation to its historical location, correcting bank instabilities which contributed to the original channel migration, and reshaping of the channel to correct stream cross-sectional instabilities. These restoration efforts have included the use of cross-rock grade-control structures to manage stream energies and sediment transport, in-stream rock barb structures to protect constructed boulder bank revetments, create pools and riffles and enhance aquatic habitat, other bank and erodible floodplain stabilization efforts, and roadway protection measures to provide additional bank stabilization and aesthetic appeal.

Skelly and Loy has also been involved throughout the project duration to provide construction oversight for the various phases of construction work.

# North Branch Mehoopany Creek Stream Restoration
# Wyoming County, Pennsylvania

### Client
Mehoopany Creek Watershed Association

### Estimated Project Value
Total: $600,000
Firm Responsibility: $120,000

### Project Completed
2007

### Key Components
Growing Greener Grants; Glaciated Terrain; Historic Channel Alignment; Grade-Control Structures; Bank Stabilization; Habitat Enhancement Structures; "W" Weir for Sediment Transport at Bridge; Construction Oversight

### Reference Contact
Mr. Rusty Bennett
Mehoopany Creek Watershed Association
Post Office Box 73
Mehoopany, PA 18629
P: 570-833-4332

The North Branch Mehoopany Creek Stream Restoration Project is located in Forkston Township, Wyoming County, Pennsylvania within the area of continental glaciation region of NE United States. The overall project included the restoration of more than 3,800 linear feet of actively eroding and unstable stream channel. The design included the relocation for a stream reach approximately 1,165 linear feet in length and restoration of the stream channel in its original location for an additional 2,695 feet. The reach is just north of State Route 87 and northwest of the town of Forkston, Pennsylvania, just upstream of the confluence with the main stem of Mehoopany Creek. The goal of this project was to make this a more stable C4 type stream, according to the Rosgen Classification of Natural Rivers.

Historically, the watershed has been highly affected by past glaciations. Because of this, the soils in the watershed tend to be coarsely textured and highly erosive. The erosive nature of the soil, combined with past land use, has caused the channel of the North Branch Mehoopany Creek to be highly unstable in localized sections of the watershed.

The design approach chosen for this stream restoration/ stabilization effort was based on the principles of natural stream formation outlined in "Applied River Morphology" by Dave Rosgen (1996). Application of the principles of natural channel formation has resulted in the creation of a 40-step design process for the restoration of impacted stream reaches. The 40-step approach uses natural channel formation principles to provide a stable stream channel, adequate floodwater routing, and improved aquatic habitat.

Restoration efforts designed for this reach included channel relocation to the historic channel alignment, a "W" weir grade-control structure to enhance sediment transport in the vicinity of the State Route 3001 bridge, in-stream structures to create pools and riffles and enhance aquatic habitat, bank stabilization measures to protect and restore the existing failing right bank, and riparian plantings to provide

additional bank stabilization and aesthetic appeal. The total area of riparian corridor restoration for the project was approximately 4.5 acres.

A total of 12 in-stream rock structures were part of the original design to increase channel stabilization and provide aquatic habitat. The most significant design challenge for this project related to location of the project within the glacially influenced region of the Northern Tier of Pennsylvania. Soils in this region possess very low natural structure and cohesiveness and tend to be very easily eroded and scoured. This condition made all proposed structural improvements highly susceptible to undermining and failure. To adapt to this natural condition, the design of individual structures was modified to include additional, more deeply-footed structures; extended floodplain sills (or groins); and more massive individual boulders to construct the various in-stream structures. The construction of the project had to be completed in two phases due to limitations in grant funding. Phase 1 was completed in 2006, and Phase 2 was completed in 2007.

This project is not only in agreement with the watershed initiatives of the Mehoopany Creek Watershed Association and its partners, but it also complements Pennsylvania's Non-Point Source (NPS) Management Program 1999 update. The NPS Management Program recognizes erosion and sedimentation impacts on our waterways as a leading cause of water quality impairment and that erosion and sedimentation reduce the productivity and utilization of our soil resources. This project will continue to improve the water quality of Mehoopany Creek and reverse the damages caused by increased sediment load and erosion to this creek.

# Ellen Run Stream Restoration
# Mansfield, Pennsylvania

**Client**
Mansfield Borough

**Project Value**
Total: $500,000
Firm Responsibility: $163,770

**Completion Date**
September 2004

**Key Components**
FGM Design; Regulatory Permitting; Construction Project Management; Glaciated Terrain

**Reference Contact**
Mr. Ed Grala
Mansfield Borough
19 East Wellsboro Street
Mansfield, PA 16933
P: 570-662-2315

Applying fluvial geomorphic (FGM) principles, Skelly and Loy, Inc. developed a design for the reconstruction and enhancement of over 1,000 feet of Ellen Run in Tioga County. This project was located within the area of continental glaciation of NE United States In addition to design, the project included obtaining regulatory permits and construction project management. Construction began in July 2004 and was completed by September 2004. A slope stability analysis was required as part of this stream rehabilitation design in order to accommodate a 40-foot high failure slope along the right bank. The design was also required to provide erosion protection to stream-adjacent properties, including the protection of buried fuel tanks at a gas station. Although the site is laterally constrained by development on one side and a steep slope on the other, the selected design relocates the active channel away from the eroding bank on the development side, thereby providing protection to streamside property owners. The plan also furnishes improved aquatic habitat in this reach through the creation of a riffle-pool complex and the addition of native riparian vegetation.

Both the failing right bank and the different concerns of multiple landowners within a topographically constrained setting required a complex mix of restoration prescriptions. Among the affected properties within the design stream reach are those of the United States Army Corps of Engineers (USACE). No significant alterations to the bankfull channel were allowed by the USACE within their property at the lower end of the project because this area is part of the Tioga-Hammond flood control reservoir. The USACE had concerns that significant channel alterations here could affect the flood storage capacity of the impoundment. The close proximity of commercial and residential buildings upstream of this area also prevented restoration of a fully natural channel pattern through the designated work reach. These sorts of complexities required Skelly and Loy to play an important public involvement role, with a number of landowner meetings necessary in order to finally achieve consensus on the design.

Both a geotechnical analysis and fluvial geomorphic assessment of Ellen Run and its valley were conducted by Skelly and Loy in order to develop the plan. The later work included the development of regional hydraulic geometry curves for the Glaciated Low Plateau Section of the Appalachian Plateaus physiographic province. Project tasks also included the evaluation of reference reach sites and the collection of detailed cross sections and longitudinal profiles of the existing stream channel. Skelly and Loy also provided on-site construction inspection services.

