Section II-5 Personnel

PERSONNEL – THE PROJECT TEAM

A brief description of the team members and their specific skills and experience will serve to demonstrate that this team is the best possible combination of professionals to produce the required document, and more importantly to translate and communicate this information to both the technical community and the public.

Cahill Associates

Michele Adams, P. E. – Ms. Adams has developed a reputation as expert in the field of stormwater management during her eighteen year career, engaged both with Cahill Associates and R. F. Weston, where she helped to design and permit a number of stormwater management systems as part of the NPDES Phase I program in the early 1990's. During the past five years, she has directed a number of stormwater management design projects for a mix of public and private clients, including Ford Motor Co. and ALCOA, as well as academic institutions such as UNC, PSU, UVA, URI and others. Ms. Adams will serve as Project Manager for this document, and share in the communication of the information with PADEP staff and other experts, a role she is presently filling through state and local contracts.

Thomas H. Cahill, P. E. – Founder and Principal Engineer of Cahill Associates, Inc., he has devoted his entire 40-year career to the issue of water quality, and the specific impacts of non-point source pollution. From early water quality modeling research in the Upper Delaware River to the various watersheds of Chester County and the Brandywine Creek in PA, followed by several years of similar applied research devoted to the Great Lakes and specifically Lake Erie, Mr. Cahill has written dozens of papers and reports on NPS pollutant transport and generation mechanisms, including the earliest efforts to derive NPS loading models from GIS-derived spatial data. For the past twenty-three years, he has designed and built stormwater management systems that infiltrate runoff, rather than simply detain, convinced that this approach was a better solution to the problem of both runoff volume and water quality. His designs with porous AC pavement led the way to practical site designs using this material, and over the past twenty years, he has become the national leader in the design of infiltration systems for stormwater management. Current concepts include the combination of stormwater management with vegetated roof technology, incorporating solar energy and light pollution.

Wesley Horner, P. P. – Mr. Horner brings some thirty years of experience to the subject of stormwater management from a land planning perspective, and has led similar report document preparation for both CA and the Brandywine Conservancy, serving as the principal author of the Delaware BMP Manual and the Sustainable Watershed Management Plan for Northern Chester County. His other experience covers numerous projects and studies, as listed in the detailed resume, but he may best be identified as the originator of the concept of "Minimum Maintenance/Minimum Disturbance", a non-structural approach to stormwater management that minimizes the impact of land development of the site. Mr. Horner will serve a Principal Planner for this Project, a role that he has filled numerous times during his career.

GeoSyntec

Eric Strecker, P. E. – Mr. Strecker is a recognized authority in the area of stormwater management, especially in the design, monitoring, and evaluation of best management practices (BMPs). For the past 17 years, Mr. Strecker has provided technical direction and assistance to public and private sector clients in stormwater master planning, National Pollutant Discharge Elimination System (NPDES) permitting and surface water pollution assessment and control. This work has included conducting applied National and local research studies for US EPA and the Federal Highway Administration, as well state and local governments throughout the western United States.

Steven Roy, P. S. – Mr. Roy has over 22 years of professional experience in the field of environmental program management and administration specializing in water resources management, stormwater management, and environmental impact assessment. He has 12 years of experience in conducting and managing environmental consulting projects and 10 years in managing and administrating state and federal environmental programs and assessments. His work focuses on the assessment of water resource impacts from land use activities.

Low Impact Development Center, Inc.

Neil Weinstein, P. P. – As Executive Director of the Low Impact Development Center, Inc., a non-profit water resource research organization, Mr. Weinstein has focused his professional interests on advocating better ways to reduce the impact of development on both land and water resources. Mr. Weinstein has over 20 years of experience in water resource research, planning, and design. This includes development of national policy documents on Best Management Practices (BMP's) and Total Maximum Daily Loads (TMDL's), stormwater and wetlands models, water conservation, stream restoration, watershed master plans, NPDES permitting, and site design.

Roofscapes

Charles Miller, P. E. – As one of the co-authors of the original PA BMP Manual some eight years ago, Mr. Miller has focused his recent efforts on the development of vegetated roof systems, bringing this technology from Europe as the founder of *Roofscapes*. He is both an expert hydrologist and engineer, and will support the overall document preparation, but his key role here will be to integrate the vegetated roof technology in the BMP Manual, as both a new construction and retrofitting BMP in highly urbanized communities where infiltration is not feasible.

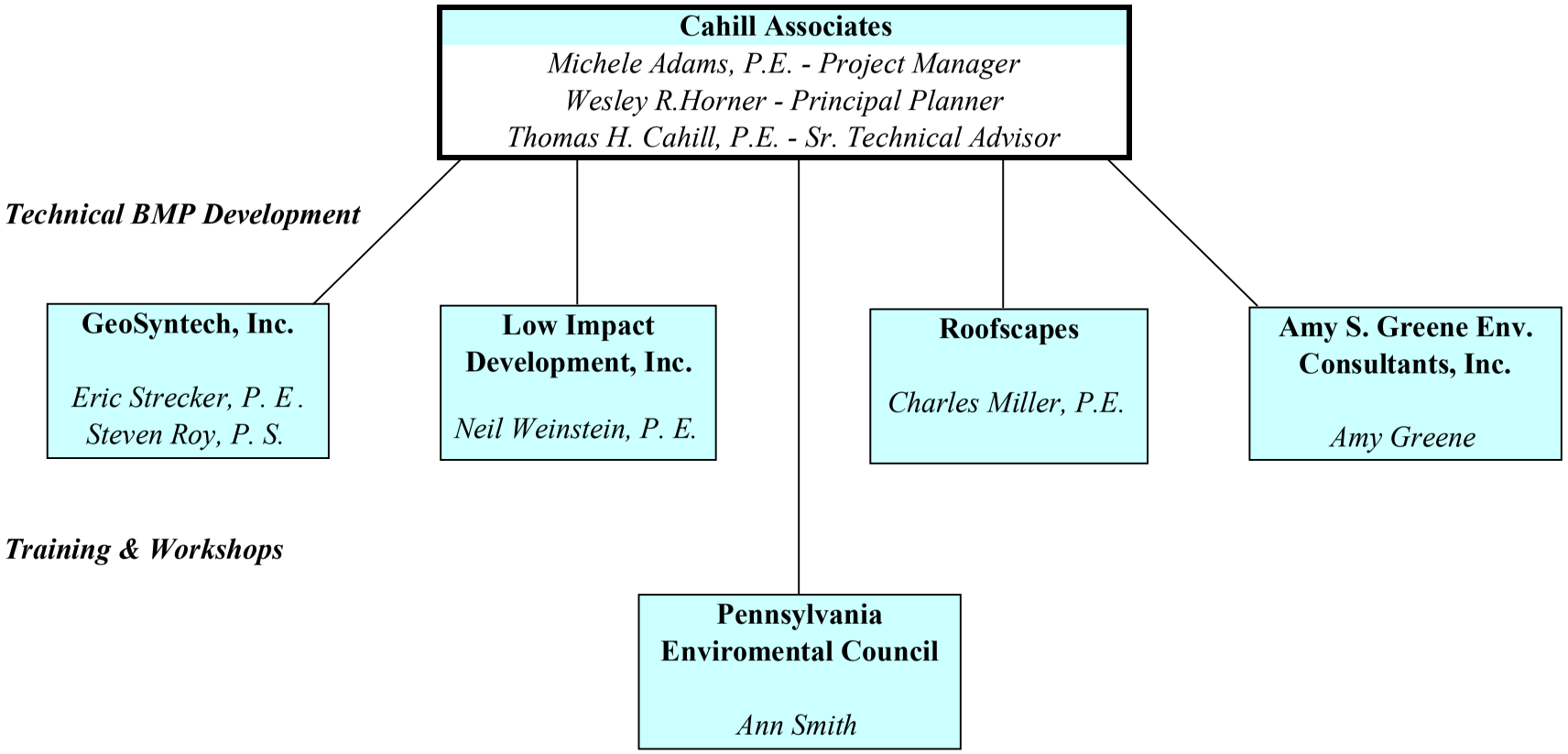
Amy S. Greene Environmental Consulting, Inc.

Amy Greene – Ms. Greene is a recognized expert in the field of wetland science, natural resources inventory, and environmental impact assessment. As principal-in-charge of all projects for ASGECI, Ms. Greene has managed and performed wetland delineations, prepared successful State and Federal permit applications and prepared mitigation plans for coastal and inland wetlands. The ASGECI experts will research and document this specific area so that the measure finds appropriate application and consideration in the Manual. ASGECI qualifies as SERB subcontractor, and the firm's supporting documentation is provided in Submittal B, Section II-8, SERB Information.

Pennsylvania Environmental Council

Ann Smith – Ms. Smith, PEC's Director of Watershed Programs, is a senior staff member with the Pennsylvania Environmental Council. Her responsibilities include managing projects relating to water resource policy outreach and education, exemplified by the current PEC-sponsored stormwater management short course training being conducted with Cahill Associates specifically targeting municipal officials. With an undergraduate degree in business and finance and graduate degree in natural resources management, Ms Smith participates in a wide variety of PEC programs statewide, including their innovative program promoting formation of an Environmental Advisory Council Network.

Pennsylvania BMP Manual
Project Team
Key Project Team Members



Michele C. Adams, P.E.
Principal Environmental Engineer

Education
B.S., Civil Engineering — Pennsylvania State University (1984)
Graduate Coursework in Water Resources Villanova University

Registration
Registered Professional Engineer:
Delaware
Pennsylvania
Virginia
North Carolina
Maryland

Employment

1984-1991	Cahill Associates
1991-1997	Roy F. Weston, Inc.
1997- present	Cahill Associates

Experience Summary

- Eighteen years of experience in civil and water resources engineering.
- Sustainable site design engineering, including Stormwater Best Management (BMP) techniques (porous pavement, infiltration trenches, subsurface storage and recharge, vegetated roofs, etc) and alternative wastewater treatment systems (wetlands, drip irrigation, recirculating filters).
- ·Design of stormwater management systems, watershed studies, evaluation of non-point source pollutants, development of pollution prevention programs, wastewater and stormwater sampling, and stream flow monitoring.
- Development of NPDES permit applications, mixing zone analyses, water quality studies, and sampling programs.
- Hydrologic Analyses and mathematical computer modeling, including CORMIX, HEC-RAS, DAMBRK, PSRM, TR20, PENTOX, HSPF, SWMM and TR55.

Ms. Adams is a Principal with Cahill Associates with over eighteen years of professional experience in water resources engineering, including stormwater management and site design; watershed studies; hydraulic and hydrologic computer-based mathematical modeling; National Pollutant Discharge Elimination System (NPDES) permit applications and permit negotiations; analysis of receiving stream capabilities and mixing zone analyses; development of water quality sampling programs; stream flow monitoring; and ecological and human health risk assessments of surface water pathways.

Much of Ms. Adams work involves Sustainable Site Design Engineering, including alternative stormwater management techniques (porous pavement, infiltration trenches, subsurface storage and recharge, vegetated roofs, etc) and alternative wastewater treatment systems (wetlands, drip irrigation, recirculating filters). Recent design projects include the Penn State/Centre County Visitor Center, which incorporates numerous sustainable design concepts. This project was the recipient of a Pennsylvania Growing Greener Grant to provide continuing education and research at the site, and to serve as a demonstration site for alternative stormwater management techniques. Ms. Adams was also the design engineer for a similar stormwater system at the Penn State Berks Campus.

Other recent design projects that feature stormwater Best Management Practices such as porous pavement or vegetated roofs include the Ford Rouge Plant in Dearborn, MI, UNC Chapel Hill in North Carolina, Fort Necessity National Monument, Grey Towers for the National Forest Service, the Washington National Cathedral in D.C., the John Heinz Refuge at Tinicum, PA, and the Penn New School in Philadelphia. Ms. Adams was the design engineer for a porous pavement project (East Whiteland Township) that was recognized by the American Society of Civil Engineers and the Pennsylvania Society of Professional Engineers as a 2001 Outstanding Engineering Achievement. Additionally, Ms. Adams is the stormwater design engineer for numerous commercial or residential projects that incorporate stormwater BMPs.

Ms. Adams also serves as a frequent Lecturer or Instructor for sessions on Stormwater Management presented by various state agencies or professional organizations. Current professional presentations include Stormwater Management for Municipal Officials sponsored by PaDEP and The Pennsylvania Environmental Council (multiple locations and dates in 2003), the Southeastern Pennsylvania Engineering Seminar sponsored by the Southeastern PA Conservation Districts (Feb 27 and 28, 2003), and a session on New Jersey's Proposed Stormwater Regulations sponsored by NJDEP and the Delaware Riverkeeper (February 14, 2003). Ms. Adams has served as an instructor for continuing education credit courses sponsored by ASCE, as well as sessions for municipal officials and engineers sponsored by PSATs.

Most recently, as part of the Northern Chester County Watersheds Sustainable Watershed program, Ms. Adams completed the detailed modeling of future impacts of development on stormwater, wastewater, water supply, and the water budget. Ms. Adams has worked closely with the municipalities to present this information at public meetings and to address future planning issues. In the Rockaway River watershed of Morris County New Jersey, Ms. Adams worked with the Rockaway River Cabinet and municipal officials to address issues of stormwater and watershed management in a rapidly developing area. At UNC Chapel Hill Ms. Adams worked to develop a stormwater program on the campus to manage stormwater to address both volume and quality issues, including compliance with local and state watershed requirements, as the campus undertakes a major expansion program.

For four years, Ms. Adams served as a consultant to the City of Philadelphia Division of Aviation to assist the City in developing a stormwater management program for the Philadelphia International Airport (PHL) and Philadelphia Northeast Airport (PNE). Ms. Adams worked with the City and the airport tenants to develop and implement a program to reduce the discharge of deicing fluids and other pollutants to the Delaware Estuary.

Between 1992 and 1996, to meet the requirements of the stormwater NPDES permitting process, Ms. Adams developed and implemented stormwater sampling programs at over fifty industrial, commercial, and military facilities throughout the United States. Ms. Adams has also conducted regulatory compliance evaluations at the various facilities, and developed stormwater pollution prevention plans to reduce the discharge of pollutants to stormwater. Additionally, Ms. Adams developed and instructed employee training sessions to increase awareness of non-point pollutant sources, and to reduce the discharge of materials to stormwater.

As part of the Combined Sewer Overflow Program, Ms. Adams completed a hydrologic and hydraulic analysis of the Combined Sewer System of the City of Chester, Pennsylvania using the US EPA Stormwater Management Model (SWMM). A key element of this effort was to apply the model and GIS to estimate not just the combined sewer overflow rates, but the associated pollutant loads from the combined sanitary and stormwater discharges. This analysis was used to develop the Long Term Control Plan for the City of Chester combined sewer system to assess the impact of the combined discharges on the Delaware Estuary, and to define measures to reduce the discharge of pollutants in the stormwater component of the combined sewer overflows.

She has performed the modeling for a number of stormwater studies which integrate the use of a GIS database with hydrologic and hydraulic models, and which address the issues of both quantity and water quality. For the Neshaminy Creek Basin Act 167 Plan in southeastern Pennsylvania, Ms. Adams participated in the development of a GIS to evaluate existing and future land use conditions, and in the application of the TR-20 computer program to evaluate the hydrologic response of the watershed under existing and future land use conditions. Other hydrologic and hydraulic watershed studies which integrate the use of the GIS and the modeling efforts have included the Act 167 Tununguant Creek Watershed study in northern Pennsylvania, the Pasco County Watershed study in Florida**,** and the Kensico Watershed in New York. Ms. Adams has also performed floodway analysis studies on a number of river systems including the Schuylkill River and the Allegany River.

In Prince Georges County, Maryland, Ms. Adams conducted a hydrologic evaluation of two streams for the design of a 23-acre wetlands mitigation area. This analysis was performed using the mathematical computer models TR20 (SCS) and HEC-2 (U.S. Army Corps of Engineers), and included evaluation of both flood conditions and low flow (7 Q10) to determine the minimum hydrologic requirements to support the wetlands mitigation area. Ms. Adams has also performed numerous hydrologic and hydraulic analyses relating to stream encroachment permits and floodplain analyses.