# St. Mary's Villa Dam Removal and Stream Restoration
# Upper Dublin Township, Montgomery County, Pennsylvania

### Client/Owner
Lindenwold Residential Associates, LLC

Dublin Villa Development, LLC

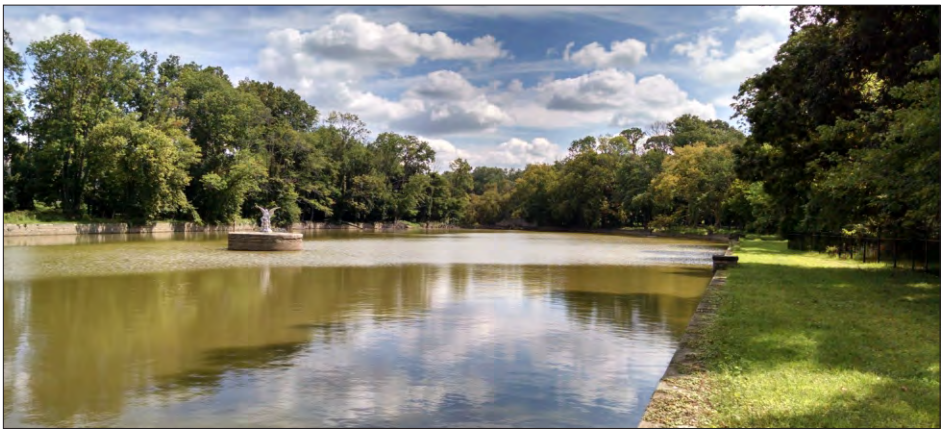
### Estimated Project Value
Total: $1,000,000
Firm Responsibility: $252,000

### Completion Date
Winter 2019

### Key Components
Dam Removal; Stream Restoration, Relocation, Mitigation; Wetland Restoration, Mitigation; Habitat Improvements; Permitting and Coordination with PA DEP Dam Safety and USACE; FEMA CLOMR/LOMR; Municipal Coordination

### Reference Contact
Mr. Leonard S. Poncia
Lindenwold Residential Associates, LLC
Post Office Box 845
Bensalem, PA 19020
P: 215-877-2885

Mr. John Williamson
Dublin Villa Development, LLC
c/o The Goldenberg Group
350 Sentry Parkway, Suite 300
Blue Bell, PA 19422
P: 610-260-9600



Due to liabilities brought on by a reclassification of the Loch Linden Dam from a C-4 to a C-2 size and hazard class, the prospective purchasers and developers of St. Mary's Villa (the Mattison Estate) desired to remove the dam. Skelly and Loy, Inc. prepared the dam removal and natural stream restoration design plan and coordinated with both Pennsylvania Department of Environmental Protection (PA DEP) Dam Safety and the U.S. Army Corps of Engineers (USACE) to secure permits and authorizations. The restoration plan will recreate a natural channel within the accumulated sediments of the lake with a short step-pool channel through the breached dam to accommodate the elevational differences.

Skelly and Loy is responsible for completing the design and permitting of the St. Mary's Lake dam removal and associated stream and wetland restoration that encompasses the study of 1,500+ linear feet of Honey Run, ultimately a tributary to Wissahickon Creek, between Loch Alsh Avenue and Farm Lane. This water body and stream are situated within a highly urbanized watershed in the greater Philadelphia area. The lake (variably referenced as St. Mary's Lake or Loch Linden) is located on the historic Mattison Estate, which was determined to be eligible for inclusion in The National Register of Historic Places in November 2014. The St. Mary's Lake was determined to no longer meet the standards of Chapter 105 – Dam Safety and Waterway Management of the Pennsylvania Code. The existing spillway is at the same level as the top of the dam and cannot safely carry flood waters away. As a result, the dam required either alteration to meet dam safety regulations or complete removal.

The project needed to be designed in a manner that would satisfy the Dam Safety regulations and protect the historical significance of the estate and its features. Skelly and Loy conducted multiple environmental and cultural studies of the site including fluvial geomorphological surveys and an archaeological survey. Based on the information acquired through significant field work, a plan was devised and coordination for the approach was discussed with the reviewing entities and stakeholders.

Skelly and Loy designed a dam breach that incorporates a reestablished stream channel with flood-prone area through the impoundment footprint and creates a remnant wetland to meet federal permitting requirements. The stream channel design is based on a holistic, natural channel approach using industry-accepted practices in fluvial geomorphology for determining appropriate hydraulic properties for a stable and functional stream system. Due to the steep gradient of the stream channel through the breached dam (in excess of 5%), a step-pool stream channel was designed. The series of rock step structures and associated pools are designed to mimic a natural steep-gradient stream, while providing energy dissipation in the pools and resistance to erosion at the rock step structures.

The mitigative wetland area is designed to maintain a functional wetland and open water environment supportive of native flora and fauna. To show that the created wetland feature would remain sustainable and not become a stagnant dead-end feature, Skelly and Loy prepared significant hydrologic and hydraulic studies to determine the pre- and post-construction contributory watersheds that would supply water to the system. Skelly and Loy's studies showed that the drainage area for the wetland system would be reduced from an excess of 200 acres to less than 10 acres, deemed to be unsustainable due to insufficient hydrology. Skelly and Loy immediately endeavored to develop alternatives for the wetland mitigation feature that would maintain sufficient hydrology to prevent pollutant accumulation and vegetation die-off. Ultimately, through close coordination with the township and their consultants, Skelly and Loy devised a plan to allow for almost 10 acres of urbanized runoff from the adjacent development to flow through the proposed system while also supplementing the hydrology with a base flow equalization channel that connects to the reconstructed stream channel through the former impoundment. In this way, the palustrine system on the west side of a low earthen berm will be continuously hydrologically connected to the adjoining tributary.

Skelly and Loy was also responsible to secure permits from PA DEP Dam Safety and the USACE. Pre-application meetings and field views were conducted by Skelly and Loy for the purpose of determining regulatory agency concerns and stipulations. By performing a U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP) analysis, Skelly and Loy was able to show that, in spite of the reduction of open water surface area, the resulting dam removal, stream restoration, and wetland creation project would result in net ecological lift to aquatic resources. This HEP analysis paved the way for issuance of a Nationwide Permit (NWP-27) rather than the more lengthy approval process for an Individual Permit.

To further complicate permitting matters, during the course of project design and permitting, this reach of Honey Run was overlain by a Federal Emergency Management Agency (FEMA) detailed flood study. Resulting from the FEMA study, floodplain lines and floodway boundaries were mapped along the project corridor. The land development approvals from Upper Dublin Township were made contingent on the project applicant receiving a Conditional Letter of Map Revision (CLOMR) from FEMA. Skelly and Loy secured the original HEC-RAS models and mapping from FEMA and prepared the hydrologic and hydraulic analysis as well as the map revisions and was successful in receiving the CLOMR for the applicant.

Skelly and Loy was also instrumental in assisting the client and their consultant with gaining land development approvals for this project. Due to the side-by-side nature of this project with the prospective land development project on the remaining acreage of the overall parcel, Skelly and Loy was called on to testify before the Board of Commissioners of Upper Dublin Township regarding the dam removal and stream restoration features. Skelly and Loy prepared renderings of the proposed project, commented on the existing and proposed conditions, and offered answers to various questions posed by the Board. Due in part to Skelly and Loy's expert testimony, conditional use approval was secured for the overall development of the property along with removal of the dam and restoration of the stream and wetland.

Construction commenced in Spring 2019 with anticipated completion in Fall/Winter 2019.

# Valley Green Road Stream Channel Stabilization
# Philadelphia, Pennsylvania

**Client**
Friends of the Wissahickon and Philadelphia Water Department

**Project Value**
Total: $700,000
Firm Responsibility: $201,200

**Completion Date**
January 2014

**Key Components**
Design-Build Stream Channel Stabilization; Urban Stormwater Management; Watershed Best Management Practices

**Reference Contact**
Dr. Maura McCarthy
Executive Director
Friends of the Wissahickon
8708 Germantown Avenue
Philadelphia, PA 19118-2717
P: 215-247-0417

Initially evaluated and described by Skelly and Loy, Inc. in a 2008 "Prioritization Assessment" (PA) for Philadelphia Water Department (PWD), this steep and highly confined unnamed tributary to Wissahickon Creek has been rapidly unraveling since the major storms of 2004. Rapid bed and bank erosion was not only threatening the critical elevated sewer crossing over the channel (not far downstream), but the channel has been rapidly eroding back into a key Wissahickon Valley Park (WVP) parking area, reducing its size and making it increasingly unsafe for visitors. Rapid erosion was also releasing enormous quantities of fine sediment to Wissahickon Creek, which has a TMDL for fine sediment pollution.