Ms. Adams has also conducted numerous studies relating to receiving stream capabilities, mixing zones, and NPDES permitted discharges. Ms. Adams performed a mixing zone analysis using the U.S. Environmental Protection Agency's (EPA) mathematical computer model CORMIX to determine the appropriate effluent temperature limitation of an industrial discharge to the Delaware Estuary, and worked with the NJDEPE and the Delaware River Basin Commission (DRBC) to assess the impacts of the discharge on the Delaware Estuary. Ms. Adams conducted a similar study for a discharge to the Chesapeake Bay. This discharge was the result of environmental remediation efforts, and Ms. Adams worked with both the State of Maryland and the U. S. Army Corps of Engineers to design an underwater diffuser to minimize the environmental impacts on the Bay and maintain water quality criteria. Ms. Adams has conducted several other similar hydrodynamic

studies in Pennsylvania, Delaware, and New Jersey to assess the impacts of discharges on receiving streams and to develop the appropriate stream monitoring programs.

In addition to professional experience, Ms. Adams currently serves on the Planning Commission and Municipal Authority in East Vincent Township, Chester County, PA.

Professional Affiliations

American Society of Civil Engineers
National Society of Professional Engineers
American Water Resources Association

Publications and Presentations

Doing It the Right Way with Infiltration BMPs, presented February 14, 2003 at the NJ DEP and Delaware Riverkeeper program on New Jersey's Proposed Stormwater Regulations.

Innovative Stormwater Management at the Penn New School, presented at the AWRA National Conference, November 5, 2002.

Sustainable Stormwater Management at UNC Chapel Hill, presented at the AWRA National Conference, November 7, 2002

Porous Bituminous Pavement: A Stormwater Best Management Practice, presented at the 1999 Southeastern Pennsylvania Stormwater Management Symposium, Villanova University

Sustainable Site Design, presented at the AIA Growing Greener Conference, Chatenooga, TN, October 1999

Innovative Stormwater Management, presented at the Pennsylvania State University Stormwater management Seminar, June 1999

Stormwater Best Management Practices, presented at the 1997 Pennsylvania Stormwater Management Symposium, Villanova University.

Technical Issues in Preparing NPDES Permit Applications, presented at the Pennsylvania Bar Institute *New Era of Water Quality Seminar*, March 1997.

Stormwater Monitoring Programs, presented at the Pennsylvania State University Stormwater Runoff and Quality Management Symposium, September 1994.

Thomas H. Cahill, P.E.
Principal Environmental Engineer

Education

B.S.C.E. Civil Engineering (Sanitary), Drexel University, 1962
M.S.C.E. Civil Engineering (Water Resources), Villanova University, 1968

Registrations

Registered Professional Engineer in Delaware, New Jersey, Pennsylvania
Registered Professional Planner in New Jersey

Summary of Experience

Mr. Cahill, Principal Environmental Engineer and President, Cahill Associates (CA), has over 40 years of professional experience in water resources engineering, hydrology, hydraulics, natural resource planning, and environmental engineering, including over 25 years in private practice. Mr. Cahill is nationally known as an expert and leader in the field of stormwater management and sustainable design. He has pioneered the use of innovative stormwater management techniques such as porous pavement and infiltration technologies, with innovative design systems dating back to the 1970's. For the US Environmental Protection Agency, he has served as a consultant in the development of innovative techniques for stormwater management in coastal drainage systems, developed for the 6217(g) program's "Management Measures For Sources of Nonpoint Pollution in Coastal Waters" (1993). For the State of New Jersey, he prepared a "Manual of Stormwater Management for the New Jersey Coastal Zone (1989)" and the 1992 follow-up report, "Limiting Nonpoint Source Pollution from New Development in the New Jersey Coastal Zone", featuring hydrologic and chemical modeling based on a Geographical Information System (GIS). Currently, Mr. Cahill is working in the Rockaway and Whippany watersheds of New Jersey to develop Sustainable Watershed Management Programs for these two watersheds. His design projects include facilities for the National Park Service, National Forest Service, US Fish and Wildlife, universities, industry, and numerous commercial sites. Currently, Mr. Cahill is involved in developing Sustainable Site Designs for Ford Motor Company, Microsoft, Disney World Hong Kong, Alcoa Industries, and the City of Philadelphia.

Mr. Cahill has been a leader in developing approaches to site planning and land use that recognize the natural values of the landscape and resources. These include approaches to protect and enhance valuable features in vegetation, topography, and water resources to improve the human use of the site. He has served as an adviser to the US Green Building Council in developing the LEEDS criteria for Sustainable Design Practices, as well as to state and regulatory agencies in developing standards for stormwater management and land use. He is currently working with the New Jersey DEP to revise stormwater management criteria in that state.

Most recently, Mr. Cahill received an award winner from the American Society of Civil Engineers and Pennsylvania Society of Professional Engineers in the 2001 Engineering Achievement Awards for his development of innovative stormwater management techniques

including porous pavement. Mr. Cahill is the author of over 100 technical papers and publications relating to land use, stormwater management, and water quality, and a frequent lecturer at environmental and engineering conferences.

From 1995 through 2000, Mr. Cahill has directed studies of sustainable watershed management in the French, Pickering, Pigeon Creek, and Stony Run watersheds in the Schuylkill River basin of southeast PA. This work includes development of a GIS data base, development of a groundwater base flow model for land use analysis, hydrologic and chemical transport modeling and wasteload impact evaluation, as well as regulatory strategy recommendations to maintain water quality criteria. He is currently directing the Implementation of this program in the 17 municipalities. A key element of this work is the development of a Model Stormwater Ordinance for adoption by the local governments.

For the University of Virginia, Mr. Cahill was instrumental in developing a water resources management plan to address and mitigate the existing and future stormwater impacts at the University. This effort included quantitative and qualitative modeling through the use of a GIS, and focused on the use of BMP's and land use recommendations, including the re-establishment of major stream channels and riparian restoration.

In southeast Pennsylvania's Upper Perkiomen Creek watershed, Mr. Cahill directed a comprehensive study of pollutant impacts on water quality in a large reservoir system and developed methods for reduction of stormwater generated loadings from various pollutant sources, again assessed through a GIS database.

For the Bucks County Planning Commission and the PA Department of Environmental Resources, Mr. Cahill completed a detailed study on stormwater management in the Neshaminy Creek Basin. The entire watershed was modeled for both hydrologic response and nonpoint source pollution using a GIS system. This study included evaluation of nonpoint source pollution impacts on 8 multi-purpose reservoirs. Land use ordinances to address stormwater management were developed for and adopted by 35 municipalities within the watershed.

Mr. Cahill has served as a leader in the application of sustainable design principles on a number of environmentally sensitive site designs, focusing on all water resource elements, including water supply, wastewater recycling, and stormwater management. Most of these projects have included the use of porous pavement with groundwater recharge or alternative methods of stormwater management, as well as alternative wastewater systems such as wetlands or woodland infiltration. Recent projects include Grey Towers National Historic Site, Fort Necessity National Monument, John Heinz National Wildlife Refuge, Temenos Retreat Center, and the Pennsylvania State University Visitor Center. Past work includes projects for DuPont, Shared Medical Systems, Bell Telephone, SmithKline, Merck, and many others.

Mr. Cahill regularly speaks at professional conferences on the issues of sustainability and stormwater management. Recently, Mr. Cahill has contributed to the development of “Sustainable Stormwater Management Criteria” as developed by LEEDS, and is a contributor to several recent publications on Green Building Design.

Mr. Cahill has served as a special consultant and expert witness for numerous clients, appearing in more than 90 court cases and legal proceedings. He is the author or co-author of over 70

professional papers and has lectured at many colleges and universities, primarily in the fields of hydrology, water quality, and pollution control.

1974-1979 Principal Engineer and President, Resource Management Associates

Mr. Cahill managed a team of professional engineers and scientists who worked on public and private water quality, environmental impacts, and pollution control projects in 15 states. Of special significance was the Lake Erie Wastewater Management Study (LEWMS), under direction of the US Army Corps of Engineers. RMA served as special consultant to the COE, developing water quality modeling and data base development based on remote sensing imagery. Similar macro-scale water quality projects were performed for regional planning agencies in Detroit, Toledo, and other regions. Research studies, using special water quality models developed by RMA, were also conducted for EPA's Environmental Research Laboratory by Mr. Cahill and his staff.

1972-1974 Director of the Environmental Management Center of the Brandywine Conservancy, Chadds Ford, PA

Mr. Cahill administered major programs in applied environmental research for the Conservancy, including land easements, environmental ordinance development, and an interdisciplinary water quality research program. He also served as principal investigator on water quality research. The impact of land use on water quality, nutrient dynamics in riverine systems, mathematical modeling of river basins, use and application of continuous monitoring instrumentation, and the optimization of wastewater systems in river basins were major research topics. Mr. Cahill specialized in studies of geochemical weathering and development of water quality and land data systems.

1969-1972 Director of Environmental Engineering and Laboratory, Chester County Health Department

Mr. Cahill's initial responsibilities included organization of programs, staff, and facilities to carry out the County's environmental enforcement program in water pollution control and solid waste disposal. He directed the formation of the Environmental Engineering Laboratory, primarily for water and wastewater analysis. He also served as special consultant on eutrophication for the US Army Corps of Engineers, evaluating reservoir conditions.

1966-1969 Project Engineer, Roy F. Weston, Inc., West Chester, PA

Mr. Cahill was responsible for the design of various municipal and industrial waste treatment facilities, including process evaluation, equipment selection, and site investigation. The facilities design work included both biological and chemical treatment processes for wastewaters containing acid and alkaline wastes, as well as other chemical processes. He served as project engineer for investigation of water supply, fire protection, and sanitary systems at several large industrial complexes and developed computer programs for hydraulic analysis. He served as project engineer for an engineering study of water supply and wastewater treatment systems for a 1,000 square mile region surrounding the proposed Tocks Island Reservoir on the Delaware River.

1962-1966 Project Engineer, Naval Facilities Engineering Command, Philadelphia, PA and San Diego, CA

Mr. Cahill performed planning and design for a wide variety of engineering projects, including detailed design, cost estimates, and feasibility studies. He served as design engineer for treatment facilities at a mining operation in western Pennsylvania. Other projects included water supply and waste treatment facilities in Southern California, New Jersey, Delaware, and North Carolina. His administrative responsibilities included management of design projects performed by engineering consultants.

Professional Affiliations

National Society of Professional Engineers
Pennsylvania Society of Professional Engineers
Professional Engineers in Private Practice
Water Pollution Control Federation
Soil Conservation Society of America
Association of Ground Water Scientists and Engineers
North American Lake Management Society

Publications

Cahill, et al., 1998. *GIS applications in the Analysis of Nonpoint Source Pollution*. T.H. Cahill, M. Adams, J. Cassels and M. Cahill, in GIS Applications for Stormwater and Nonpoint Sources, Am. Water Resources Assoc., Ann Arbor Press, Feb. 1998.

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Cahill, et al., 1996. *Sustainable Watershed Management at the Rapidly Growing Urban Fringe*. T. H. Cahill, J. McGuire, W. R. Horner, and R. D. Heister, at Watershed, 96, Balt. Conv. Ctr., Balt., MD. June 8-12, 1996.

Cahill, et al., 1996. *Protecting, Restoring and Maintaining the Hydrology of Natural Stream Corridors in the Urban Environment*. T. H. Cahill, Society for Ecological Restoration Conf., Paved to Protected: Restoration in the Urban/Rural Context, Rutgers Univ., New Brunswick, NJ, June 21, 1996.

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Cahill, 1994. *The Impact of Coastal Drainage on Shallow Water Habitats and Possible Management Solutions.* T.H. Cahill, W.R. Horner, J. McGuire, M. Sauter and T. Hanna, Estuarine and Marine Shallow Water Habitats Conference in the Mid-Atlantic Region: Session III, Impacts and Assessments in Shallow Water Habitats, Absecon, NJ, March 8-11, 1994.

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Cahill, 1994. *GIS Watershed Application in the Analysis of Nonpoint Source Pollution.* T.H. Cahill, W.R. Horner, J.S. McGuire, EPA; National Conference on Environmental Problem-Solving with Geographic Information Systems, Cincinnati, Ohio, September, 1994.

Cahill, 1994. *The Role of Land Use Management in Watersheds Which Drain to Reservoirs.* T.H. Cahill, W.R. Horner, J. McGuire, Lake and Reservoir Management; an International journal of the North American Management Society, Volume 9, No. 2, October 1994.

Cahill, 1993. *Hydrologic and Water Quality Modeling with Geographic Information Systems.* T.H. Cahill, J. McGuire and C. Smith, Geographic Information Systems and Water Resources: American Water Resources Association, March 1993.

Cahill, 1993. *Using Geographic Information Systems to Develop Best Management Practice Programs for Watershed Management: Case Studies in the Delaware River Basin.* W.R. Horner and T.H. Cahill, Proceeding Watershed ’93: A National Conference on Watershed Management, Cahill Associates, West Chester, PA, March 21-24 1993.

Cahill, 1992. *Limiting Nonpoint Source Pollution from New Development in the New Jersey Coastal Zone: Summary.* T.H. Cahill, W.R. Horner, J.S. McGuire, and C. Smith, NJDEP; S. Whitney and S. Halsey, Cahill Assoc., West Chester, PA, September, 1992.

Cahill, 1992. *Structural and Nonstructural Best Management Practices for the Management of Non-Point Source Pollution in Coastal Waters: A Cost-Effectiveness Comparison.* T.H. Cahill and W.R. Horner, The Coastal Society; Thirteenth International Conference: Conference Proceedings Organizing for the Coast, Washington, D.C., April 1992.

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Cahill, T.H. and J. Richman, Esq., 1987. *Cost Benefit Analysis and Alternatives PA-614 Dark Hollow Dam, Neshaminy Basin, Bucks County,* For Neshaminy Water Resources Authority, Jamison, PA, May, 1988.

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Sandoval, M., T.H. Cahill, and F.H. Verhoff, 1975. *Mathematical Modeling of Nutrient Cycling in Rivers.* ACS, Div. Of Environmental Chemistry, Philadelphia, PA.

Bliss, N., T.H. Cahill, E.B. MacDougall, and C.A. Staub, 1975. *Historical Trends in Water Quality in the Brandywine Basin.* Tech. Paper 1, Tri-County Conservancy of the Brandywine, Chadds Ford, PA.

Hammer, T.R., T.H. Cahill, and C.A. Staub, 1975. *Land Use Impacts on Water Quality.* Tech. Paper 11

Cahill, T.H., P. Imperato and F.H. Verhoff, 1974. *Evaluation of Phosphorus Dynamics in a Watershed.* ASCE, Journal of Div. Of Environmental Engineering, 100:EE2, Proceedings Paper 10445.

Cahill, T.H., P. Imperato, P.K. Nebel, and F.H. Verhoff, 1974. *Phosphorus Dynamics in a Natural River System.* AIChE Symposium Series 145, Vol. 71, New York, NY.

Cahill, T.H., 1973. *The Potential of Water Quality Problems in the Proposed Tocks Island Dam Reservoir.* In "The Tocks Island Dam: A Preliminary Review." Save the Delaware Coalition, Philadelphia, PA.

Cahill, T.H., 1972. *The Application of Continuous Monitoring to Water Quality Models.* In "Water Quality Instrumentation." Inst. Soc. Of America, Vol. 2, Pittsburgh, PA

Cahill, T.H, 1972. *The Impact of Development on the Environmental of Chester County.* Land Use on an Ecological Basis Symposium at West Chester University, West Chester, PA.

Cahill, T.H.,1968. *The Potential for Cultural Eutrophication in the Tocks Island Reservoir.* Masters Thesis, Villanova University, 1968

Wesley R. Horner, A.I.C.P.
Principal Planner

Education

Master of City and Regional Planning, 1975
Harvard University, Graduate School of Design, Cambridge MA
Bachelor of Arts, 1971
Haverford College, Haverford PA

Professional Affiliations

American Planning Association, Member
Pennsylvania Planning Association, Member
American Institute of Certified Planners
American Water Resources Association

Professional Experience

Cahill Associates, West Chester, PA, 2000

Directs planning and GIS projects, including watershed studies, river conservation plans, special resource-based planning projects. For the Lehigh Valley Planning Commission as part of the Pennsylvania Department of Environmental Protection's Act 167 Stormwater Management Program, manages preparation of the Best Management Practice Manual and Infiltration Feasibility Report: Infiltration of Stormwater in Areas Underlain by Carbonate Bedrock. Manages the Darby Creek River Conservation Plan, a complex State planning program involving 31 municipalities in four counties with 500,000 residents. He directs planning in the Sustainable Watershed Management program in northern Chester County and southern Berks County municipalities (14 in total), where focus is on application of water quantity and water quality models to ensure that ultimate watershed build out maintains water resource standards and criteria under stressed conditions; he has developed a program of model ordinances for implementation of the SWM program, presented to the Delaware River Basin Commission as an Integrated Resources Plan. He directed the new comprehensive planning process for Radnor Township, Delaware County and is managing a series of special outreach training courses teaching stormwater management to municipal officials, being undertaken with the Pennsylvania Environmental Council. He has spoken at major conferences and professional events and authored and co-authored numerous technical papers.