Historical channelization and flow confinement associated with Valley Green Road and (later) the installation of the parking area, along with unconstrained stormwater runoff from the small but steep urbanized catchment upstream, has caused the progressive erosion of the stream channel through this area. The old WPA-era check dams and then gabions that had previously been installed to help stabilize the stream have all proven inadequate and had been largely dismantled by recent severe erosion. Stream energy is especially high through this stream corridor because of steep slope (4% to 15%) and because of extreme lateral confinement by the parking area and steep forested slope along the right bank.

The 2008 PA recommended that a rock-lined step-pool channel be installed along this narrow stream corridor. No loss of parking space was permitted since parking areas are already scarce in WVP. Channel cross sections would have to be sufficiently large to accommodate the very high stream flows associated with major rainstorms that occasionally hit this area. This was important since any out-of-bank flow would run down the steep parking area and damage the stream corridor immediately downstream of the project site.

The final treatment is exceptionally robust and will be capable of withstanding the forces associated with the relatively infrequent but powerful design flows associated with this particular subwatershed. The step-pool form of the channel

will dissipate flow energy, reducing stream stress on the unprotected channel and sewer crossing immediately downstream. A total of 17 channel-spanning large rock weirs were installed along the 375-foot-long project reach. Every effort was made to preserve existing trees, although several very large trees which were near the end of their lifespan and were leaning toward the parking area were removed for safety reasons.

The construction of the channel utilized the highly desirable argillite 'blockstone' that is now being used almost exclusively for environmental construction projects within WVP. This rock weathers to a pleasing color that fits well with the park's natural environment and can be used to create tightly fitted, highly stable structures. Approximately 2,750 tons of this special rock were utilized in the project.

This design-build project was jointly funded by Friends of the Wissahickon (FOW) and PWD, with all work except final landscaping completed by the end of 2013. The FOW funded design, permitting, and construction (all performed by Skelly and Loy and AMS of Skelly and Loy, Inc. (AMS), the firm's in-house construction team) in addition to reconstruction of the parking lot. The PWD funded the acquisition of the rock. The FOW was also responsible for final landscaping, (with further assistance from AMS). This included eradication of invasive knotweed and the installation of extensive native woody plantings along the right (hillside) bank.

# Neill Drive Pumping Station Stream Restoration and Infrastructure Protection
# Philadelphia, Pennsylvania

## Client/Owner
Philadelphia Water Department

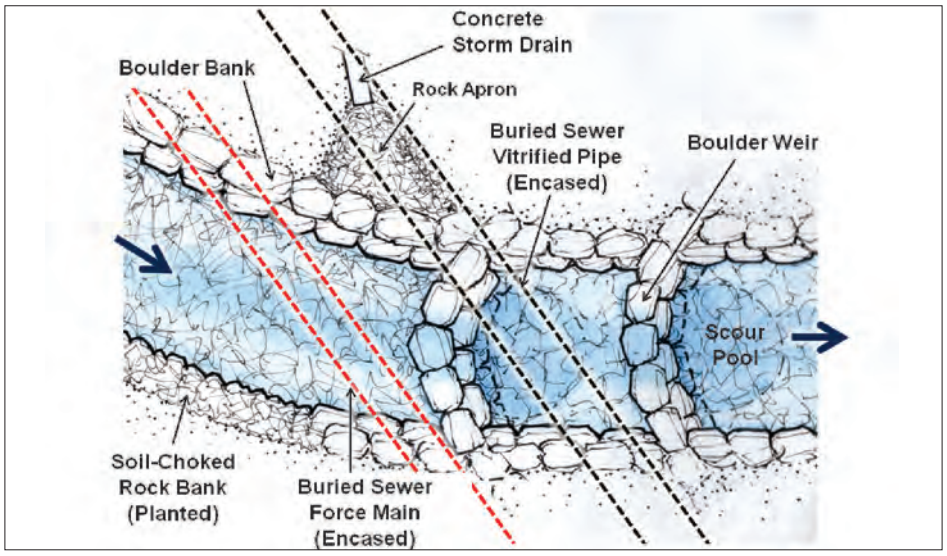
## Estimated Project Value
Total: $4,500,000
Firm Responsibility: $465,000

## Completion Date
Ongoing

## Key Components
Stream Restoration; Step-Pool Stream; Abandoned Dam Removals; Stakeholder Coordination; Gravity Sewer, Force Main, and Water Line Protection; Stormwater Outfall Retrofits; Accumulated Legacy Sediments; Permitting and Coordination with PA DEP and USACE; PPR, Stakeholder, and Landowner Coordination

## Reference Contact
Mr. Richard Anthes, Jr.
Philadelphia Water Department
Aramark Tower, 4th Floor
1101 Market Street
Philadelphia, PA 19107-2994
P: 215-906-6895

Mr. Rick Howley
Philadelphia Water Department
Aramark Tower, 4th Floor
1101 Market Street
Philadelphia, PA 19107-2994
P: 215-685-6034
Rick.Howley@phila.gov




Within one of a series of short, steep, northeast-trending valleys on the southwest side of the Schuylkill River, this long and complex problem area is located in the Wynnefield Heights area of West Philadelphia, just southeast of City Line Avenue (State Route 1). The lower end of this first-order stream is located within the northernmost part of West Fairmount Park.

The stream originates at two pipe outlets near Conshohocken Avenue and flows through what quickly becomes a steep, deep, and narrow ravine. The stream is unnamed, although Philadelphia Parks and Recreation (PPR) has indicated that it could be referred to as Roberts Run since the valley here was historically known as Roberts Hollow. The lower end of the valley is far less steep than the upper ravine and is not topographically confined. The PWD Pumping Station is about 100 feet from the stream in this lower section and is accessed by a short stub road from Falls Road via Neill Drive.

Many decades of urbanization have progressively narrowed and squeezed the upper valley of this stream into a narrow thread confined by steep fill slopes, parking lots, and apartment buildings. Public infrastructure (sewer lines, water mains, stormwater outfalls), in addition to some old private conduits, closely parallel and cross this narrow valley throughout its length. Several derelict dams and other abandoned obstructions, relicts from past phases of development extending back more than 100 years, also remain scattered along the stream. These defunct structures now serve only to interrupt and redirect storm flows, causing significant streambank erosion in numerous localized 'hot spots.' Gabion walls placed some time ago along much of the lower stream reach are likewise beginning to fail because of erosional undercutting and deterioration of the baskets. All of these factors, coupled with the ongoing decades-long increase in stormwater runoff rates and volumes, have led to reach-long streambank erosion, streambed degradation, and exposure (and local failure) of private and City-owned sewer, stormwater, and water infrastructure.

With the intent of rectifying these extensive and multi-faceted impacts, PWD engaged Skelly and Loy to assess and prioritize the potential restoration of this reach of stream. Working closely with PWD staff, Skelly and Loy, Inc. performed a full walk-through of the site, documenting the many problems noted above and including these observations in a Prioritization Memorandum for the Neill Drive site. This especially detailed assessment proposed a number of potential solutions for several of the localized problem areas scattered all along the stream corridor (see the attached drawing). This report ultimately led to Skelly and Loy providing the PWD with a proposal for the design of the restoration of this severely degraded (but functionally restorable) tributary stream.