Associate Director

Environmental Management Ctr. Brandywine Conservancy, Chadds Ford, PA 1996-2000

Directed Municipal Assistance Group projects, including preparation of municipal plans and ordinances. Managed the Conservancy's Environmental Management Assistance Program, the two-volume *Environmental Management Handbook*, subscribers meetings, and the technical newsletter *Environmental Currents*. He directed the Conservancy's Water Based Land Use Regulation Program, integrating critical land use and water resource management functions, through application of WATBUG, the Conservancy's unique climatic water budget simulation model. Prepared innovative stormwater and wastewater management plan elements for individual development proposals, for municipalities, and on the watershed level. Co-authored *Conservation Design for Stormwater Management*, a

manual of innovative natural system-based stormwater practices commissioned by the State of Delaware. Has authored numerous professional papers delivered at national environmental, engineering, planning conferences throughout the county.

Project Manager
Cahill Associates, West Chester PA, 1982-89, 1991-1996

Senior Environmental Planner
Chester County Planning Commission, West Chester PA, 1989-1991

Manager of Planning
WAPORA/Jack McCormick and Associates, Berwyn PA, 1978-82

Senior Planner
Delaware County Planning Department, Media PA, 1977-78

Planner
BCM (Betz Converse Murdoch Engineers), Plymouth Meeting PA, 1975-77

Noteworthy Projects

Mr. Horner has participated in a broad array of projects for both government and private sector clients. His most recent experience and expertise is focused in several major work areas:
Environmental Planning, Stormwater/Nonpoint Source Management, Watershed Planning, Wellhead Protection, 537/302/208 Wastewater and Water Supply Planning:

- For the New Jersey Dept. of Environmental Protection and Energy, prepared a stormwater management manual for New Jersey coastal drainage areas, focusing on water quality constituents such as nutrients, hydrocarbons, metals, and other nonpoint source pollution sources.

- For the U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration, participated in program development for Congressionally mandated Coastal Zone Management Act Amendments of 1990. Focus of this work was on preventive and cost-effective nonstructural nonpoint source management measures to be imposed on state coastal regulatory agencies.

- Managed the Ridley Creek Stormwater Management Plan Phase 1 process, Chester County's first stormwater management plan under the PA Stormwater Management Act, which involved 20 municipalities in both Chester and Delaware Counties.

- At the direction of London Grove Township, Mr. Horner analyzed Township hydrology, geology, other relevant factors to define appropriate stormwater standards in a revised municipal ordinance. Issues included determination of the volumetric criteria for recharge, adequacy of recharge criteria for peak rate control, and water quality requirements in this rapidly growing municipality where maintaining White Clay Creek baseflow was essential.

- Engineered a comprehensive water resource-based development concept for Chester County's largest proposed mixed use development, Churchill, at the direction of the Brandywine Conservancy and other environmental groups. Concept reflected an integrated watershed management approach, including stormwater, wastewater, water supply and important natural functions of the Brandywine Creek.

- Researched spray irrigation technology functioning in SE Pennsylvania; prepared and published a report on spray irrigation of wastewater effluent for Chester County Commissioners.

- Evaluated Philadelphia Water Department's wastewater, water supply, and stormwater facilities operations with focus on impact of new Federal and State regulations, including new EPA policies on Combined Sewer Overflow problems and improved management of stormwater systems, as required pursuant to new NPDES stormwater permit program. Delivered expert testimony summarizing findings for City Advocate as part of 1992 Rate Adjustment Hearings.

- For Hudson Riverkeeper, developed nonstructural alternatives for proposed $7 billion construction of new water filtration facilities for New York City water supply system. Emphasis was on the Catskill watershed portion, where development was contributing both point and nonpoint pollutant sources to eutrophying reservoirs (Cannonsville). Recommendations were reported to EPA's Carol Browner, including flow-weighted water quality criteria to be used as basis for nonstructural watershed management program, complying with Federally mandated Safe Drinking Water Act water quality standards.
- Participated in numerous 537 and 201 wastewater facility plans in Pennsylvania, other Middle Atlantic States.

- Organized Chester County program for wellhead protection under the Federal Safe Drinking Water Act Amendments, involving County Planning Commission, Health Department, and Water Resources Authority; planned a wellhead protection seminar for 73 municipalities; prepared planning bulletin on municipal program development.

Comprehensive Planning, Land Use, and Impact Analysis:

- Directed multi-phased research project on transfer of development rights for the William Penn Foundation, inventorying Pennsylvania TDR applications and developing a manual for TDR success.

- For the Watershed Association of the Delaware River (Riverkeeper), developed a watershed management program for the 4-county/18-municipality Upper Perkiomen Watershed, where major concern was protection of the over-enriched Green Lane Reservoir (part of the Philadelphia Suburban Water Company System). Water quality sampling and analysis revealed significant point source pollutant load reductions, but increasing nonpoint source loads from new land development, malfunctioning onsite septic systems, agricultural sources. Tiered "bottom-up/top-down" management strategies were developed, targeting existing and projected pollutant sources.

- Directed land use, socioeconomics, cultural resources studies for controversial EIS for proposed railroad in Niagara County, NY.

- Completed environmental report for proposed new rail line in Presque Isle, Maine and environmental assessment for proposed abandonment of B&O rail line in Washington DC/Montgomery County MD.

- Studied major land use and socioeconomic effects of re-use of 2,500-acre Raritan Arsenal in Edison NJ, involving disturbance of extensive wetlands areas and formulation of multi-phased mitigation plan.

Regulatory and Institutional Analysis:

- Inventoried and analyzed existing codes and ordinances in 38 municipalities in Bucks and Montgomery Counties, as part of Act 167 stormwater management process for Neshaminy Creek Watershed; researched model comprehensive water resources ordinances, including all aspects of stormwater, wastewater, and water supply.

- Developed Historic District mechanism for five municipalities in Gettysburg Battlefield area to preserve cultural resource values and guard against induced growth impacts.

- Designed innovative fast-track NPDES permit process for EPA's regulation of West Virginia coalfields.

- Participated in numerous municipal zoning litigations and curative amendment proceedings.

- Prepared the financial/institutional/legal/management work modules for regional 208 water quality management reports in Pennsylvania, Alabama, South Carolina as well as numerous 201 wastewater facility plans in eastern United States.

- For CONRAIL, researched alternative disposition approaches for their historically certified railroad bridge over the Hudson River at Poughkeepsie NY, including demolition costs, capital and operating costs of rehabilitation, and other re-use options.

Socioeconomics, Fiscal Analysis, Demographics:

- For CONRAIL, researched alternative disposition approaches for their historically certified railroad bridge over the Hudson River at Poughkeepsie NY, including demolition costs, capital and operating costs of rehabilitation, and other re-use options.

- For EPA, analyzed employment and population projections for sewage facility projects in Milwaukee WI, Pennypack/Central Montgomery County PA, Bushkill/Lehigh and Northampton Counties PA, Patuxent/Anne Arundel County MD, Gettysburg/Adams County PA, Horsham PA, Chalfont/New Britain PA, Buckingham PA, Mobile AL, and Kent County DE.

- Performed fiscal impact studies as part of major land development proposals, including Winston Towers, Cliffside Park NJ; Sterling One, Orange County NY; Rolling Hills, Springfield PA; Fox Trail Farms, Newtown Square PA; Sciolla Townhouses, Cheltenham PA; Mid-County Village, Marple Twp. PA

Andrew L. Potts, E.I.T.
Project Manager

Education

Master of Science Civil Engineering
University of Virginia, Charlottesville, VA, 2000
Bachelor of Science Physics, Minor Mathematics
Ursinus College, PA, 1997

Professional Experience

Mr. Potts has extensive experience in water resources, stormwater management, and sustainable site design applications. While employed by the University of Virginia, he assisted in the development of the Nitrate Total Maximum Daily Load (TMDL) for Muddy Creek/Dry River, the first TMDL approved in Virginia encompassing significant point and nonpoint sources of pollution. Mr. Potts utilized surface and ground water monitoring and computer modeling in his master's thesis work, *Impact of Hydrological Calibration on Water Quality and Watershed Management* (University of Virginia, 2000).

Since joining Cahill Associates in 2000, Mr. Potts has focused on sustainable site design, innovative stormwater management, hydrologic analyses, development plan reviews, watershed studies, and water resource based presentations. He is skilled in the utilization of both drafting and GIS software, especially AutoCAD and ArcInfo. Mr. Potts is currently supporting projects for the University of North Carolina, US Fish and Wildlife Service, Lehigh Valley Planning Commission, University of Rhode Island, Wegmans, and the Aluminum Company of America. He has also co-authored several articles on stormwater management through infiltration, porous pavement, infiltration on limestone, and watershed modeling.

Relevant Projects

2002 University of North Carolina, Estes Drive Parking Lot, Chapel Hill, NC
Provided design and construction oversight for a new 300-vehicle porous parking lot (250 in porous asphalt, 50 in porous concrete) with subsurface infiltration. One of the first porous asphalt applications in North Carolina, completed August 2002.

2002 US Fish and Wildlife Service, John Heinz Nation Wildlife Refuge, Philadelphia, PA
Providing construction administration for the stormwater management system for the National Environmental Education Center that includes a porous asphalt parking lot with infiltration beds, bioretention basins, and bioswales. Under construction August 2002.

2002 Lehigh Valley Planning Commission, Infiltration Stormwater BMP Manual, Little Lehigh Creek Watershed, PA
Primary author of "Detailed How to Design Infiltration BMPs over Limestone" section of "Technical Best Management Practice Manual & Infiltration Feasibility Report: Infiltration of Stormwater in Areas Underlain by Carbonate Bedrock within the Little Lehigh Creek Watershed," Draft – November 2002.

2002 University of North Carolina, Friday Center Parking Lot, Chapel Hill, NC
Assisted in the design and construction inspection of a new 700-vehicle porous parking lot with infiltration beds. Due to the expected usage as well as existing conditions (topography and soils), the facility incorporates a combination of porous and standard asphalt and concrete over multiple infiltration beds. Constructed Summer 2002.

2002 Stormwater Management Retrofits, Radnor Township, PA
Designed porous and standard pavement with subsurface infiltration beds to retrofit two existing office complexes for Radnor Township.

2002 University of North Carolina, Rams Head Development, Chapel Hill, NC
Designing an innovative stormwater management system for the 400,000+ SF Rams Head Center development project. The system includes storage/infiltration beds, a vegetated rooftop plaza irrigated with stored rainwater, water quality bioswales, and a daylighted stream channel.

2001 Environmental and Civil Site Design, Beth Am Israel Synagogue, Penn Valley, PA
Designed a stormwater management system that utilizes subsurface storage/infiltration, stabilized vegetated overflow parking areas, and a bio-filtration area to alleviate flooding and minimize non-point source pollution while encouraging ground water recharge.

2001 University of North Carolina, Stormwater Management Program, Chapel Hill, NC
Provided technical services to design and implement a stormwater management plan for the main campus of UNC-CH. The Program includes an evaluation of current and proposed conditions on campus and identification of specific projects for implementation.

Publications and Presentations

"Infiltration Bmp Manual For A Challenging Environment: How To Infiltrate On Limestone," to be presented at EWRI's World Water & Environmental Resources Congress 2003.

"*Infiltration BMPs*," presented at New Jersey's Proposed Stormwater Regulations: Get up to Speed *Fast*! February 14, 2003.

Key technical author of "Technical BMP Manual: Infiltration of Stormwater in Areas Underlain by Carbonate Bedrock within the Little Lehigh Creek Watershed" prepared for the Lehigh Valley Planning Commission, November 2002.

"*Nitrate TMDL Development: The Muddy Creek/Dry River Case Study*," Water Resources Update, Universities Council on Water Resources, Issue No. 122: March 2002.

Adams, M., Cahill, T., and Potts, A. *"The Hydrology of Stormwater Management Technologies: Detention vs. Infiltration,"* as presented in the Southeastern Pennsylvania Stormwater Symposium at Villanova University, Villanova, PA October 2001.

Potts, Andrew. *Impact of Hydrological Calibration on Water Quality and Watershed Management*. University of Virginia, Charlottesville, VA, 2000.

Daniel P. Wible, E.I.T
Project Manager

Education

B.S. Civil Engineering, Villanova University, 2000
M.S. Water Resources and Environmental Engineering, Villanova University, 2001

Professional Experience

Mr. Wible has extensive experience in the research and design of stormwater Best Management Practices (BMPs). As a graduate student at Villanova University, he was heavily involved in the research and maintenance of the converted wetland BMP on the campus. This work involved the overall maintenance of the site, the preparation of a laboratory for future water quality testing, continuous collection of flow and rain gauge data, data analysis, and the development of a website.

Since joining Cahill Associates in 2000, Mr. Wible has focused on sustainable site design, innovative stormwater management, and hydrologic analysis. He has designed several porous pavement and infiltration systems, as well as an innovative wastewater treatment system, all in keeping with sustainable site design. He is skilled in a variety of technical software, such as AutoCAD and HEC-HMS (Hydrologic Modeling System). He has also amassed considerable experience in construction administration and field testing. Currently, Mr. Wible is involved in the design of projects for St. David's Episcopal Church in Radnor, PA, Warrington Square in Bucks County, PA, the University of Rhode Island, the Wayne Arts Center, and the Springside School in Philadelphia.

2002 Porous Parking Lots at the University of North Carolina, Chapel Hill, NC
Designed two expansive porous parking lots, with subsurface storage and infiltration capabilities. The two lots, totaling more than 9 acres in surface area, were comprised of both porous bituminous asphalt and porous concrete. The subsurface beds were designed to alleviate flooding, minimize non-point source pollution, encourage ground water recharge, and provide substantial research opportunity for the university.

2002 Porous Parking Lots at the University of Rhode Island, Kingston, RI
Designed an 800-car, porous pavement parking lot directly across from the new convocation center. This porous system, complete with subsurface stone reservoir, was designed to greatly reduce flooding, minimize non-point source pollution, encourage ground water recharge, as well as provide substantial research opportunity for the university.

2002 Washington National Cathedral, Washington D.C.
Designed an innovative stormwater management system that utilizes multiple subsurface infiltration trenches and beds, as well as various stream stabilization measures. This system has resulted in greatly reduced flooding downstream of the site and is recharging the receding water table in the Olmstead Woods.

2002 Porous Pavement Pathways at Swarthmore College, Swarthmore, PA
Designed two porous pavement pathways with subsurface infiltration trenches on the campus. The porous pathways promote infiltration, ground water recharge, reduced downstream flooding, and decreased non-point source pollution. The paths are also being used as a tool for education on sustainable site design.

2001 Innovative Stormwater Management at Penn-Alexander Public School, Philadelphia,PA
Designing a stormwater management system that utilizes porous pavement with subsurface storage/infiltration, vegetated swales, and bioretention pond; designed to alleviate flooding, minimize non-point source pollution, and encourage ground water recharge.

2001 Porous Concrete Plaza at Villanova University, Villanova, PA
Assisted in the design of a stormwater management system that utilizes porous concrete and subsurface storage/infiltration; designed to alleviate flooding, minimize non-point source pollution, encourage ground water recharge, and provide substantial research opportunity for the university.

Research Experience

2000-2001 Conversion of an Urban Stormwater Detention Basin to a Wetland Best Management Practice
Responsible for the overall maintenance of site, continuous collection of flow and rain gauge data, development of project website, wetland planting, and data analysis.

Publications and Presentations

Adams, M., Cahill, T., and Wible, D. "*Infiltration BMPs: Porous Pavement and Beyond,*" as presented at the Environmental & Water Resources Institute's World Water and Environmental Resources Congress 2003, Philadelphia, PA June 2003.

Adams, M., Brien, C., Neukrug, H., and Wible, D. *"Innovative Urban Stormwater Management at the Penn New School,"* as presented in the American Water Resources Association's 2002 Annual Water Resources Conference in Philadelphia, PA November 2002.

Wible, Daniel, Marchetti, Brian. 2001, Conversion of an Urban Stormwater Detention Basin to a Wetland Best Management Practice, website (no longer posted); Villanova University, Villanova, PA.

Wible, Daniel. 2001, Bartley Plaza – Stormwater Recharge Beds, website (no longer posted): Villanova University, Villanova, PA.

Susan A. McDaniels
Project Scientist – GIS Manager

Education

Master of Science Water Resources and Environmental Engineering
Villanova University, Villanova, PA, (in progress)
Bachelor of Science Biology-Ecology, Minor Geography
West Chester University, West Chester, PA, 1998

Professional Experience

Ms. McDaniels has a background in ecology and has extensive experience in experimental design, field sampling, and ecological assessment. In her present position with Cahill Associates, Ms. McDaniels has been working in the area of spatial information, utilizing Geographic Information Systems (GIS) in environmental problem solving and planning. She is proficient in the use of GIS software, specifically ArcInfo and ArcView. She has worked on numerous projects with Cahill Associates as the GIS coordinator and is responsible for, GIS data compilation and creation, data analysis, quantitative modeling, as well as data documentation and presentation. She was a principal developer of the interactive GIS - Water Balance model developed by Cahill for the Green Valleys Association. Ms. McDaniels understands the power of GIS as a tool, and the need to put this power in a form that can be used and understood by watershed stakeholders.

Ms. McDaniels also has extensive experience in watershed planning efforts in Pennsylvania and New Jersey. She has worked closely with local government and watershed stakeholders and has lead informational meetings to educate the community about the water quality and quantity effects of development and the use of stormwater BMPs. She has managed several water resource studies and planning efforts that focus on sustainable watershed management.

2002 University of North Carolina Stormwater Management Plan, Chapel Hill, NC
Ms. McDaniels designed, created, and updated a GIS database and model for the campus. This information was used to evaluate impervious and pervious surfaces for hydrologic modeling. The model generated stormwater volume and pollutant loading estimates for existing conditions as well as future conditions as anticipated over an 8-year development plan period. Additionally, the GIS was used to model the effectiveness of recommended stormwater management alternatives.

2000 Upper and Middle Neshaminy River Conservation Plan, Bucks County, PA
Ms. McDaniels served as project manager with the Delaware Riverkeeper Network to develop a DCNR funded River Conservation Plan for the Upper and Middle Neshaminy Creek Watershed. She worked closely with the Plan's steering committee and municipal committee to develop a comprehensive water resource plan that is highly focused on pertinent issues in the Neshaminy, particularly stormwater management. Ms. McDaniels played the primary role in obtaining municipal and public feedback through all stages of plan development.

2002 Plumstead Township Detention Basin Retrofit, Bucks County, PA

Ms. McDaniels served as project manager with Plumstead Township to evaluate the detention basins in an existing large lot residential development within the township. The purpose of the evaluation was to retrofit the detention basins to control stormwater volume and to maximize water quality benefits. The development is located in an impaired watershed (Pine Run) that is listed on the State 303(d) list. Ms. McDaniels worked closely with the township to develop a retrofit design that utilizes stormwater infiltration trenches placed outside the basins (where the soils were not compacted) to capture and infiltrate a portion of the total runoff generated from the site. The retrofit also incorporates basin outlet modifications that will detain smaller storm events and vegetative elements within the basin to increase water quality benefits.

2001 Pine Run Watershed NPS Pollutant Assessment, Bucks County, PA

Ms. McDaniels designed and created a GIS database and model to perform a non-point source pollutant runoff analysis for the Pine Run Watershed. This model estimated nonpoint source pollution loadings based on land use and established pollutant reduction scenarios specific to the watershed. Ms. McDaniels co-authored a report to present the model results to the client and municipal stakeholders. Currently, she is designing a retrofit of a conventional detention basin to an infiltration basin in order to demonstrate the effectiveness of infiltration for stormwater management in the watershed.

2000 Valley Creek Detention Basin Retrofit: Chester County, Pennsylvania

Utilized spatial data and conducted field visits to determine ideal locations to retrofit dry detention basins to allow infiltration. Prepared report detailing conceptual retrofit designs for several detention basin in the watershed. Worked with the grantee, Green Valleys Association to obtain permission to conduct the retrofit within a Township owned basin. Currently designing the retrofit which includes infiltration trenches to capture and infiltrate runoff generated from a multi-family development on limestone geology.

2000 Parole Growth Management Area Stormwater Evaluation: Anne Arundel County, Maryland

Compiled GIS data provided by the county and created impervious surfaces data set. Delineated watersheds in the study area and conducted impervious surfaces and runoff analysis for Anne Arundel County's Growth Management Area. Participated in planning strategy meetings to evaluate stormwater management alternatives for potential development projects in the area. Prepared maps for presentation to the client.

1999 University of North Carolina - Chapel Hill Environmental Master Plan: Chapel Hill, North Carolina

Managed GIS data set development for the campus. The data set included watershed delineation, impervious surfaces analysis, as well as other natural features. Conducted field visits to verify campus stormwater drainage. Conducted runoff analysis for the campus. Worked closely with the client and team members to provide recommendations for sustainable implementation of future development included in the overall University Master Plan.

1998 Rockaway River Watershed: Morris County, NJ
Compiled digital geographic data from multiple sources for watershed assessment. Hydrologic and natural feature data was merged with municipal information; tabular data was produced in order to analyze watershed characteristics and conditions. Presented study findings and action recommendations to municipal decision-makers throughout the watershed to promote municipal resolutions to support the plan.

1998 Sustainable Watershed Management: Northern Chester County, PA
Assisted in the planning and implementation of a computer aided Water Balance Model for sustainable management of water resources in Northern Chester County. Compiled and prepared GIS data for use in an ArcView GIS application integrating spatial data and tabular hydrologic data, to assess current watershed conditions and plan for future water resource use under existing planning strategies.

Presentations and Publications

"*Implementing Low Cost Detention Basin Retrofits: Lessons Learned*", presented at the American Water Resources Association's 2002 Annual Water Resources Conference in Philadelphia, PA, November 2002.

"Application of a Water Balance Model and GIS for Sustainable Watershed Management", presented at the National EPA GIS Conference in Cincinnati, OH, October 1999.

"Evaluation of Coverboard Designs for Reptile and Amphibian Biodiversity Monitoring: Responses to Variation in Microhabitat," presented at the Delaware Valley Chapter of the Society for Conservation Biology *Annual Meeting*, March 1998.

Carfioli, Margaret A., Harry Tiebout III, Susan A. McDaniels, Kristina Heister, and Fredric Lutcher. *"Monitoring Plethodon Cinereus Populations: Field Tests of Experimental Coverboard Designs"*, in R. C. Bruce, R. J. Jaeger, and C. P. Hauck (editors). The Biology of the Plethodontid Salamander, Plenum Publishing Corp., NY (in press).

Courtney E. Marm
Production Manager – GIS Analyst

Education

B.S. Biology, West Chester University, 1999
Minor Geography and Planning
Certificate of GIS, Pennsylvania State University, 2002
M.S. Urban and Regional Planning, Temple University (in progress)

Professional Experience

Since joining Cahill Associates, Ms. Marm has focused on the spatial application of her biological and planning background through the use Geographic Information Systems. Ms. Marm has broad experience in urban watershed planning, municipal comprehensive planning, and stormwater analysis and modeling. She is skilled at creatively utilizing ESRI's ArcInfo 8.1, ArcGIS 8.2, and ArcView 3.2, in conjunction with engineering CAD drawings, in order to analyze site stormwater conditions for proposed development at a sub-basin scale. Ms. Marm is proficient in the use of the Cahill Water Balance Model; where existing land use conditions are compared to zoning conditions on a sub-basin level. Ms. Marm has presented project conclusions at multiple watershed conferences and municipal meetings in order to articulate the relative significance of the project analysis, and to offer steps for future action.

Ms. Marm also incorporates an editorial role into final document preparation for both printed and digital formats. Utilizing standard software packages including Adobe Photoshop, PageMaker, and Illustrator, Ms. Marm is efficient and organized in maximizing work product output.

2002 Radnor Township Comprehensive Master Plan: Radnor Township
Led discussions with township officials to convey the benefits of an integrated GIS system for the township. Created existing land use parcel map for Comprehensive Plan and completed a riparian buffer analysis to determine the type and number of parcels that could be affected by a proposed buffer ordinance. Performed a nonpoint pollutant analysis by applying pollutant-loading factors to existing land use categories to quantify the effects of increased urbanization on the natural resources of the Township. Primary author for Natural Resource section and Community Facility section of the Plan. Edited and formatted entire document for final release for public and Commissioners comments.

2002 Technical BMP Manual and Infiltration Feasibility Report: Lehigh Valley Planning Commission
Supported internal project team and client in preparation of Act 167-based Technical BMP Manual, distributed to LVPC and municipal steering committee.

2001 Darby Creek Watershed River Conservation Plan: Darby Creek Valley Association
Worked with officials of 31 municipalities and watershed residents to prioritize existing threats to river resources and strategize watershed management opportunities. Inventoried and organized existing GIS data sets from multiple sources including Delaware County Planning Commission, Philadelphia Water Department, and U.S. Environmental Protection Agency Region 3, and PASDA. Catalogued and created,

where necessary, watershed historic, recreational, biological, archeological, economical, and natural resources mapable datasets for presentation in written report and public stakeholder meetings.

2000 Whippany Watershed Ordinance Planning: Morris County, New Jersey
Utilizing New Jersey Department of Environmental Protection's digital data, catalogued existing GIS data for the Whippany Watershed and organized the watershed-based GIS database for municipalities. Analyzed municipal Subdivision and Land Development Ordinances, Floodplain Ordinances, Zoning Ordinances, and Stormwater Ordinances to propose revisions that incorporate sustainable planning and management strategies.

2000 Environmental Master Plan: University of North Carolina Chapel Hill, NC
Assembled GIS data for stormwater management study, using campus planimetric data. Prepared basemaps for field analysis of hydrologic environment. Delineated campus drainage conditions for analysis of proposed Master Plan development, using 1" = 200' Digital Orthorectified Aerial photography, 1' contour lines, and existing storm sewer network. Created impervious surface coverage for both existing conditions and proposed Master Plan conditions, critical for hydrologic analysis at campus sub-basin level.

1999 Rockaway River Watershed: Morris County, NJ
Created digital GIS coverages for use in sustainable watershed management planning and hydrologic budget analysis for the Rockaway River Watershed. Produced original poster layout and managed poster design and delivery to every municipality and library in the watershed. Presented findings of Sustainable Watershed Management Plan to elected officials at municipal planning meetings within the watershed in order to obtain resolutions of support for the plan.

Publications

Horner, W., and Marm, C. *Radnor Township Comprehensive Master Plan Update,* Radnor Township, Pennsylvania, 2002.

Horner, W., and Marm, C. *Darby Creek Watershed Conservation Plan*, Draft 2001.

Cahill, T. and Marm, C. *Investigation of Stormwater System at Longview Development and Impact to Ruffini Property*, 2001.

ERIC W. STRECKER, P.E.

water resources
water quality
stormwater management
fisheries biology

EDUCATION

University of Washington: M.S.E., Civil Engineering, 1985
Humboldt State University, Arcata, California: B.S., Fisheries Science, 1983;
B.S. Environmental Engineering, 1983

REGISTRATIONS

Registered Civil Engineer: California, 1987
Registered Civil Engineer: Oregon, 1991
Environmental Engineer: Oregon, 1995

PROFESSIONAL HISTORY

GeoSyntec Consultants, Associate, 2000-Present
URS Greiner Woodward Clyde, National Manager-Water Quality Practice, 1985 - 2000
University of Washington, College of Engineering, Lecturer, 1985
California Department of Fish and Game, Fisheries Seasonal Aide, 1983
U.S. Forest Service, Fisheries Technician, 1979 - 1982

REPRESENTATIVE SKILLS AND EXPERIENCE

Mr. Strecker is a recognized authority in the area of stormwater management, especially in the design, monitoring, and evaluation of best management practices (BMPs). For the past 17 years, Mr. Strecker has provided technical direction and assistance to public and private sector clients in stormwater master planning, National Pollutant Discharge Elimination System (NPDES) permitting and surface water pollution assessment and control. This work has included conducting applied National and local research studies for US EPA and the Federal Highway Administration, as well state and local governments throughout the western United States.

Representative project experience includes:

- *Watershed Management/TMDL Implementation.* Mr. Strecker served as Project Manager for the development of San Diego Creek Natural Treatment Systems Master Plan for the Irvine Ranch Water District. The plan includes the selection, sizing and initial design of over 35 wetland treatment systems in the Watershed. The purpose of the plan is to meet TMDL loading limits for stormwater system discharges. He currently is leading an effort to assess potential BMPs for implementation of TMDLs Lake Tahoe. This work includes assessing potential BMP implementation scenarios as well as assessing their costs. He will also be providing guidance on the overall watershed modeling and monitoring efforts. He has also assisted in the development of TMDL implementation plans for the Columbia Slough in Portland, Oregon.
- *Stormwater Master Planning.* Mr. Strecker served as Project Manager for the development of integrated stormwater master plans for the City of Spokane, Washington; and West Linn, Oregon. He also developed master plans for the Spokane and Snohomish counties. The plans addressed flood control, water quality, and habitat protection, and included detailed hydraulic hydrologic modeling, water quality modeling and analysis, and natural resource evaluations. Mr. Strecker directed the decision analyses associated with preparation of these plans and played a key role in public participation efforts. He has also assisted large development projects with stormwater master planning, including the Irvine Company, Rancho Mission Viejo, Newhall Ranch, and Playa Vista. For Playa Vista, Mr. Strecker serves as Project Manger on a study to determine the effects of the project on receiving waters, a project that included design of stormwater treatment wetlands.
- *NPDES Stormwater Permitting.* Mr. Strecker prepared municipal NPDES stormwater permit applications for the cities of Portland, Eugene, and Gresham, Oregon, and Boise, Idaho, All four permits involved development of city-wide stormwater management plans specifically designed to address local stormwater pollution issues. The permits prepared for Portland and Eugene also included design, installation, and operation of nationally acclaimed stormwater monitoring programs. He has also assisted numerous development projects in meeting post-construction permit compliance issues.
- *Water Quality Design Standards Development.* The City and County of Honolulu retained Mr. Strecker to develop water quality standards that the City and County could use to reduce runoff pollution from new development projects. He is providing the same assistance to the County of Santa Barbara.
- *BMP Research.* On behalf of the United States Environmental Protection Agency (USEPA), Mr. Strecker conducted a comprehensive, nationwide study of BMP effectiveness. Included in this study was an assessment of the protocols used to evaluate BMPs. The results, which concluded that there exist wide discrepancies in evaluating the effectiveness of BMPs, were provided to USEPA headquarters. He also managed the effort to develop a detailed BMP monitoring guidance document based upon the ASCE BMP database.
- *Water Quality Research Projects, USEPA.* Mr. Strecker served as Project Manager for three separate research projects for USEPA. The projects involved 1) an extensive literature review on the use of wetlands to control stormwater pollution; 2) development of a probabilistic methodology to assess the impacts of urban stormwater run off on lakes; and 3) development of a statistical characterization of storm events to evaluate non-point source contributions to runoff.

- *Federal Highway Administration (FHWA) Highway Runoff Studies*. Mr. Strecker contributed to the development of a probabilistic approach that the FHWA uses to predict highway runoff pollutant loading. The database developed by Mr. Strecker includes 31 highway sites nationwide, and covers over 1000 storm events and 20 pollutants. Mr. Strecker also managed a project to assist FHWA in research related to field-testing methods for water quality, monitoring technologies applicable to highway sites, and the development of a detailed stormwater monitoring guidance documents.
- *Stormwater Permits for Construction Activities:* Mr. Strecker assisted a large semi-conductor company with construction monitoring and pollution prevention planning for stormwater control during development of new facilities for the company. He also provided expert testimony on a legal matter involving compliance with Oregon's 1200-C NPDES Construction Stormwater permit.

AFFILIATIONS

American Society of Civil Engineers, Urban Water Resources Research Council
American Fisheries Society
American Water Resources Association
American Public Works Association
Oregon Association of Clean Water Agencies, Stormwater Committee
Water Environment Federation, Watershed Management Committee

SELECTED PUBLICATIONS

Strecker, E. W. and W. C. Huber, Editors, "Global Solutions for Urban Drainage", Proceedings of the Ninth International Conference on Urban Drainage, Portland, Oregon, USA, September 8-13, 2002, American Society of Civil Engineers, Reston, Virginia, ISBN 0-7844-0644-8, 2002.