To date, Skelly and Loy and its team of subconsultants have 1) delineated wetlands and watercourses on the site; 2) surveyed the topography and cultural features of the area; 3) acquired, reduced, and summarized fluvial geomorphic data (profile, riffle/pool/run lengths, detailed cross sections, pebble counts, substrate sampling, etc.); 4) performed geotechnical testing including 23 test pits drilled to bedrock; and 5) assembled an existing-conditions hydrology and hydraulic report and model to document current flow profiles and propose design bankfull channel dimensions.

Realization of the full scope of work for this project will result in a stream restoration plan for the full 2,000 feet of valley length, with construction documents prepared to allow for a phased construction approach. Due to the significant gradient of the stream (some portions exceed 13%), much of the stream restoration will consist of creating a step-pool stream arrangement to resist the exceptionally high shear stresses and to protect adjoining infrastructure.

Skelly and Loy has prepared concept design plans, and will be coordinating with PPR and adjoining landowners, preparing substantially complete design documents, and coordinating utility review. This will then lead to preparation of a Joint Permit Application to the Pennsylvania Department of Environmental Protection (PA DEP) and the United States Army Corps of Engineers and the creation of the PS&E design and Final Design documents, with this followed by bidding and construction (which is currently slated for 2021).

# Nesquehoning Creek Levee Stabilization and Stream Improvement
# Carbon County, Pennsylvania

**Client/Owner**
Carbon Conservation District

**Project Value**
Total: $486,472

**Completion Date**
Ongoing

**Key Components**
Levee Stabilization; In-Stream and Riparian Habitat Enhancement; Design; Permitting; Bid Documents; Construction

**Reference Contact**
Mr. Chris Storm
District Manager
Carbon Conservation District
5664 Interchange Road
Lehighton, PA 18235
P: 610-377-4894

Nesquehoning Creek above the Borough of Nesquehoning in Carbon County has been manipulated and channelized since the late 1800s, a legacy of extensive historical mining activity in this area. This included the placement of massive amounts of mine spoil in the valley bottom, development of streamside coal processing plants, routing of a railroad along the stream to service the mining industry, and, more recently, industrial development.

The extensive old fill (along with areas of original terrain) creates a high confining 'terrace' along the entire north bank of the creek. A high, unstable and non-engineered levee was constructed along the south side of the stream. From the Borough of Nesquehoning, this straightened and fully confined reach of the Nesquehoning Creek extends upstream for a distance of over two miles, ending at the outlet of Broad Run, one of several steep tributaries descending from Broad Mountain.

A 2008 assessment of the Nesquehoning Creek watershed conducted by Skelly and Loy, Inc. identified this entire two-mile-long reach of Nesquehoning Creek (Reach 003/004) as severely impaired, both geomorphically and biologically. Historical stream straightening resulted in a highly simplified (structureless) stream, with this providing little of the habitat complexity required for healthy fish populations (this reach is now virtually all riffle). Stream water quality, on the other hand, is relatively good, with this part of Nesquehoning Creek ranked as a cold water fishery capable of supporting trout populations.

Subsequent to the watershed assessment, which found Reach 003/004 to be of the highest priority area for rehabilitation, an intensive follow-up field survey of erosion conditions was conducted to determine where a pilot stabilization project should be constructed (about half of the four miles of bank in this reach is significantly eroded). Project access, property protection, extent of adjacent wetlands, and other factors were also considered.

The site selected for initial stabilization and stream and riparian enhancement is along the south side (right bank) of the stream and consists of a ±1,000-foot-long section

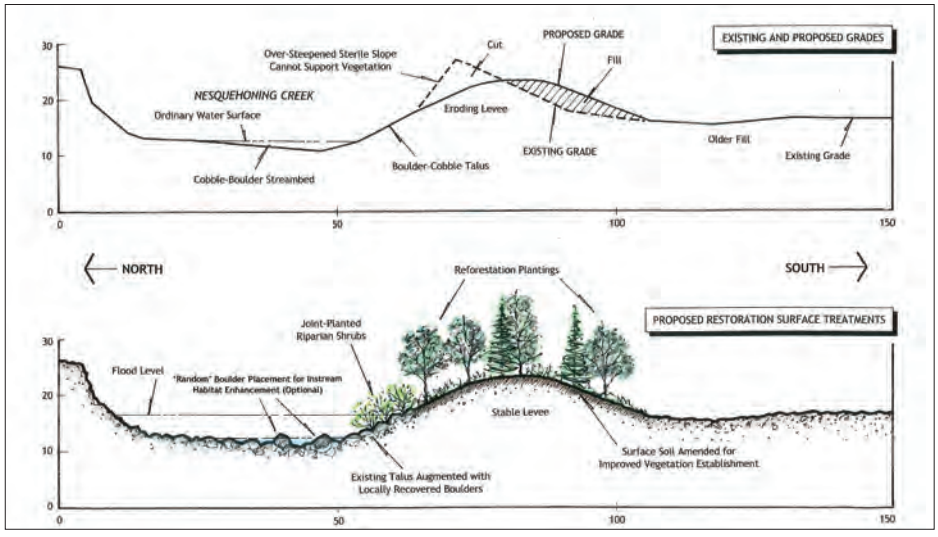
of especially high and unstable levee, along with the associated stream channel. The Nesquehoning has continued to adjust to artificial straightening by swinging from side-to-side within confining banks. This (plus slight initial channel curves) has resulted in less bank erosion in some places and more in others, as in the selected project site. Periodic slope failure here is currently releasing large quantities of sandy sediment to the stream. This is smothering streambed gravels and impacting aquatic life.

This project will focus on removing the top of the >15-foot-high eroding levee and lowering the entire waterside slope of the structure to a stable angle of 3H:1V or lower. The lowered levee top will be higher than the 100-year flood and higher than several other sections of the dike. Material removed from the over-steepened waterside slope of the existing levee will be placed on its landward side, allowing a cost-saving balanced cut-and-fill operation.

Renovation of the sterile soils on the cutback slope and across the new, lowered top of the levee using proven mined-land reforestation practices will allow vegetation colonization by both planted and volunteer growth. A special focus will be the establishment of lower riparian vegetation along the toeslope and active channel margin since lower bank woody vegetation is largely absent through this entire two-mile-long stretch of stream. Once established, this vegetation not only provides food chain support for fish but also provides crucial velocity cover, allowing fish to hold in the reach during floods. Waterside revegetation will be accomplished through intensive joint planting.

The 'lag' of large rock along the toe of the existing bank already provides substantial scour protection, but this will be reinforced by the addition of very large boulders recovered from the immediate area. Forming some of these into 'boulder hook' habitat enhancement structures will provide valuable small scour pools (“pocket water”) along the stream margin. Boulder placement throughout the low-flow channel in this target reach will also be used to create pocket water and local gravel segregation for trout spawning. The combination of in-stream and bankline complexity provided by these structural and revegetation measures will substantially improve conditions for trout in this area.

Undertaken with state Growing Greener funding, this project is currently in the construction phase by AMS of Skelly and Loy, Inc. Construction completion of Phase I is anticipated for Spring 2019.



# NTM's Services

Newell, Tereska & MacKay (NTM) Engineering, Inc. is a civil engineering firm that specializes in water resources design, bridge design and inspection, and engineering instruction for public and private sector clients. NTM's core services include hydrologic and hydraulic studies, waterway permitting, stormwater design and permitting, GIS, transportation and bridge engineering, bridge inspection, and technical course development and training.