Strecker, E., J. Clary, B. Urbonas, J. Jones, M. Quigley, and J. O'Brien, "Developing and evaluating a stormwater BMP effectiveness database," Water Science & Technology Vol 45 No 7 pp 65–73, IWA Publishing 2002.

Strecker, E., "Integrated Stormwater Master Planning and BMP Performance," In: Proceedings of the Third International Conference on Watershed Management, December 11-14, 2001, Taipei, Taiwan, Edited by Jan-Tai Kuo and Shaw L. Yu, In publication.

Strecker, E.W., "Low Impact Development (LID): How Low Impact Is It?," Water Resources Impact, Vol. 3 NO. 6, pp. 10-15, Nov. 2001.

Strecker, E., and B.R. Urbonas, "Assessing Receiving Water Effects of Urban Stormwater Best Management Practices (BMPs)," In: Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation, Proceedings of An Engineering Foundation Conference,

Snowmass Village, Colorado, August 1-24, 2001, Edited by Ben R. Urbonas, ISBN 0-7844-0602-2, pp. 426-437.

Strecker, E., "Low Impact Development (LID): Is it Really Low or Just Lower?," In: Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation, Proceedings of An Engineering Foundation Conference, Snowmass Village, Colorado, August 1-24, 2001, Edited by Ben R. Urbonas, ISBN 0-7844-0602-2, pp. 210-222.

Strecker, E., J. Clary, B. Urbonas, J. Jones, M. Quigley, and J. O'Brien, "Developing and evaluating a stormwater BMP effectiveness database," In: Innovative Technologies In Urban Drainage, NovaTech 2001, Lyon, France, , ISBN 2-9509337-3-4, pp. 161-168.

Strecker, E.W., M.M. Quigley, B.R. Urbonas, J.E. Jones, and J.K. Clary, "Determining Urban Storm Water BMP Effectiveness," ASCE Journal of Water Resources Planning and Management, Vol. 125 NO. 3, pp. 144-149, May/Jun. 2001.

Strecker, E.W., L. Mayo, M. Quigley, and J. Howell (2001). Guidance Manual for Monitoring Highway Runoff Water Quality. FWHA Report No. FHWA-EP-01-021, 206pp.

Strecker, E. and K. Reininga, "Integrated Urban Stormwater Master Planning," Proceedings of the National Conference on Tools for Urban Water Resource Management and Protection, EPA/625/R-00/001, pp. 132-146, July 2000.

Whipple, William, Donald DuBois, Neil Grigg, Edwin Herricks, Howard Holme, Jonathan Jones, Conrad Keyes, Jr., Mike Ports, Jerry Rogers, Eric Strecker, Scott Tucker, Ben Urbonas, Bud Viessman, and Don Vonnahme, "A Proposed Approach to Coordination of Water Resource Development and Environmental Regulations", Journal of the American Water Resources Association, V. 35, N. 4, 713-720, August 1999

Strecker, E.W., K.M. Wong, M.K. Stenstrom, "GIS to Estimate Stormwater Pollutant Mass Loadings," ASCE Journal of Environmental Engineering, Vol. 123, No. 8, pp. 737-745, August 1997.

Strecker, E.W, "Ecological Development: The Integration of Stormwater Management into the Playa Vista Project," Proceedings of the *Engineering Foundation Conference on Sustaining Urban Water Resources in the 21st Century*, Malmo, Sweden, September 7 – 12, 1997.

Strecker, E.W., "Use of Wetlands for Stormwater Pollution Control," Infrastructure, Spring 1996, pp. 48-66.

Strecker, E.W., B. Urbanas, "Monitoring of Best Management Practices," Proceedings of the 22nd Annual Conference of the Water Resources Planning and Management Division of ASCE, Boston, Massachusetts, May 1995.

Strecker, E.W., "Stormwater Management – An International Perspective," presented at the Water and Sewerage '95 Conference, Auckland, New Zealand, February 1995.

Strecker, E.W., K. Reininga, “Implementation of Nonpoint Pollution Source Control Programs for Municipal Separate Storm Sewer NPDES Compliance in Oregon—Plan and Lessons Learned,” presented at the Pacific Northwest Pollution Control Association Annual Conference, Spokane, Washington, September 1994.

Strecker, E.W., “Constituents and Methods for Assessing BMPs,” Proceedings of the Engineering Foundation Conference on Stormwater NPDES Related Monitoring Needs, Crested Butte, Colorado, August 7 –12, 1994, pp. 329-348.

Strecker, E.W., “ Stormwater Monitoring for Assessing Effectiveness and Compliance,” Presented at the Oregon Chapter APWA Spring Conference, Eugene, Oregon, April 1994.

Strecker, E.W., K. Brownlee, and M. Lorenz, “Duck Creek Restoration,” Presented at the Stormwater Solutions in Alaska Conference, Anchorage, Alaska, April 1994.

Strecker, E.W., M. Fowler, “Statistical Analysis of Urban Stormwater Runoff Water Quality Data for Portland, Oregon,” presented at the International River Quality Symposium, Portland, Oregon, March 1994.

Strecker, E.W., “The Use of Wetlands for Stormwater Pollution Control,” presented at the National Conference on Urban Runoff Management, Chicago, Illinois, April 1993.

Strecker, E.W., “Comprehensive Stormwater Monitoring and Results from Portland and Eugene, Oregon,” presented at the National Conference on Urban Runoff Management, Chicago, Illinois, April 1993.

Strecker, E.W., G. Boyd, and P. Mangarella, “ Targeting and Selection Methodology for Urban Best Management Practices,” presented at the National Conference on Urban Runoff Management, Chicago, Illinois, April 1993.

Strecker, E.W., E. Driscoll, J. Kersnar, and R. Horner, “The Use of Wetlands for Stormwater Pollution Control,” Terrene Institute, Washington, D.C., 1992, pp. 66.

Strecker, E.W., and M. Stenstrom, “Estimation of Urban Runoff Pollutant Loadings Entering Santa Monica Bay,” invited presentation at the Santa Monica Bay Restoration Conference ‘92, June, 1992.

Strecker, E.W., and E. Driscoll, “Assessment of BMPs Being Used in the U.S. and Canada,” Proceedings of the Sixth International Conference on Urban Storm Drainage, Niagra Falls, Canada, June 1992.

Strecker, E.W., E.D. Driscoll, and P.E. Shelley, “Pollutant Loadings and Impacts from Highway Stormwater Runoff,” Volume I, Design Procedures, FHWA-RD-88-006, March 1990; “Users Guide for Interactive Computer Implementation of the Design Procedure,” Volume II, FHWA-RD-88-007, March 1990; “Analytical Investigation and Research Report,” Volume III, FHWA-RD-88-008, March 1990; “Research Report Data Appendix,” Volume IV FHWA-RD-88-009, March 1990.

Strecker, E.W., E.D. Driscoll, P.O. Shelley, P.R. Gaboury, and J.D.Sartor, " The U.S. Federal Highway Administration's Receiving Water Impact Methodology," Science of the Total Environment, '93, 1990, pp. 489-498.

Strecker, E.W., "The Use of Wetlands for Control of Urban Runoff Pollution in the USA," Proceedings of the Fifth International Conference on Urban Storm Drainage (Y. Iwasa and T. Sueihi, Eds.), Osaka, Japan, July 1990, pp. 1495-1500.

Strecker, E.W., " The Use of Wetlands for Stormwater Pollution Control," presented at the Ninth Annual International Symposium on Lake, Reservoir, and Watershed Management, Austin , Texas, November 1989.

Strecker, E.W., E.D. Driscoll, and G.E. Palhegyi, "PC-SYNOP—A Rainfall Analysis Tool," Proceedings of Stormwater and Water Quality Model User Group Meeting, J. Guo, B. Urbonas, and T. Barnwell (eds.), Denver, Colorado, October 1989, pp. 161-172.

Strecker, E.W., "Characterization of Pollutant Loadings from Highway Runoff in the U.SA.," Proceedings, *Fourth International Conference on Urban Stormwater Drainage*, Lausanne, Switzerland, September 1987.

Strecker, E.W., Wen-sen Chu, and D. Lettenmaier, "An Evaluation of Data Requirements for Groundwater Contaminant Transport Modeling," Water Resources Research 23 (3), 1987, pp. 408-424.

Strecker, E.W., J.D. Dean, A.M. Salhotra, and L.A. Molkey, "Exposure Assessment for the Pesticide Aldicarb in Florida, U.S.A.," Proceedings of the *International Conference on the Vulnerability of Soil and Groundwater to Pollutants*, Noordwijk, The Netherlands, 1987.

Strecker, E.W., and Wen-sen Chu, "Parameter Identification of a Groundwater Contaminant Transport Model, Groundwater 24(1), 1986, pp. 56-62.

Strecker, E.W., Wen-sen Chu, and D. Lettenmaier, "Uncertainties in Groundwater Transport Modeling," Proceedings of the *ASCE Water Forum '86: World Water Issues in Evolution Conference*, Long Beach, California, August 1986, pp. 966-972.

Strecker, E.W., and Wen-sen Chu, "Parameter Identification of Water System Models, Proceedings of the *ASCE Specialty Conference on Computer Applications in Water Resources*, Buffalo, New York, June 1985, pp. 1190-1197.

STEVEN P. ROY

source water protection
water resources
watershed management
stormwater management
NPDES and SDWA compliance
environmental impact studies
land use planning
hydrology
golf courses and water quality

EDUCATION

M.S., Water Resources, State University of New York, College of Environmental Science and Forestry, 1980
B.S., Forest Hydrology, University of Massachusetts, 1977

PROFESSIONAL HISTORY

GeoSyntec Consultants, 2000 – Present
Tetra Tech, Inc., 1997 – 2000
Apogee Research, Inc., 1993 – 1997
Horsley & Witten, Inc., 1990 – 1993
USEPA, Office of Ground-Water Protection, 1987 – 1990
Massachusetts Dept. of Environmental Protection, 1980 –1987
Berkshire County Regional Planning Comm., 1979 - 1980

REPRESENTATIVE EXPERIENCE

Mr. Roy has over 22 years of professional experience in the field of environmental program management and administration specializing in water resources management, stormwater management, and environmental impact assessment. He has 12 years of experience in conducting and managing environmental consulting projects and 10 years in managing and administrating state and federal environmental programs and assessments. His work focuses on the assessment of water resource impacts from land use activities. He has conducted policy analyses and regulatory program reviews for state and local governments. He has also researched drinking water quality threats and the development of appropriate state and local regulatory approaches, and he has conducted technical reviews of major environmental impact statements (EISs).

Mr. Roy has worked at the local, state, and federal levels of government developing and managing ground water protection and water management programs. He has served in the Environmental Protection Agency as the manager of the Wellhead Protection Program, where he developed programs, policies, and technical documents for the protection of ground water quality. He has also worked for the Commonwealth of Massachusetts as the Water Management Program manager and Ground Water Program manager in the Division of Water Supply. In this capacity Mr. Roy was responsible for preparing regulations and developing a program for the control and permitting of all water withdrawals in the state. He also conducted technical reviews of the impacts of inter-basin water transfers on local water resources.

Mr. Roy managed a $10 million water supply protection land acquisition program for Massachusetts. He has also performed work as an environmental planner on the county level, where he reviewed EISs for major construction works in the county. He also has forest management experience. He has published extensively on water management and ground water program implementation.

Wellhead Protection and Source Water Protection Program Management

- *Upper Neponset Watershed Supply Study.* Conducting water supply demand and sharing options for a six community area in Massachusetts.
- *Providence Rhode Island Water Board.* Conducting an analysis of potential water quality threats to the Situate Reservoir. Potential threats include a large regional landfill and a tire burning facility.
- *U.S. EPA, Office of Ground Water and Drinking Water.* Managed a project to prepare a report to Congress on the status of ground water programs in the U.S. The published report A Safe Drinking Water Act, Section 1429 Ground Water Report to Congress, EPA-816-R-99-016" was the first comprehensive evaluation of state ground water protection programs as required by the Safe Drinking Water Act Amendments of 1996.
- *American Water Works Association.* Conducted 10 two-day seminars titled "Source Water Protection: Effective Tools and Techniques". These seminars are accompanied by a comprehensive seminar workbook that provides references and examples of drinking water protection approaches. The seminars were conducted from February 4th - April 15th, 1999 in major cities throughout the U.S. The workbook was prepared and directed by Mr. Roy under a contract with AWWA and funding from the U.S. EPA.
- *Ground Water Management and Supply Protection Plan, Eastern Shore of Virginia.* Conducted research on ground water use, ground water quality threats, and availability of water, and produced a comprehensive management plan for adoption at the local level. This included a survey and assessment of underground storage tanks and an assessment of their potential threat to ground water quality. This project was a U.S.EPA Wellhead Protection Demonstration Grant Project.
- *Clermont County, Ohio.* Project Manager for the development of a comprehensive watershed management plan for the 500 square mile Lower East Fork of the Little Miami River. This multi-year effort included stakeholder involvement, water quality monitoring review source water assessment, stormwater assessment and management, GIS applications, database development and management, and recommendations, support to the implementation of the Community Project XL Agreement, and development of the management plan.
- *New Jersey DEPE Comprehensive Ground Water Protection Program.* Reviewed state's ground water program and conducted a self-assessment of the program with EPA guidance. This included a review of site investigation and remediation programs.
- *Pennsylvania Wellhead Protection Workshops.* Conducted six 1-day workshops for the Pennsylvania Department of Environmental Resources on threats to ground water quality including the siting and management of underground storage tanks.

- *Wellhead Protection Implementation - Study of State and Local Implementation of Wellhead Protection Programs*. For U.S. EPA Office of Ground Water and Drinking Water, studied the implementation of WHP in five states with approved programs, including their site investigation/remediation efforts for ground water.
- *Baltimore County, Maryland - Wellhead Protection Strategy*. Conducted research on ground water quality threats for small public water systems and produced a model ordinance that regulated primarily small aboveground and underground storage tanks. This project was a U.S. EPA Wellhead Protection Demonstration Grant Project.
- *Water Resource Compatibility Study, Carroll County, Maryland.* Analyzed Master Plan for development against the County's source water management plan. Assessed water quality threats from facilities such as septic systems and underground storage tanks. This project was a U.S. EPA Wellhead Protection Demonstration Grant Project.

U.S. Environmental Protection Agency and State Management Experience

- *National Program Manager for EPA's Office of Ground-Water Protection*. Served as the Section Head of the Source Management Unit (GM-14, 1987- 1990). Responsible for program administration and management of the Wellhead Protection Program under the Safe Drinking Water Act. Specific duties included staffing the program, developing and producing technical assistance documents on ground-water protection, developing policies and guidance on administration and program issues, providing guidance and support to state agencies and regional offices on groundwater protection, managing contractors to support program efforts, reviewing state program submittals, and developing new efforts to support program. Also conducted and facilitated meetings involving EPA regional staff and headquarters program staff.
- *State Water Management Program Manager for the Commonwealth of Massachusetts' Division of Water Supply (1980 – 1987).* Responsible for program development, administration, and management for the Massachusetts Water Management Act (G.L. Chapter 21G), the state's first water allocation/permitting law. Specifically responsible for staffing program, writing water withdrawal registration regulations and permitting regulations, and general oversight of water withdrawals throughout the Commonwealth. *New England Interstate Water Pollution Control Commission (NEIWPCC).* Worked directly for the Massachusetts Department of Environmental Quality Engineering, Division of Water Supply, to conduct statewide ground water resource planning. Responsible for the administration and management of a comprehensive ground water planning, protection, and technical assistance program. A portion of the program consisted of the development and implementation of technical assistance projects for water conservation, purchase of protection areas, water supply contamination cleanup, and public water supply planning and protection. Managed the Aquifer Land Acquisition Program, a $10 million grant program to assist public water supplies served by ground water in the development of protection programs and the purchase of land to assist in the protection. Assisted and directed the review of site investigations including landfills, underground storage tanks, and wastewater discharges to ground. Also, assisted in the development of state ground water and water supply policy for the Massachusetts Water Resources Commission. As a Regional Environmental Planner, Berkshire County Regional Planning Commission, Pittsfield, Massachusetts, duties included developing and

implementing environmental planning projects on lake management, water quality protection, septage management, and solid waste and conducting environmental impact reviews of capital improvement projects.

Stormwater Management, NPDES and SDWA Compliance

- *Rogers Street Stormwater Controls, Dartmouth, MA.* Assessing stormwater impacts from a small residential drainage area to the Buzzards Bay. Designing Low Impact Development Controls to reduce bacterial loading from stormwater discharges.
- *Massachusetts Nonpoint Source Management Manual.* Conducting a rewrite of the State's Nonpoint Source control manual for local officials. Developing a hardcopy document, CD-ROM version, and web-based document.
- *Fawn Lake, Bedford, Massachusetts.* Conducting a lake restoration project to resolve an aquatic vegetation problem. Designing and permitting a hydroraking and chemical application management program. In addition, a public education effort of workshops and an educational flyer has been accomplished.
- *Low Impact Development Stormwater Controls.* Designed a series of Low Impact Development stormwater controls for a 41 unit residential development using bioretention cells, raingardens, drainage swales, and constructed wetlands.
- *Massachusetts Environmental Trust*. Conducting a multi-year watershed public education and outreach effort for Town Line Brook in Revere, Malden, and Everett, MA. This project is aimed at presenting technical information on flooding and water quality to local official and the residents of this 2,500-acre watershed to build public support for water quality and flooding implementation efforts.
- *Massachusetts Development Finance Agency, Devens, MA.* Conducting a comprehensive stormwater master plan for the redevelopment of a closed military base.
- *BayRoads program in Massachusetts*. Conducted four seminars for local public works officials on the Stormwater Phase II requirements. Over 180 local officials participated in these one-day seminars. The Six Minimum Elements of the Phase II program were presented along with several local examples that GeoSyntec is currently conducting.
- *Massachusetts Environmental Trust*. Conducting an evaluation of the use of low impact development stormwater control techniques to reduce stormwater flooding of Town Line Brook in Revere, Malden, and Everett, MA. This comprehensive watershed project will analyze stormwater runoff and identify opportunities for off-line stormwater storage and infiltration as well as channel dredging and stream restoration.
- *Town of Littleton, Massachusetts*. Conducting a stormwater low impact development design project to control nutrient loading to a recreational lake from a residential area. Nutrients and sediments from the stormwater collection system are impacting the lake by contributing excessive nutrients and sediment. Aquatic macrophytes and invasive plant species are reducing the

usefulness of the lake. The design is using bioretention cells, grassed swales, and disconnected impervious areas to reduce, treat and infiltrate stormwater runoff.

- *Massachusetts Department of Environmental Protection.* Conducted a study of nonpoint source contributions to lake, pond, and coastal waters in the towns of Kingston, Pembroke and Plymouth. These towns have approximately 20 waterbodies listed as impaired on the 303(d) list. Using a GIS/modeling approach, nutrient loads were estimated and control measures recommended to improve water quality and designated uses.
- *Stormwater NPDES Permits*. Prepared and submitted NPDES stormwater general permits for several industrial facilities.
- *Prince George's County, Maryland.* Managed a comprehensive support contract to assist the County with implementation of their NPDES Stormwater Permit. Providing contract and project management for over $500K annual task orders including watershed wet weather monitoring, watershed modeling, biological assessment, and report preparation.
- *Prince George's County, Maryland.* Managed a project to develop a technical document on Low-Impact Development. Low Impact Development is achieved at the site planning level when the predevelopment hydrologic regime (volume, frequency, peak runoff rate) is maintain through on-site techniques. This project involved writing a manual (Low-Impact Development Design Strategies, EPA 841-B-00-003) for national distribution through the U.S. EPA.
- *Howard County, Maryland*. Project principal for a six-year support contract to assist the County implement their NPDES Stormwater Permit. Tasks include pollutant loadings assessment, watershed assessment, pollution prevention, and annual reporting.
- *Prince George's County, Maryland.* Managed the production of a report on the impacts of nitrogen loadings from septic systems on the Patuxent River. Using GIS and a revised loading model, predicted future conditions under various build out and technology control options.
- *U.S. EPA, Office of Wetlands, Oceans and Watersheds*. Conducted a 2-day workshop on Clean Water Act Tools for Watershed Protection. The purpose of the workshop was to present how the regulations and programs operated under the Clean Water Act and other federal water resource laws provide data, direction, funding, and support for the implementation of water resource protection measures at the watershed level. This is a workshop offered within EPA's Watershed Academy series.
- *U.S. EPA Office of Wastewater Management*. Assisted in a project to develop environmental indicators for the NPDES Stormwater Phase I program. Developed potential indicators and conducted reviews of 10 municipal NPDES stormwater programs from around the U.S. This information was included is a report to Congress on the status of the Phase I program.
- *U.S. EPA, Office of Wastewater Management*. Conducted a project to implement environmental indicators for the Clean Water State Revolving Fund (CWSRF) Program. Environmental indicators are used to measure the effectiveness or outcomes of programmatic efforts. Assisted an EPA task force select potential indicators and identify databases to support the indicators. Conducted pilot projects with several states to evaluate the selected indicators.

- *U.S. EPA, Office of Wastewater Management*. Managed and directed a project to identify and recommend solutions to barriers against decentralized wastewater treatment. Conducted executive-level interviews of researchers and state and local program managers around the country, developed specific funding, outreach, and management approaches for national leadership in this area.

Golf Courses and Water Quality Experience

- *Turner Hill Golf Course, Ipswich, MA*. Site and design plan technical review support to the Conservation Commission and Planning Board
- *Queenstown Harbor Golf Course*. Expert witness testimony before the Chesapeake Bay Critical Area Commission regarding nutrient loading and environmental controls for a proposed golf course.
- *Queenstown Harbor Golf Course IPM and Water Quality Monitoring*. Developed Integrated Pest Management Program and installed 14 shallow wells to collect groundwater samples. Conducted quarterly sampling and reporting from 1993 – 2000.
- *South River Golf Course Water Quality Monitoring*. Designed and installed four deep monitoring wells and conducted sampling from 1997 - 2000.
- *Southampton, NY Golf Course Site Investigation.* Conducted preliminary site investigation for a new golf course and provided preliminary design and permitting support. 1999.
- *Hope, NJ Golf Course Permitting Assistance.* Conducted review of golf course expansion and presented testimony.
- *Golf Course and Water Quality*. Conducted three training sessions for golf course superintendents on water quality issues associated with golf course construction and operation, and presented IPM techniques to reduce water quality threats.

Underground Storage Tank Experience

- *U.S. Environmental Protection Agency, Office of Underground Storage Tanks (OUST*). Served as project manager in support of a mission contract from July 1993 to July 1994. Responsibilities included preparation and budgeting of work plans, project management oversight, technical support and oversight of over 30 work assignments, client communications, and project reporting. This work included the management of several subcontractors and consultants working on the projects. In addition, has participated in the technical tasks of several of the work assignments, including the production of a technical manual on site investigations at underground storage tank sites, facilitation of technical meetings to produce industry standards for tank upgrading and leak detection, and review and analysis of state corrective action programs. Managed the following projects in support of EPA's Office of Underground Storage Tanks:
  - Nebraska FY93 LUST Corrective Action Streamlining Project
  - Technical Support for Piping Video
  - Streamlining Arizona's Corrective Action Process
  - Support for Corrective Action Streamlining

- Underground Storage Tank Technical Support
- Facilitation of ASTM Subcommittee Meetings
- Streamlining Colorado's Corrective Action Process
- Leak Detection Training - Nevada and Hawaii
- Streamlining Index
- Ohio Delegated Authority Review
- Streamlining Los Angeles County's Corrective Action Process
- Streamlining Vermont's Corrective Action Process
- Streamlining New York's Corrective Action Process
- Corrective Action Training on Indian Lands
- Streamlining New Jersey's Corrective Action Process
- Streamlining Puerto Rico's Corrective Action Process
- Streamlining Washington D.C.'s Corrective Action Process
- Streamlining Arizona's and Nevada's Corrective Action Process
- Streamlining Alabama's Leak Detection Program Streamlining
- Streamlining Rhode Island's Corrective Action Program

EXPERT WITNESS EXPERIENCE

New York City Watershed Agreement, 1993 – 1997, Water Quality
Chesapeake Bay Critical Areas Commission, 1993, Golf Course
Tybouts Corner Landfill, Delaware, 1992, Groundwater Quality

PUBLICATIONS

Technical Reports

- Water Resources Planning AWWA Manual M50, 2001. American Water Works Association, Water Resources Division. (Prepared chapter on Watershed Management and Groundwater Protection)

- Low Impact Development Design Strategies, An Integrated Design Approach, January, 2000. USEPA 841-B-00-003. (Project Manager and contributing author)

- A Safe Drinking Water Act, Section 1429 Ground Water Report to Congress, 1999. U.S. EPA-816-R-99-016. (Project Manager and contributing author)

- Report to Congress on the Phase I Storm Water Regulations, February, 2000. U.S. EPA – 833-R-00-001. (Project Manager and contributing author)

- Total Water Management, August, 1998 Prince George's County, Maryland

- Source Water Protection: Effective Tools and Techniques You Can Use, 1999. American Water Works Association

- Wellhead Protection Programs: Tools for Local Governments, 1989. USEPA, Office of Ground-Water Protection

- Developing a State Wellhead Protection Program: A User's Guide to Assist State Agencies Under the Safe Drinking Water Act; 1987. USEPA, Office of Ground-Water Protection

- Relative Risk Ranking Screening System; Guide to Groundwater Supply Contingency Planning for Local and State Governments. 1990. USEPA, Office of Ground-Water Protection

- A Review of Groundwater Contamination from Light Industry. 1990. USEPA, Office of Ground-Water Protection

Training and Seminars Presented

- "Storm Water Quality Enhancement Workshops" Baystate Roads Program. (4 one-day workshops) April 9-12, 2001. Northampton, Peabody, Worcester, and Taunton, MA

- "Source Water Protection: Effective Tools and Techniques". American Water Works Association. February 4th - April 15th, 1999 (10 two-day workshops at various locations across the country). With Tetra Tech, Inc.

- "Clean Water Act Tools for Watershed Protection". U.S. EPA Watershed Academy. February 23-24, 2000. With Tetra Tech, Inc.

- "Tools for Groundwater Protection". U.S. EPA Office of Ground-Water Protection. 1992 (10 two-day workshops at various locations across the country) With Horsley & Witten, Inc.

- "Pennsylvania Wellhead Protection Workshops". 1992. Pennsylvania Department of Environmental Resources (Conducted six 1-day workshops in various locations in Pennsylvania). With Horsley & Witten, Inc.

- "Golf Courses and Water Quality – A Comprehensive Short Course in Successful Golf Course Development and Maintenance Techniques to Minimize Impacts to Water Quality". 1990. New Seabury, MA and College Park, MD. With Horsley & Witten, Inc.

- "Golf Courses and Water Quality – Developing and IPM Program for a Golf Course." 1992. Rutgers University, NJ, Cook College Office of Continuing Professional Education, Advanced Turfgrass Management.

AFFILIATIONS

American Water Works Association
Low Impact Development Center, Board of Directors
North American Lake Management Society, Member

TRAINING

Hazardous Waste Operations and Emergency Response 40-hour training program

MARCUS M. QUIGLEY, P.E.

civil/environmental engineering
stormwater management
surface and subsurface hydrology and hydraulics
nonpoint source pollution
database development and management

EDUCATION

M.S., Civil and Environmental Engineering, Oregon State University, 1998
B.S., Environmental Engineering, University of Notre Dame, 1995

REGISTRATIONS

Registered Civil Engineer, California, #61838
Massachusetts Licensed Construction Supervisor, #82291

PROFESSIONAL HISTORY

GeoSyntec Consultants, 2000-Present
URS Greiner Woodward Clyde, 1997-2000
Oregon State University, 1995-1997
Barrientios and Associates, 1993

REPRESENTATIVE EXPERIENCE

Mr. Quigley's experience has provided him with a broad background in modeling, field data acquisition, data analysis, and design. His technical areas of expertise include surface and subsurface hydraulics and hydrology, analysis of water quality, and fate and transport modeling. He has been extensively involved in urban and highway stormwater Best Management Practice design, monitoring, protocol development, and data analysis.

- *Newhall Ranch Hydraulics and Hydrology Modeling, Newhall Ranch, CA. Newhall Ranch Company.* As Task Leader, Mr. Quigley oversaw and conducted detailed continuous simulation SWMM (RAIN, RUNOFF, EXTRAN, and STATISTICS) modeling of pre-, post-, and post with BMP- development conditions in the Chiquito Canyon portion of this proposed 22,000-unit development to assess long-term hydrologic, hydraulic, and geomorphic impacts as part of the project EIR. Flow duration effects were of primary concern in the watershed. The modeling conducted provided a means for directly assessing frequency and duration of critical flows.
- *ASCE/EPA Guidance Manual "Urban Stormwater BMP Performance Monitoring – A Guidance Manual for Meeting the National Stormwater BMP Database Requirements (April*

2002)". As a Project Engineer, Mr. Quigley is working as a member of the ASCE Urban Water Resources Research Council Project Team. As part of this project he was co-author of this national guidance manual for monitoring of urban stormwater BMPs.

- *ASCE/EPA Determining Urban Stormwater Best Management Practice (BMP) Removal Efficiencies*. Project management and development of the National Stormwater Best Management Practices Database. Work included data collection, analysis, and development of performance protocols for EPA. Through this project Mr. Quigley had a primary role in reviewing, extracting, and analyzing data from over 500 stormwater structural and non-structural best management practice studies conducted over the last 20 years and developed standard statistical methods for evaluating efficiency and performance of BMPs. Currently, Mr. Quigley is leading a project team to reanalyze data stored in the database using standardized and statistically rigorous methods.
- *Federal Highway Administration "Guidance Manual for Monitoring Highway Runoff Water Quality" (FHWA-EP-01-022, June 2001)*. Mr. Quigley was co-author for this national guidance manual for monitoring of stormwater runoff from the near-highway environment.
- *Revisions for the EPA Guidance Specifying Management Measures for Sources of Nonpoint Pollution In Coastal Waters.* Revised summaries of effectiveness and qualitative descriptions for urban stormwater Best Management Practice technologies for the updated version of the guidance document.
- *California Department of Transportation (Caltrans) Litter Management Pilot Study*. Developed and evaluated the effectiveness of a variety of litter management practices in reducing the quantities of litter entering the Caltrans freeway stormwater drainage system. He played a key role in:
  - site reconnaissance and field survey for all State freeway sections in Los Angeles County;
  - establishment and development of database and alternatives analysis methodology for site selection;
  - custom site, water quality, flow, and litter monitoring equipment design for often difficult to monitor locations;
  - oversight and management of manufacture and installation of automatic monitoring equipment;
  - detailed hydraulic and hydrologic analysis for design of monitoring devices;
  - water quality, rainfall, and flow data analysis for quantification of the performance of Best Management Practices for standard water quality parameters and litter;
  - development of monitoring protocols; and
  - quantitative and qualitative data QA/QC.

- *Pine Tree Brook Stream Assessment and Design, Milton, MA.* As Project Manager and Technical Lead, Mr. Quigley directed and led this assessment of approximately 13,000 ft of Pine Tree Brook upstream of the confluence of Pine Tree Brook with the Neponset River. The assessment included identification of all outfalls and major structural features as well as stream dimensions, sediment accumulation, and vegetation conditions along the project reach.