Established in 2006, NTM currently employs 54 professionals and is located in Dillsburg, Pennsylvania, with branch offices in State College and Philadelphia, Pennsylvania. The firm's four principals—Donna Newell, John Newell, Rachel Tereska, and Jeffrey MacKay—are all licensed professional engineers with master's degrees in civil engineering and offer a combined 70+ years of civil design experience. NTM is a certified Disadvantaged Business Enterprise (DBE) in Pennsylvania, Delaware, Maryland, and West Virginia and a Women-Owned Small Business (WOSB) with the federal government.

**Offices in:**

- **Dillsburg, PA**
- **Philadelphia, PA**
- **State College, PA**

## Hydrologic & Hydraulic Modeling

- Bridge and culvert modeling
- Riverine numerical modeling
- 2D hydraulic modeling
- Watershed studies
- Scour analysis and countermeasure design
- Waterway permitting
- Floodplain analysis and flood map revisions

## Stormwater & Site Design

- Act 167 stormwater management plans
- NPDES permits
- Erosion and sediment pollution control plans
- Low impact development design
- Post-construction stormwater management plans

## GIS

- Modeling
- Mapping and analysis
- Utility management
- Authority asset management

## Bridge Design & Inspection

- Single- and multi-span structures
- Box and arch culverts
- Rehabilitation strategies
- Retaining and sound barrier walls
- Fatigue and fracture critical inspection
- Load ratings (traditional and gusset plate)

## Transportation Design

- Geometric design
- Temporary Signals
- Traffic maintenance and protection plans
- Storm sewer (drainage) designs
- Alternatives analysis

## Technical Training & Course Development

*PennDOT:*

- H&H and Permitting Procedures
- Introduction to Hydrologic Methods & Modeling with WMS
- Advanced WMS Applications
- Introduction to Hydraulics and HEC-RAS
- Advanced HEC-RAS and Scour Analysis
- *PennDOT Drainage Manual* Overview
- Highway Drainage Design
- Stormwater Management Design and NPDES Permits
- Erosion and Sediment Control Design
- Maintaining Stormwater BMPs: Procedures and Design Considerations
- PennDOT Culvert Design Procedures
- Introduction to Highway Hydraulics

**NTM Engineering, Inc.** 717.432.4425 ❖ www.ntmeng.com

Dillsburg, PA ❖ State College, PA ❖ Philadelphia, PA

# PennDOT H&H Professional Development Series and Drainage Professional Development Series

**Client:** PennDOT
**Location:** Statewide
**Reference:** Kimberly Rice, Project Manager, (717)783-4722

Training H&H Stormwater Highway

NTM Engineering developed and instructs PennDOT's highly rated Hydrologic and Hydraulic (H&H) Professional Development Series and the Highway Drainage Professional Development Series. These Series were PennDOT's first customized series ever developed.

The training courses, 10 out of 12 of which were developed by NTM, focus on PennDOT practices and specifications. The courses are geared toward engineers responsible for designing, analyzing, and permitting highway stream crossings and drainage systems.

The H&H Series is a sequence of five customized courses related to H&H design and permitting of highway bridges and culverts. The Drainage Series aims to incorporate recent changes in PennDOT policies and technical guidance (e.g., PennDOT's *Drainage* and *Design Manuals*, and PA DEP's *Stormwater BMP Manual*) and the interpretation and enforcement of environmental regulations into practical courses.

Since 2007, NTM has instructed over 127 courses across Pennsylvania. Past course attendees have included participants from:

- Every PennDOT Engineering District
- All PA Department of Environmental Protection regional offices
- U.S. Army Corps of Engineers
- PA Department of Conservation and Natural Resources
- PA Fish and Boat Commission
- Consultants from over 50 engineering firms

NTM is a National Council of Examiners for Engineering and Surveying Registered Continuing Education Provider (NCEES RCEP).

**"This is perhaps the best training course that I have ever attended in the 20+ years at PennDOT.... Thank you!"**

*~ Anonymous comment from course evaluations, supplied by PennDOT*

## KEY PROJECT FEATURES

### H&H Series Courses:

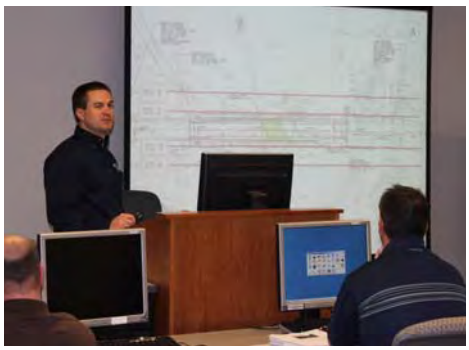
- PennDOT H&H and Permitting Procedures
- Introduction to Hydrologic Methods and Modeling with WMS
- Advanced WMS Applications
- Introduction to Hydraulics and HEC-RAS
- Advanced HEC-RAS and Scour Analysis

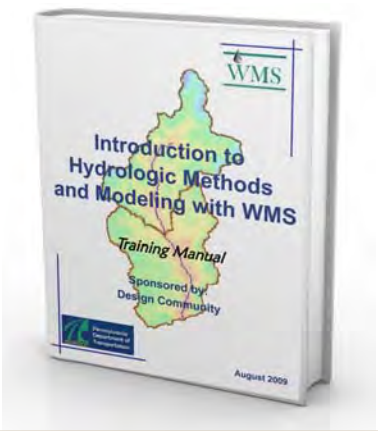
### Drainage Series Courses

- PennDOT *Drainage Manual* Overview
- Highway Drainage Design
- Stormwater Design & NPDES Permits
- Erosion & Sediment Pollution Control Design
- Maintaining Stormwater BMPs: Procedures & Design Considerations

### Additional Courses:

- Culvert Design Procedures
- Introduction to Highway Hydraulics






**NTM Engineering, Inc.** 717.432.4425 ❖ www.ntmeng.com

Dillsburg, PA ❖ State College, PA ❖ Philadelphia, PA

# BMPs for Erosion and Sediment Control Plans

## Selecting and designing BMPs using the *PA DEP Erosion and Sediment Pollution Control Program Manual*

A critical component of any land development or highway plan and the NPDES permit is the Erosion and Sediment Control (E&S) Plan. Inadequate design of E&S best management practices (BMPs) results in plan re-submissions and project delays, while over-design leads to unnecessary project costs. Eliminate multiple plan submissions and reduce your client's project costs by attending this course, which focuses on the selection and design of E&S BMPs using the *PA DEP Erosion and Sediment Pollution Control Program Manual*.

Every participant will receive a course binder containing annotated lectures and step-by-step instructions for designing E&S BMPs.

Lecture topics include:

- Proper selection and cost-effective design of various E&S BMPs.
- Design considerations in special protection watersheds and areas adjacent to streams and wetlands.
- Cost savings opportunities.

Upon successful completion of the course, attendees will be able to:

- Identify cost-savings opportunities associated with E&S Plans.
- Avoid common design errors that result in plan re-submissions.
- Design various types of perimeter sediment controls.
- Select and design appropriate channel lining.
- Locate and design sediment basins and traps.
- Properly size rock outlet protection.
- Modify BMP specifications in sensitive areas.