The field assessment was used to prioritize improvements to the stream. Recommendations for improvement and strategies for implementation were included in the final report for the project. Conceptual designs for constructed wetlands, bioretention cells, and enhanced phyto-buffers were developed. Bid documents for

- *Rogers Street Water Quality Control Assessment and Design, Dartmouth, MA.* As a Project Engineer and task leader, Mr. Quigley oversaw all technical aspects of field data collection, continuous simulation, and discrete event modeling, and facility design. The project included the preparation of designs for a system of drainage swales and a connected constructed wetland for water quality mitigation.
- *Linden Brook Stormwater Assessment and Design, Malden, MA.* As Project Manager and Technical Lead, Mr. Quigley oversaw the assessment, sampling, and BMP design for control of non-point pathogen controls under funding from the Massachusetts Coastal Zone Management Coastal Pollutant Reduction program. The project included wet and dry weather sampling of storm drains, assessment of source areas and conveyance systems in the watershed, and design of structural and non-structural controls. In addition, he prepared, for the city, a grant application under the Section 319 program to provide funding for implementation of the proposed constructed wetland design.
- *Devens Massachusetts Stormwater Master Planning*. Mr. Quigley served as Task Leader for modeling and design of stormwater quality and quantity planning for redevelopment of the former Fort Devens Army facility. Designs included developing conceptual and final designs for a variety of stormwater controls as well as capital improvements to the existing drainage infrastructure.
- *Town Line Brook Hydrologic and Water Quality Study, Massachusetts Environmental Trust (MET).* Mr. Quigley is currently helping the MET in assessing the extent of flooding and water quality impairment in the Town Line Brook Watershed and to recommend alternative management measures and capital improvements for mitigation. The project includes modeling of the watershed, conveyances, main channel hydraulics, and tidal influence though use of the SWMM model. Mr. Quigley is Task leader for model development and execution, information and document collection, and mitigation alternatives analysis. The modeling approach integrates GIS into model data preparation to assist in efficiently assessing capital improvement alternatives and presenting modeling results.
- *Long Lake Restoration Project, Littleton Massachusetts.* As Task Manager and Project Engineer, Mr. Quigley is conducting and managing this project providing alternatives analysis, water quality modeling, distributed stormwater BMP design utilizing GIS, and source control and low impact development implementation for Long Lake. The overall approach is to use a distributed, in-watershed approach to remediating the effects of residential runoff and increased development on the water quality of Long Lake.
- *Caltrans Stormwater Monitoring and Research Contract*. Lead a task to develop design storm depths for structural best management practices for the California Department of Transportation.

- *Crossroads Landfill Phase 8 Expansion.* As a Project Engineer, Mr. Quigley modeled and designed post-closure stormwater management facilities for permitting this 95-acre landfill expansion. The HydroCAD™ Stormwater Modeling System was integral to the design process. The post-closure system included six detention facilities and an extensive cover terrace, down chute, and piped conveyance system.
- *Class V Injection Well Survey for EPA.* Conducted field survey of Class V injection wells in selected tracts in Maine, Vermont, and New Hampshire for evaluation of the proliferation of large capacity septic systems, stormwater drainage wells, and agricultural drainage wells. Collection of supporting documentation included interviews with state, county, and local officials regarding permitting of large capacity septic systems. Field survey entailed identifying and verifying specific locations of stormwater drainage wells and septic systems.
- *Confidential Manufacturing Client, Worldwide,* Mr. Quigley is Project Manager for development and deployment of an environmental site management database system for sites company-wide. This project involves database protocol development, relational database design and programming, front-end development, training, clearinghouse setup and maintenance, and dissemination and implementation support across numerous sites and among on-site consultants. The database initiative includes implementation of processes for integration of both current and future data collection as well as legacy data.
- *Confidential Manufacturing Client, Bio-Pilot Site Management Database Development and Deployment.* Mr. Quigley developed and deployed a custom Access data management system for near-real time tracking for a pilot in-situ bioremediation study conducted at the facility. Mr. Quigley developed the database back-end architecture and font-end user interface for the deliverable database software application. The front-end analysis tools included menu driven graphing, query, and report modules. The database incorporates in excess of 30,000 analytical records from three separate primary data sources. The front-end and data set are updated weekly or bi-weekly basis (depending on pilot test operation) during the project.
- *St. Germain Drum Site, Taunton, Massachusetts.* Developed Community Relations Plan (CRP) for Superfund time critical removal action for Potentially Responsible Party (Zeneca Inc.) and oversaw site database management for this MCP site.
- *National Cooperative Highway Research Program project, Environmental Impact of Construction and Repair Materials on Surface and Ground Waters.* Wrote and developed a Visual Basic for Applications computer model for the leaching, transport, removal, reduction and retardation of contaminants from various waste amended asphalt mixes, chemically treated pilings, and pavement sealants in the near-highway environment. Responsibilities also included authoring monthly, quarterly, interim, and final reports and presentation of modeling development strategy and results to an oversight panel.

Mr. Quigley has, additionally, been involved in all aspects of preparing, running and presenting flood profile models, including the creation of digital maps for presentation of field data and model output, stream gauging measurement for calibration, surveying of stream and flood plane cross-sections, preparing data and running the HEC-2 model.

PUBLICATIONS/PRESENTATIONS

Quigley,M.M., Invited Workshop Presentation, SUN2 – Design of Best Management Practices for Source Water Protection, American Water Works Association, Preliminary Technical Program, Source Water Protection Symposium: New Tools and Technologies, Albuquerque, New Mexico, January 2003.

Quigley, M.M., Strecker, E.W., and B. Urbonas, Overview of the Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements, Edited by Eric W. Strecker and Wayne C. Huber, Ninth International Conference on Urban Drainage, Global Solutions for Urban Drainage, Portland, Oregon, September 8-13, 2002.

Strecker, E.W., Urbonas, B., Quigley, M.M., Howell, J., and T. Hesse, Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements, EPA-821-C-02-005, pp. 248, April, 2002.

Strecker, E.W., Mayo, L., Quigley, M.M., and J. Howell, FHWA Guidance Manual for Monitoring Highway Runoff Water Quality, FHWA-EP-01-022, June, 2002.

Quigley, M.M., Roy, S.P., and L. Gil, Town Line Brook Urban Watershed Study - Modeling Incremental Improvements, 7th Biennial Conference on Stormwater Research & Watershed Management, Tampa Florida, May 22-23, 2002.

Roy, S.P., Quigley, M.M, and S. Danos, Stormwater Retrofit of Long Lake, Littleton, MA – Using Low Impact Development Approaches, 7th Biennial Conference on Stormwater Research & Watershed Management, Tampa Florida, May 22-23, 2002.

Strecker, E.W., Quigley, M.M., Urbonas, B.R. Jones, J. and J. Clary, Determining Urban Stormwater BMP Effectiveness, Journal of Water Resources Planning and Management, American Society of Civil Engineers, Vol. 127, No.3, May/June, 2001.

Nelson, P.O., Huber, W.C., Eldin, N.N., Williamson, K.J., Azizian, M.F., Pugazhendhi, T., Quigley, M.M., Hesse, T., Lundy, J.R., Frey, K.M., and R.B. Leahy, "Environmental Impact of Construction and Repair Materials on Surface and Ground Waters", National Cooperative Highway Research Program, NCHRP Report 448, Transportation Research Board, National Research Council, National Academy Press, Washington, D.C., 2001.

Clary, J, Kelly, J., O'Brien, J., Jones, J., Quigley, M. " The National Stormwater Best Management Practices Database: A Key Tool to Help Communities Meet Phase II Stormwater Requirements", *Stormwater*, vol. 2, no. 2, March/April 2001.

Quigley, M.M., "Evaluating Stormwater Quality Controls, Methods and Results from the National Stormwater Best Management Practices Database Project", Guest Speaker, New England Floodplain and Stormwater Managers Association, Hotel Viking, Newport Rhode Island, December 7, 2000.

Quigley, M.M. and Strecker, E.W., Protocols and Methods for Evaluating the Performance of Stormwater Source Controls, Invited Paper, NATO Advanced Research Workshop on Source Control Measures for Stormwater Runoff, St. Marienthal, Germany, November 8-12, 2000.

Quigley, M.M., "Evaluating Stormwater Quality Controls, Methods and Results from the National Stormwater Best Management Practices Database Project", Guest Speaker, Dinner Lecture at Boston Society of Civil Engineer's joint meeting of the Hydraulics and Water Resources Group and the Environmental Engineering Group, Radisson Hotel, Boston, Massachusetts, September, 14 2000.

Strecker, E.W., Quigley, M.M., and Urbonas, B.R., "EPA's Program for Improving Urban BMP Design and Selection Information – Results of Evaluation of the Existing Database", WEF Specialty Conference, Watershed 2000, Vancouver, British Columbia, July 8-12, 2000.

Strecker, E.W., Quigley, M. M., and Urbonas, B. R., "Determining Urban Stormwater BMP Effectiveness", Tools for Urban Water Resource Management and Protection, USEPA and Northeastern Illinois Planning Commission, Chicago, Illinois, February 7-10, 2000.

Hesse, E.T., Quigley, M.M., and Huber, W.C., "Environmental Impact of Construction and Repair Materials on Surface and Ground Waters", *User's Guide for IMPACT*, National Cooperative Highway Research Program Project 25-9, Dept. of Civil Construction and Environmental Engineering, Oregon State University, Corvallis, OR, 2000.

Huber, W.C. and Quigley, M. M., "Simplified Fate and Transport Model of Runoff from Highway Construction and Repair Materials", 8th International Conference on Urban Storm Drainage, August 30 – September 3, 1999, Sydney Australia.

Strecker, E.W., Quigley, M. M., and Urbonas, B. R., "Determining Urban Stormwater BMP Effectiveness", 8th International Conference on Urban Storm Drainage, August 30 – September 3, 1999, Sydney Australia.

Strecker, E.W., Quigley, M. M., and Urbonas, B. R., "Analysis of EPA's National Stormwater BMP Database", ASCE 26th Annual Water Resources Planning and Management Conference, Tempe, Arizona, June 6-9, 1999.

Guest Lecturer, "Applications in Stormwater Management", American Society of Civil Engineers, Continuing Education Series, Boston, Massachusetts, September 8-10, 1999.

PROFESSIONAL ASSOCIATIONS AND SOCIETIES:

Committee Member and Vice-Chair, Hydraulics and Water Resources Group, Boston Society of Civil Engineers

Technical Peer Review, Civil Engineering Practice: Journal Of The Boston Society Of Civil Engineers Section/ASCE

Member, American Society of Civil Engineers

Member, Urban Water Resources Research Council, ASCE

Phi Kappa Phi Honor Society, Oregon State University

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Mr. Weinstein is the Executive Director of the Low Impact Development Center, Inc, a non-profit water resource research organization. Mr. Weinstein has over 20 years of experience in water resource research, planning, and design. This includes development of national policy documents on Best Management Practices (BMP's) and Total Maximum Daily Loads (TMDL's), stormwater and wetlands models, water conservation, stream restoration, watershed master plans, NPDES permitting, and site design. He is a qualified expert witness on land use, zoning, and environmental issues. As the Director of the Low-Impact Development Center he is responsible for directing research, training, and seminars on the integration of Low Impact Development technology into ultra-urban, suburban, and rural environments.

Education	M.S., Environmental Engineering, Johns Hopkins University, 1997 M.L.A., Landscape Architecture, University of Georgia, Athens, 1983 B.S., Agriculture, University of Maryland, College Park, 1980
Licenses, Certifications, and Professional Organizations	Professional Engineer: Maryland #28443 Registered Landscape Architect: Maryland #625, Virginia #269 American Institute of Certified Planners American Society of Civil Engineers Urban Water Resources Research Council

Project Experience:

Guidance and Design Manuals

- Low Impact Development Design Manual *Naval Facilities Engineer Command*
- Feasibility Study for the Use of Low-Impact Development for Wet Weather Flows in Urban Areas, *USEPA*
- Ultra-Urban Best Management Practices, *Federal Highway Administration*
- Low-Impact Design Manual, *Prince George's County, Maryland*
- Protocol for Developing Nutrient TMDL's, *United States Environmental Protection Agency*
- LID Standards and Specifications, *National Capitol Region, GSA*

Low Impact Development Design and Pilot Projects

- Navy Yard Pilot Projects, *Naval District Washington*
- Mt. Ranier Streetscape Retrofits, *Maryland State Highway Administration*
- M Street Water Quality Improvements, *EFA Chesapeake*
- Ft. Lee Commissary Parking Lot Restoration, *Ft. Lee, Virginia*

System Retrofits

- Bladensburg Port Towns Water Quality Improvements, *Prince George's County, Maryland*
- Storm Drain System Repair, Quantico Marine Base, *Quan*tico, *Virginia*
- Pond 3 Outfall Repair, Sandy Hill Creative Disposal Project, *Prince George's County, Maryland*
- Mayfield Pond Retrofit, *Howard County, Maryland*

Stream Restoration and Wetland Mitigation

- Quincy Manor Run, *Prince George's County, Maryland*
- Kreutz Creek Stream Relocation, *York County, Pennsylvania*
- Annapolis Junction Wetland Mitigation, *Anne Arundel County, Maryland*
- Route 288 - Tuckahoe Creek Mitigation, *Chesterfield County, Virginia*

Publications

Weinstein, Neil A., Davis, A. and Raja Veramanacheni. Low Impact Development Applications for Highway Design in Urban Areas. Proceedings of the International Association of Water Quality, 2001

Weinstein, Neil A. and Larry Coffman. Low Impact Development Applications for Urban Wet Weather Flow. Novatech 2001

Weinstein, Neil A. In publication. Wetlands Geographic Information System Assessment Tool. Proceedings of the First Interagency Modeling Conference, 1998

Weinstein, Neil A., Mow-Soung Cheng, Larry Coffman, and Michael Clar. In publication. Low-Impact Development Hydrologic Analysis and Design. The 25th Annual Conference on Water Resources Planning and Management. American Society of Civil Engineers, 1998

Weinstein, Neil A., and Joseph B. Sesil., 1997. Pond Outfall and Spillway Renovation. Virginia Watershed and Lakes Management Symposium.

Weinstein, Neil A., and Paul A. Bernard, 1995. The Goose Creek Reservoir Restoration Project. Water Management in Urban Areas. Proceedings of the American Water Resources Association

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Dr. Koch has over 10 years of experience in water resource modeling, development of technical guidance documents, and professional classroom instruction. His professional achievements include the start-up of a high-profile floodplain mapping project, the incorporation of Low Impact Development concepts into a county stormwater management design manual, and several years of facilitating technology transfer through the National Highway Institute. Through the Low Impact Development Center he assists organizations with the integration of Low Impact Development strategies into their design practices, policies, and guidance documents.

Education

- Ph.D., Biological Systems Engineering, University of Nebraska, 1994
- M.S., Technology and Policy (Environmental Emphasis), MIT, 1990
- M.S., Agricultural Engineering, Texas A&M University, 1987
- B.S., Civil Engineering, George Washington University, 1984

Licenses, Certifications, and Memberships

- Registered Professional Engineer, Maryland #25880
- Certified Instructor, National Highway Institute, FHWA
- American Society of Civil Engineers
- Maryland State Water Quality Advisory Committee
- Universities Council on Water Resource

Project Experience:

Guidance and Design Manuals

- Case Studies in Low Impact Development, *Prince George's County, Maryland*
- Stormwater Design Manual (co-editor), *Prince George's County, Maryland*
- Practical Highway Hydrology course instructional materials, *Federal Highway Administration*
- HDS-2 (new dual-unit edition), *Federal Highway Administration*

Surface Water Modeling

- Watershed modeling and floodplain mapping for Lumber River Basin in North Carolina. This project involved more than 3000 square miles of drainage area and 1600 linear miles of riverine floodplains.
- Hydrologic modeling and hydraulic modeling for road flood mitigation project in suburban Washington, D.C.
- Reviewed applications made to FEMA for changes in flood zone maps.
- Wrote Fortran code for experimental two-dimensional finite element model of surface runoff.

Environmental Assessment

- Coordinated subconsultant activities in river sediment sampling and biological assessment in a dredging reconnaissance study.
- Performed water budget computations for wetlands design.

Technical Instruction and Communication

- Taught 3-day classes in Practical Highway Hydrology at state departments of transportation under the auspices of FHWA's National Highway Institute. Revised instructional materials for both the hydrology course and a new NHI course featuring the Watershed Modeling System.
- Facilitated workshop of stakeholders concerned with incorporating LID into county stormwater design manual revision.
- Presented findings of flood mitigation and dredging studies at public meetings.
- Showed results of Low Impact Development case studies at two conferences.
- Drafted agenda for workshop to facilitate federal interagency LIDAR standards development.
- Substituted for regular instructor in an upper-level undergraduate hydraulics course. *Catholic University, Washington, DC*

Specialized Skills

HEC-RAS • GeoRAS • TR-20 • HEC-1 • HEC-2 • HEC-HMS • STELLA • SURFER • NeuralWare (Artificial Neural Networks) • ArcView • PC ArcInfo • FORTRAN • Watershed Modeling System (WMS) • Microsoft Project • FastTrack Schedule

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Ms. Guillette is a Landscape Architect and Urban Planner whose work focuses on urban ecological designs and the integration of stormwater management features into master and site plans. Her extensive background in education and training help enhance the learning opportunities and educational aspects of her projects.