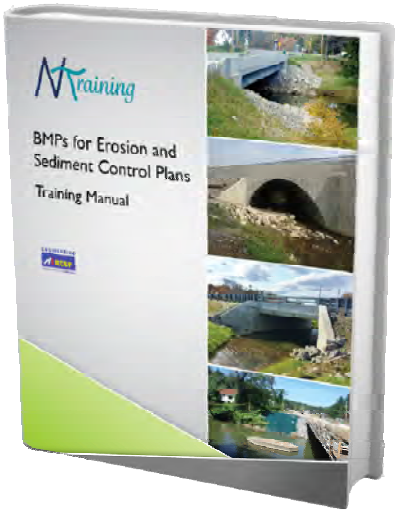
**14 PDHs**

**NTM Training Center**
**130 W. Church Street**
**Suite 100**
**Dillsburg, PA 17019**

**$750 per person**

**$650 for early bird registration, or for two or more from the same firm.**

**For more information, please visit *www.ntmtraining.com***




NTM is a National Council of Examiners for Engineering and Surveying Registered Continuing Education Provider (NCEES RCEP).

# Bells Mill Run Stream Restoration Project
# Functional Credit Gain Assessment

**Client:** Philadelphia Water Department
**Location:** Philadelphia, PA
**Reference:** Erik Haniman, 1101 Market Street, 4th Floor, Philadelphia, PA 19107, (215)685-4877

H&H

NTM Engineering assisted with an open-end Natural Stream Channel and Wetland Design, Assessment, & Monitoring contract for the Philadelphia Water Department. Part of a work order involved completing a functional credit gain assessment for the Bells Mill Run, a tributary to the Wissahickon Creek, Stream Restoration Project, which was designed and permitted under a previous contract with the Department. The project finished construction in 2012, so a functional credit gain assessment was needed.

NTM provided personnel with stream assessment experience to help with the field data collection. NTM personnel provided:

- Pebble counts;
- Cross-section surveys;
- Restoration feature identification and condition assessments;
- Riparian vegetation assessments;
- Macroinvertebrate surveys; and
- Any necessary additional field services.

NTM personnel also compiled data, downloaded photos, and prepared field equipment, along with providing project management and task coordination.

## KEY PROJECT FEATURES

- Data collection
- Stream assessment
- As-built verification

# Poquessing Creek Watershed Stream Assessment Report

**Client:** Philadelphia Water Department
**Location:** Philadelphia, PA
**Reference:** Marc Cammarata, PE, 1101 Market Street, 4th Floor, Philadelphia, PA 19107, (215)685-4948

H&H GIS

## KEY PROJECT FEATURES

- Data collection
- GIS mapping
- Hydrologic modeling
- Hydraulic modeling

Under a Natural Stream Channel and Wetland Design, Assessment, & Monitoring contract for the Philadelphia Water Department, NTM Engineering assisted with the assessment of streams within the Poquessing Creek Watershed. The resulting report described the watershed with its land use, geology, and soil characteristics and geographic information systems (GIS) maps detailing the multiple sub-watersheds, land use, geology, and soils.

To implement the stream assessment, NTM utilized cross-section surveys, cross-section extension surveys, Unified Stream Assessment Method (USAM) worksheets, photographs, longitudinal profiles, bankfull calibrations, pebble counts, Mecklenburg worksheets, sinuosity calculations, canopy covers, infrastructure track downs, narrative descriptions, and GIS mapping.

The Poquessing Creek Watershed Stream Assessment included the sub-watershed reaches, as in Figure 1.

| Sub-watershed | Reaches |
|---|---|
| Upper Poquessing Creek | 39 |
| Middle Poquessing Creek | 54 |
| Lower Posquessing Creek | 8 |
| Black Lake Run | 3 |
| Upper Walton Run | 14 |
| Lower Walton Run | 6 |
| Upper Byberry Creek | 35 |
| Lower Byberry Creek | 3 |

***Figure 1***

NTM compared the field observed bankfull elevations (from 2007 and 2012) and resulting discharge developed utilizing the Manning's equation with two other hydrologic sources, including a regional curve for urban areas and the Poquessing Creek Act 167 Plan discharges. USAM results were summarized to describe in-stream habitat, vegetative protection, bank erosion, floodplain connection, buffer condition, vegetated buffer width, and floodplain vegetation, habitat, and encroachment. The design team utilized this information to develop the "best fit" discharge at each cross-section. We also analyzed the Poquessing Creek Stream Gage discharges using David Rosgen's "Step Wise Procedure for Calibrating Bankfull Discharge at USGS Stream Gage Stations." Based on historic land use data, the stream gage rating was compared to land use development over time to demonstrate how the increase in impervious surface affected the stream's hydrograph and bankfull frequency.

The design team developed detailed recommendations that addressed channel stability and infrastructure and habitat and ranked the recommendations based on channel instability, habitat

availability, floodplain connection, threatened infrastructure, and riparian buffer quality to prioritize restoration reaches. The rankings were also mapped to provide a visual aid in restoration planning.

NTM performed GIS, field streambank assessment, and hydrologic and hydraulic (H&H) tasks for this stream assessment project.

# Sandy Run and Benton Brook Stream Corridor Restoration

**Client:** Philadelphia Water Department

**Reference:** Rick Howley, Manager, Ecological Restoration Unit, (215)685-6034

**Location:** Philadelphia, PA

H&H

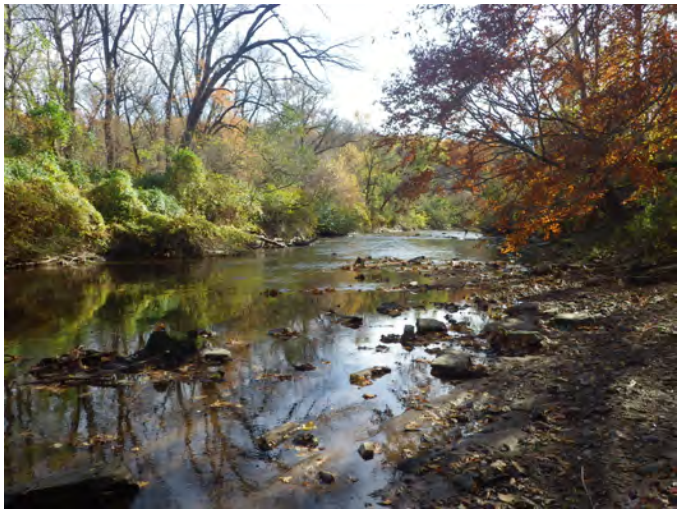
## KEY PROJECT FEATURES

- H&H analysis was performed to restore and enhance stream banks and ecosystems
- Hydrologic SWMM model developed for each watershed to the project sites

The study area for Sandy Run includes the reach of Sandy Run downstream approximately from the Pennypack Creek to 350 feet upstream of Ryan Avenue and includes the Ryan Avenue bridge. This area is in a FEMA approximate floodplain (Zone A). The study area for Benton Brook includes a 1,650-foot reach of Benton Brook from an outfall near Evarts and Large Streets to its confluence with the Pennypack Creek. This lower portion of Benton Brook is in a detailed FEMA (Zone AE) with a floodway. The drainage area to the study site is approximately 0.34 square miles and is highly urbanized and storm sewered.

A hydrologic and hydraulic (H&H) analysis was performed for this project to restore and enhance Sandy Run and Benton Brook's stream banks and ecosystems. NTM was responsible for the hydrologic analysis and proposed condition hydraulic modeling using the HEC-HMS and HEC-RAS models respectively. A requested by PWD, a hydrologic stormwater management surface runoff model (SWMM) was developed for each watershed to the project sites.

The required physical features of the watershed (DEM, soils, land cover, etc.) was created in GIS and/or WMS to develop the parameters required for a hydrologic model. The NRCS curve number method was utilized. For the stream reach analysis, surveyed cross section data was required for HEC-RAS transect data in order to properly analyze flow velocities and stability.



**NTM Engineering, Inc.** 717.432.4425 ❖ www.ntmeng.com

Dillsburg, PA ❖ State College, PA ❖ Philadelphia, PA

# Tacony Creek Stream Corridor Restoration – Reaches 4 and 5

**Client:** Philadelphia Water Department
**Location:** Northeast Philadelphia, PA
**Reference:** Erik Haniman, Aramark Tower, 2nd Floor 11th & Market Sts., Philadelphia, PA 19107, (215)200-5233

H&H

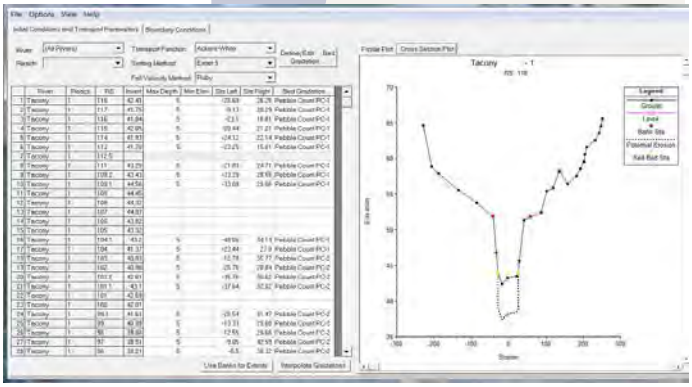
## KEY PROJECT FEATURES

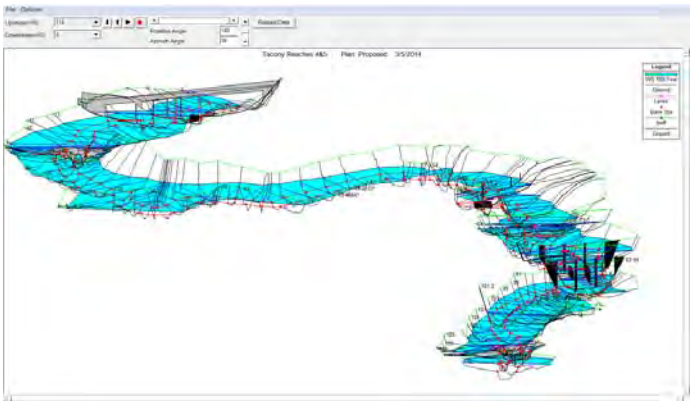
- ❖ Data collection
- ❖ GIS mapping
- ❖ Hydrologic modeling
- ❖ Hydraulic modeling

NTM Engineering assisted with restoring and enhancing Reaches 4 and 5 of the Tacony Creek Park's ecosystem and Philadelphia Parks and Recreation (PPR) Multi-use Trail beneath Roosevelt Boulevard (US1). As part of its restoration and green initiatives, the Philadelphia Water Department intends to restore the Tacony Creek stream corridor, which extends from Cheltenham Avenue on the upstream extent down to Castor Avenue on the downstream extent. Tacony Creek is an impaired, urban stream subject to regular combined sewer overflows and flashy hydraulics. The project's goals were to:

- ❖ Provide for public health/safety, while enhancing recreational and natural experiences for visitors
- ❖ Strengthen the links among the park and its neighborhoods via green infrastructure gateways
- ❖ Reduce sediment accumulation and downstream scour at bridges
- ❖ Improve the corridor's habitat quality and diversity and the Creek's water quality
- ❖ Protect existing infrastructure and limit new structures
- ❖ Utilize green designs and materials and reduce life-cycle impacts
- ❖ Preserve, protect, and interpret historical features within the park
- ❖ Avoid increases to the 100-year floodplain and provide additional flood storage

NTM developed the project's hydrologic and hydraulic (H&H) model (SWMMS and HEC-RAS) and determined the Creek's inflow hydrographs, combined sewer overflow, and surface water discharging into the project area. Since NTM personnel helped to develop the Tookany/Tacony/Frankford Creek Act 167 Stormwater Management Plan, our engineers were very familiar with the watershed's existing modeling and data.





NTM created the HEC-RAS hydraulic model that integrated both reaches. Bridge and structure data was acquired. Project survey data provided the channel and floodplain topography and structure geometry. Our hydraulic engineers determined Manning's n values in the field. Water surface profiles were modeled for a range of flows, including 1-, 1.5-, 2-, 5-, 10-, 25-, 50-, and 100-year recurrence interval flows and included an analysis of the effects of the proposed PPR trail on water surface elevations. Velocity distributions were then developed and sediment transport modeling was performed to assist with the stream restoration.

# I-80 Reconstruction Open End

**Client:** PennDOT District 5-0

**Reference:** Christopher Kufro, Assistant District Executive, (610)871-4575

**Location:** Borough of Stroudsburg, Monroe County, PA

## KEY PROJECT FEATURES

- H&H memo for various alternatives for transporation improvements to I-80, Section 17M
- Hydrologic computations, including stream gage analyses
- Hydraulic modeling for existing and proposed alternatives for four bridges

NTM prepared a Hydrologic and Hydraulic (H&H) Memo for various alternatives for transportation improvements to I-80, Section 17M located in the Borough of Stroudsburg, Monroe County, Pennsylvania. NTM performed Hydrologic computations, which included stream gage analyses. There is a stream gage on the Pocono Creek, two gages on the McMichael Creek and one on Brodhead Creek. The period of record varies, and some data was dated; therefore, the appropriate period of record was determined for each gage. Regression methods were also analyzed and compared to the gage data, FEMA flows, and Act 167 flows that were modeled.

Hydraulic modeling was performed for the existing condition and two proposed alternatives for each of the four bridges (Pocono, Little Pocono, McMichael, and Brodhead). In addition, there was potential for floodplain encroachment with road widening from the crossing of Pocono Creek downstream where the Pocono Creek parallels I-80 and the SR 209 interchange to the West Main Street interchange, a distance of approximately 3,300 feet; therefore, additional existing and two alternatives analyses for this 3,300-foot section of Pocono Creek was also included in the conceptual hydraulic models and were compiled into a H&H memo. NTM was responsible for project management, H&H set up, computations, agency meetings, and QA/QC. (E02656)

# F. Anticipated Fee for Scope of Services

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## PROPOSED SCOPE OF SERVICES

As stated in the Request for Qualifications for Professional Services and as replicated below, we agree that the minimum scope of services for this project includes:

***Deliverable #1 - Data Collection:***

i. Site Visit and Determine Survey Limits
ii. Selection of Reference Reach
iii. FGM Stream and Topographical Survey
iv. Review Available Data and Prepare Initial Condition Plan and Report
v. Prepare Wetland Delineation and Report

***Deliverable #2 - Preliminary Design:***

vi. Prepare Preliminary Design Drawings and Riparian Planting Plan
vii. Develop Project Estimates and Cost

***Deliverable #3 - Final Design and Permitting:***

viii. Develop Hydrology and Hydraulics Design
ix. Perform Geotechnical and Slope Analysis
x. Develop a Grading Plan
xi. Pre-application Meetings for Permitting
xii. Prepare Erosion and Sediment Control Plan
xiii. Prepare and Submit NPDES Permit Applications
xiv. Prepare and Submit Section 404 / Chapter 105 Joint Permit Applications

***Deliverable #4 - Construction Documents:***

xv. Prepare Technical Specifications
xvi. Prepare Construction Drawings
xvii. Prepare Long-Term Monitoring /Operation & Maintenance Plan

## ANTICIPATED FEE

We anticipate that an appropriate baseline fee for this project is ***$80,000.00*** as shaped by the Suggestions, Recommendations, and Assumptions that are outlined in Requirement G.

Please note that this is a baseline fee for design services to meet the minimum obligations noted in the Scope of Services outlined above. As we have come to know throughout our decades of providing natural stream channel design services, various unforeseen circumstances may arise in the course of executing design projects. Factors such as updated regulations, threatened and endangered species listings and delistings, cultural resource investigation requests, invisible subsurface conditions, utility coordination, regulatory agency staff changes, and evolving site conditions all come to bear on the ultimate cost of a natural resource restoration project. With these factors in mind, we feel that it would be prudent to consider a potential project budget range of ***$80,000.00*** to ***$140,000.00***. More discussion on the potential project budget range is included in Requirement G.

# G. Suggestions, Recommendations or Assumptions

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

## PROJECT UNDERSTANDING

The principal objectives of this design and permitting project are to 1) develop a "construction-ready" restoration design plan for the referenced project and 2) apply for federal and state waterway permits required for the project and NPDES permits as necessary for project impacts. The work scope below covers all aspects of design and permitting, from initial site assessment to the provision of detailed design plans and specifications for bidding and construction.

Major baseline work efforts for this project include development of a detailed topographic base map for the project site (or those portions where active restoration will take place) and a delineation of jurisdictional wetlands in all proposed project areas along this reach and access paths which might be potentially impacted by the proposed restoration activities. All background information required for a Joint Application for Pennsylvania Department of Environmental Protection (PA DEP) Water Obstruction and Encroachment Permit and Unites States Army Corps of Engineers (USACE) Section 404 Permit will be obtained in this project.

## MINIMUM SCOPE OF SERVICES [BASELINE FEE STANDARD]

The following is a minimum list of tasks necessary to provide the deliverables identified in the Request for Qualifications.

### Deliverable #1 – Data Collection

- Acquire background information required for the design (e.g., existing mapping, historical maps, contacts, utility information, etc.).
- Establish site controls (benchmarks) and create a topographic base map (utilizing aerial flight mapping techniques and traditional surveying, as required) of the affected stream corridor and access paths suitable for the design plan. The map will show utilities, existing wooded areas, structures, delineated wetland boundaries, and other site features pertinent to the design. LiDAR mapping may be utilized to supplement the field topographic work.
- In accordance with Pennsylvania regulations, register a Design Phase OneCall to identify underground utilities that may be present on the site.
- Conduct a detailed stream corridor FGM assessment and measure the cross section and profile of the stream for design purposes, for both the project reach and an acceptable reference reach. The cross sections and profile will be used to provide details in the construction drawings. Other relevant morphological information describing transition zones in the upstream and downstream channel and riparian zone condition will also be collected as necessary for design.
- Reduced and compiled physical channel data collected from FGM stream survey will be used to create a morphological chart that describes the physical properties of the stream.
- Acquire additional site information relevant to the design and permitting, including the jurisdictional wetland delineation (and supporting documentation) and a description of site habitats and natural resources. Additional investigations required for permitting include notifications to the Pennsylvania Historical and Museum Commission (cultural resources) and a review of the Pennsylvania Natural Diversity Inventory (threatened and endangered species).
- This project is within the upper boundary of Bog Turtle Habitat assessment requirements. The minimum habitat assessment will be conducted coincident with the wetland and watercourse delineation activities.

### Deliverable #2 – Preliminary Design

- Using information gathered and created in the above deliverable, refine and develop the conceptual design of the proposed improvements. The conceptual design will be presented to key stakeholders for comment and revisions.
- Provide a conceptual level Engineer's Cost Estimate.

**Deliverable #3 – Final Design and Permitting**

- Prepare a Hydrology and Hydraulic Analysis for review by PA DEP. This analysis is a required component of the permit application.
- Prepare an Erosion and Sediment Pollution Control Plan for review by the assigned entity in lieu of Monroe County Conservation District. Erosion and sediment control drawings showing Best Management Practices will be created along with an erosion and sediment control narrative.
- Prepare a Post-Construction Stormwater Management Plan (PCSM) including drawings and supporting calculations.
- Prepare and process NPDES application through the assigned entity in lieu of the Monroe County Conservation District concurrently with the Erosion and Sediment Pollution Control Plan.
- Prepare final (construction-ready) design drawings with all necessary base mapping, profiles, sections, details, notes and specifications.
- Prepare and process Joint PA DEP/USACE Permit application.

**Deliverable #4 – Construction Documents**

- Address regulatory feedback or requirements and update final design drawings, details, notes and specifications as a result of final regulatory coordination and approval of permits.
- Compile and provide a complete set of construction documents to Monroe County Conservation district to begin bidding and construction processes.

**SUGGESTIONS AND RECOMMENDATIONS**

- Based on observations made during the pre-bid site meeting, the soils appear to consist of glacial till/ stratified drift comprised of sand, silt and larger stone. We presume that this material was obtained locally as displayed from the obvious borrow and bench area surrounding the historic railroad embankment. We recognize that a slope stability analysis will suggest slope angles that are stable and that provide an arbitrary factor of safety. However, we feel that these slopes will remain too steep to best provide for a fully restored stream corridor that would support vegetative development. Therefore, unless required by a regulatory agency, we suggest the elimination of any substantial geotechnical exploration (deep borings, soil extractions, shear testing, etc.), and defer to a limited geotechnical analysis based upon limited soil grab samples and laboratory analysis. While we do feel that a slope stability analysis is warranted (and is included within our scope of work), we offer that the “hands-on” experience of a geotechnical engineer will prove exceptionally valuable in this situation.

**ASSUMPTIONS (BASELINE FEE STANDARD)**

- Electronic files will be sufficient for deliverables.
- The majority of the Site Survey will be conducted Unmanned Aerial Vehicle (UAV, or drone) survey methods. To provide appropriate detail for design, traditional survey methods will be required to supplement aerial survey methods in limited areas that may be obstructed by vegetation.
- Fluvial Geomorphology measurements and survey will be limited to the project stream reach and will be conducted in a manner consistent with Natural Channel Design methodology. A downstream reference reach will not be surveyed because Skelly and Loy will rely on publicly available and internal historical reference reach data for similar valley and stream types.
- It has been our experience that established access roads and equipment access paths may be excluded from the calculated Limits of Disturbance for the purpose of determining NPDES permit eligibility. We also recognize that the former borrow pits may be utilized for disposal of the excavated slopes from the project site. Excluded disturbances for established roads coupled with restoration of former grades within

borrow pits will aid in reducing overall disturbance footprints outside of the purview of 25PA105 regulations. In this case, we assume that an NPDES permit application will not be required.

- Wetland delineation and habitat evaluation will be conducted from the access point to the general project area. We assume that bog turtle habitat is not present within the zones required for evaluation based on the anticipated project area.
- H&H Analysis will be limited to basic evaluative methodologies (Manning's analysis) used in previous projects, assuming that previous allowances for limited H&H requirements associated with stream restoration in Northeast Pennsylvania remain acceptable to regulatory review agencies.
- It is anticipated that there will be one phase of E&S activities illustrated on the E&S plan.
- Water Management within the E&S plan can be accomplished with a temporary bypass pump.
- It is assumed that PA DEP will process the application on behalf of the USACE as a Pennsylvania State Programmatic General Permit (PASPGP).
- FEMA map revisions are not necessary.
- Regression estimates are suitable for the purposes of the hydrology analysis.
- Specifications on drawings will be suitable for construction purposes. A stand-alone specification package (using divisions or similar format) is not necessary for this project.