Education

- M.L.A., Landscape Architecture and Urban Planning, University of Pennsylvania, Philadelphia, PA; 2002
- B.S., Education, Florida State University, Tallahassee, FL

Additional Training

- University of Texas, Austin, TX; Mediation Training; 1996 – 1997
- George Washington University, Washington, D.C.; Graphic Design; 1989-1991

Project Experience:

Site and Master Plans

- **Newark Transit Hub, *Newark, DE,*** Designed a central plaza that accommodated circulation for buses, shuttles, and pedestrians in and out of the historic core of the city. The stormwater management constraints of the urban site predicated the use of porous paving, water collection mechanisms, bioswales, and bioretention areas to manage and utilize stormwater on site.
- **Dallas Arboretum Master Plan Update**, *Dallas, TX*, The Master Plan Update for the Dallas Arboretum involved an evaluation of the historical and botanical resources in its natural and regional cThe team of designers submitted a proposal that highlighted historical design elements (gardens and paths), preserved and restored botanical material, redesigned a circulation pattern and a network of paths that accommodated extensive public use, anontext. d designed outdoor plazas, exhibits and research facilities.
- **Avalon Park & Preserve**, *Long Island, NY,* Design for a portion of the entrance to the 82-acre forest preserve on eastern Long Island. The design connected the parking/service area to the memorial garden and utilized native plant materials that thrive in urban, non-irrigated spaces consistent with the goal of ecological restoration of the woodland and meadow landscape.
-

Specialized Skills

Adobe Photoshop, Adobe Illustrator, AutoCAD, ArcGIS, PageMaker, MS Office [Access, Excel, PowerPoint, Word], Visio, FileMakerPro, QuarkXPress, learning Dreamweaver [web design] and Flash 5.

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Green Technology for the Urban Environment

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cmiller@roofmeadow.com

Charles D. Miller, P.E., Principal

Education

M.S., Civil Engineering, University of Utah
M.S., Geology and Geophysics, University of Utah
B.S., Chemistry, College of William & Mary

Professional Registrations

Professional Engineer: Maryland, Pennsylvania, Virginia, Delaware and New Jersey
Professional Geologist: Virginia

Employment History

1997 – present	Principal, Roofscapes, Inc.
1985 – present	Senior Water Resources Engineer, CH2M HILL, Inc.
1981 – 1985	Water Resources Engineer, Satterthwaite, Assoc.
1976 – 1979	Field Exploration Geologist, Getty Oil Company
1973 – 1974	Laboratory Chemist, Medical College of Virginia

Memberships

American Society for Testing and Materials (ASTM) Subcommittee on Sustainability-Buildings, Green Roof Task Group (E.06.71)
Technical Advisory Committee, Green Roofs for Healthy Cities Coalition
Technical Advisory Committee, Center for Green Roof Research, Penn State Univ.
Deutscher Dachgärtner Verband (German Roof-Gardening Association)
American Society of Civil Engineers (ASCE)
American Landscape Contractors of America

Recent Publications

Miller, C., and Pyke, G., 1999, *Methodology for the Design of Vegetated Roof Covers*, Proceedings of the 1999 International Water Resource Engineering Conference, ASCE, Seattle, WA.

Miller, C., 1998, Vegetated Roof Covers, *A New Method for Controlling Runoff in Urbanized Areas*. Proceedings of the 1998 Pennsylvania Stormwater management Symposium, Villanova University.

Pennsylvania Association of Conservation Districts (PACD), in association with others, 1998, *Pennsylvania Handbook of Best Management Practices for Developing Areas*, Harrisburg, PA (C. Miller, project manager).

Relevant Experience

Mr. Miller has 20 years of experience in projects related to civil and environmental engineering. For the past four years he has focused his attention on best management practices (BMPs) for water resource management. These include biofiltration systems, integrated landscape measures, constructed wetlands, and vegetated roof covers. He edited the new *Pennsylvania Handbook of Best Management Practices for Developing Areas* which was published in spring of 1998. He has also been active in working with local governments to update stormwater management practices. This work has included leading workshops on best management practices, conducting field hydrologic assessments for the Wissahickon Creek River Conservation Plan, and framing new model ordinances for the New Jersey Division of Community Affairs, and the Great Swamp Watershed Association, New Jersey. Recent projects include

the design and installation of 33,000 square foot 'green roof' for Chicago's City Building, and design and installation of a parking lot bioretention system for Gwynedd-Mercy College.

Related work has included designing a 14-acre constructed wetland for the treatment of wastewater prior to discharge to the Susquehanna River. This design featured a flexible configuration of lift stations and control systems to allow operation of its two main cells in parallel or series, and with recycle as required. He has also worked to repair an eroded beach and protect valuable wetlands near Barnagat Inlet in New Jersey. This project involved the deployment of sand-filled geotubes and beach nourishment by dredging. Other work included the preparation of designs and specifications for the restoration of 500 acres of salt marsh in Delaware Estuary.

In 1997, Mr. Miller formed Roofscapes, Inc. to introduce, design and install advanced measures for the control of urban runoff. Mr. Miller is presently working closely with architects and landscape architects in five states. 'Green roof' projects include Fencing Academy of Philadelphia, Chicago City Hall, Heinz 57 Headquarters (Pittsburgh), chiropractic center (Pennsylvania), Heritage Office Complex (Maryland), and the Midwest Green Technology Center (Illinois). Mr. Miller also continues to consult on a part-time basis with CH2M HILL Inc.

Representative Projects

Vegetated Roof Cover, Chicago City Hall. Roofscapes, Inc. was selected to install a 33,000 square-foot vegetated cover as part of the *Chicago Urban Heat Island Initiative*. This project is scheduled for completion in the first half of the year 2000. The project involves covering one-half of the roof area associated with the combined city-county facility in downtown Chicago. When completed, it will allow comparative data on runoff and temperature to be collected from the two sides of the building. The project is unusual in that it utilizes light-weight extensive cover designs in combination with intensively landscaped areas. Native plant species are emphasized in this project.

Vegetated Roof Cover, Fencing Academy of Philadelphia. Designed and installed a 3,000 square-foot vegetated roof cover for the Academy in 1998. This system features a low-profile, light-weight veneer of vegetation incorporating hardy varieties of *Sedum* and grass. This project was planned as a demonstration of a how vegetated roof covers can be used effectively for urban runoff management. The system was installed on top of an existing roof, where it provides a meadow-like setting of perennial plants that is accessible to the adjacent penthouse apartment. The project is being monitored on an on-going basis to evaluate the benefits of this new approach.

Vegetated Roof Cover, Chiropractic Health Center, Pennsylvania (confidential client**).** This project, which is presently in construction, incorporates a 6,000 square-foot vegetated roof cover designed by Roofscapes, Inc. The three-inch deep light-weight vegetated cover is intended to lessen the impact of the development on the environment and allow the building to blend into the surrounding landscape. The project is unusual in that it involves construction on a sloping roof. The eaves of the roof, inspired by Asian architecture, are designed to discharge runoff as curtain. An electronic leak detection system is also being furnished to this project.

Vegetated Roof Cover, Heinz 57 Center, Pittsburgh, Pennsylvania. Designed and installed a 12,000 square-foot vegetated roof cover for the Heinz Company Headquarters Building in Pittsburgh. This system consists of a 5-inch deep, two-layer (Type III Roofmeadow®) system without irrigation. In incorporates about 20 different species of perennial plants that create a cover of flowering perennial plants that surround the penthouse office floor. Complications associated with this project, included lifting materials to the terraces on the 14th floor.

Plaza Stormwater Management System for the Ramshead Project, Chapel Hill, North Carolina. Mr. Miller is presently engaged in preparing specifications and details for a 40,000 square-foot green roof plaza. The plaza design is being optimized to manage runoff from a two-acre development at the University of North Carolina. This system features a 36-inch deep vegetated cover that will support full-size trees. The vegetated cover system will retain up to 100,000 gallons of water following rainfall events. This water will be subsequently consumed for irrigation of the plaza landscape.

This project is part of a larger initiative by the city of Chapel Hill to reduce the impact of on-going development.

Green Roof Proto-Type for Florida Department of Environmental Protection. Mr. Miller is working with FLDEP and the Bonita Bay Group to develop green roof systems that respond to the special conditions in south Florida. There are no precedents for green roof projects in subtropical or tropical climates world-wide. Therefore, this work has large implications for the extension of green roof technologies into new regions. The objective is to develop specialized media formulations, plants lists, and structural solutions. Proto-type systems will be installed and tested on a 2,400 square-foot building roof, beginning in 2002.

Computer Simulator Development. Developed a new computer tool to aid in the design of vegetated roof covers. This is an unsaturated flow model that can predict the runoff hydrograph from roofs treated with vegetated covers. The model incorporates site-specific data describing seasonal rainfall patterns and potential evapotranspiration. It can be used to 1) demonstrate peak runoff rate suppression for specified design storms, 2) predict moisture content during dry months, and 3) estimate reductions in total annual roof runoff. The model was presented at the ASCE 1999 International Water Resources Engineering Convention.

Wissahickon Creek River Conservation Plan. The Wissahickon gorge in the Fairmount Park portion offers some of the most dramatic river landscapes in Pennsylvania. However, the development of the watershed has resulted in severe impacts associated with water quality, flooding and habitat destruction. Mr. Miller prepared a detailed assessment of hydrologic conditions on this watershed and made specific recommendations for the deployment of best management practices and for the implementation of new stormwater ordinances. The project was jointly funded by the Fairmount Park Commission of Philadelphia and the Pennsylvania Department of Conservation of Natural Resources (DCNR). The project focuses on approaches for restoring riparian landscapes and hydrologic function to the watershed.

Pennsylvania Association of Conservation Districts. Project manager for the preparation of the new *Pennsylvania Handbook of Best Management Practices for Developing Areas*. The Handbook is the common reference for watershed planning and management activities in the State, including those regulated under the Clean Streams Law, and Pennsylvania Acts 167, 102, and 105. In addition to providing descriptions and design guidelines for approximately 40 stormwater management measures, the Handbook also provides practical information on comprehensive watershed planning and the development of local stormwater ordinances. Participants in the project advisory committee included the NRCS, PaDEP Bureau of Land & Water Conservation, and the Soil and Water Conservation Society.

Urban Bioretention Demonstration, Gwynedd-Mercy College, Pennsylvania. Designed and supervised the construction of two bioretention islands in an existing parking lot of the Gwynedd-Mercy College. The work was funded by a grant from the Coastal Zone Management Program (National Oceanic and Atmospheric Administration). This grant was administered by the Pennsylvania Department of Environmental Protection. The purpose of the project was to provide an example of a water quality measure that could be economically retrofit in a highly impervious setting. The design was based on research conducted by the University of Maryland and Prince George's County, MD. It utilizes a traffic island as a high rate biofiltration system to treat the first flush of runoff. Its performance will be monitored by the College and the Montgomery County Planning Commission.

Constructed Treatment Wetland, Lancaster County Solid Waste Management Authority, Lancaster, PA. Managed the design of a 14-acre constructed wetland. The design objectives were to: 1) improve the cold weather treatment efficiency of the existing leachate treatment system, 2) minimize space requirements by utilizing land area which was unsuitable for other development purposes, 3) preserve a high degree of flexibility of operation, and 4) provide a visually pleasing site design with value as a wetlands interpretative center to augment the adjacent public park. The design features a terraced system of wetlands, containing a range of wetland habitat zones. A series of weir overflow structures and weir boxes allow a flexible pattern of flow control. The project also involved and environmental inventory of Mann's Run which constitutes the receiving water for the wetland.

B.L. England Station, Atlantic Electric, Beesleys Point, NJ. Alternatives were required to replace a 20,000 square feet pressure-dosed tile field which was failing. The development of options was complicated by the location of the Station within a coastal wetland. The project included an investigation of the conditions which led to failure of the tile field and a detailed technical, risk, and cost-based analysis of available disposal alternatives. These were: 1) direct discharge of treated effluent to Little Egg Harbor, 2) recharge of the coastal water table aquifer using injection wells, and 3) construction of high-rate infiltration basins. Extensive data collection, including borings, pumping tests, and tidal measurements were required. Injection wells, which combined compact space requirements with a high degree of reliability, were the recommended option. Mr. Miller prepared designs, and supervised the construction and testing of the disposal system. This project is the first of its kind to be operating in the state of New Jersey.

Great Swamp Watershed, New Jersey. The Great Swamp Watershed is a unique environmental asset which is currently under threat by development. In particular, changes in runoff patterns are resulting in increased quantities of TSS and dissolved contaminants being discharged to the marsh, while infiltration to groundwater is decreasing. Mr. Miller assisted the Great Swamp Watershed Association in preparing a model ordinance to support the regional development plan for the Great Swamp Watershed and prepared a guide for use by the local townships in implementing the provisions of the new ordinances. This work was a direct outgrowth of Mr. Miller's work on watershed investigations conducted four years earlier for the Association when it was formulating its watershed management proposals. Subsequent to this work, Mr. Miller was retained by the New Jersey Department of Community Affairs to prepare a BMP manual that is tailored to the local conditions and which will support the goals of the Great Swamp Watershed Management Plan.

Delaware Estuary, Public Service Electric and Gas of New Jersey. Prepared designs, cost estimates, specifications and bid packages for construction activities which will restore 500 acres of salt marsh in the Delaware estuary. The project includes the eradication of an invasive reed species (*Phragmites australis*) which has degraded the productivity of the marsh. The central engineering element of restoration is the dredge excavation of 125,000 cubic yards to enlarge existing tidal channels and create new channels. A 30-acre dredge spoil impoundment has been designed to support this operation. The project also involved public access improvements, including the construction of roads and parking facilities. Mr. Miller also managed the analysis of potential flooding impacts associated with the planned construction. In related work, he led the investigation of six salt marshes in Cumberland County, New Jersey. These investigations included measurements of marsh topography, tidal peak attenuation across the marshes, and patterns of vegetation. Also the influence of key hydraulic controls, such as culverts and valves, were investigated.

City of Allentown, PA. Conducted an in-depth analysis of conditions contributing to chronic flooding in the City's Livingston Drainage District. The project included field data collection and hydraulic modeling of the existing storm drainage system. The study focused on the potential benefits associated with constructing relief storm sewers or diversions. The study concluded that, while some reduction in flooding could be achieved through the construction of relief sewers, improvements of conditions in many critical flood prone areas would depend on the implementation of measures which could be adopted in the upper watershed. Storm sewer improvements could reduce but not eliminate the need for additional measures, including detention basins in the upper watershed and strategic flood proofing within the City. Simulation of conditions in the upper watershed led to specific recommendations for the location and sizing of new detention facilities.

Peck Iron and Metal Company, Richmond, VA. Managed the preparation of designs and permits for the safe closure of this residual waste landfill which resides in the flood plain of the James River. In addition to having to achieve compliance with the local flood plain management ordinances, the project was also regulated under the Chesapeake Bay Preservation Act (CBPA), which sets strict limits for phosphorus in stormwater discharges. The project included the design of a cover system for the landfill which used a geosynthetic mesh to reinforce turf and resist tensions associated with the 100-year river discharge. Runoff collection channels and bermed sediment facilities were designed to comply with CBPA phosphorus limits as well as local runoff peak release requirements.

Genstar, Inc., Millville, NJ. Mr. Miller provided technical advice and senior review for design of a sand mine development . The project involved a long range development plan, with staged excavation to minimize water table impacts in adjacent areas. A strategy was developed in which the construction of intermediate impounding dikes could be used in lieu of pumping to support surrounding groundwater levels. The design included a comprehensive proposal to reclaim the site as a recreational area.

Dam Rehabilitation Projects, New York and Pennsylvania. Working for owners whose dams had failed the preliminary inspections conducted as part of the National Dam Inspection Program, Mr. Miller managed numerous investigations and design studies. Compliance with dam safety regulations was obtained through either remedial design, or through supplemental analysis which could demonstrate adequate stability. Eleven dam remediation projects were completed. All of these incorporated watershed rainfall event modeling using HEC-I and HEC-6 (dam break) and hydraulic analysis of spillways and other control structures. Representative examples include:

> Bear Gulch Dam in Schoharie County, New York. This was an earthen dam with an inadequate spillway and toe seepage problems. Remedial measures were designed, including a new spillway, embankment crest road, and seepage control blanket. These modifications brought the dam into compliance with State safety requirements.
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> Wappinger's Falls Dam, in Dutchess County, New York. This project involved core drilling of the 100-year old masonry structure from a floating platform and installing piezometers to measure uplift pressures. Structural data obtained from the cores, combined with the measured pore pressures, led to removal of the dam from the unsafe structures list

Llanerch Reclamation Project, Llanerch, PA. Mr. Miller managed the investigation of the stability of a high wall. This is a demolition waste landfill which occupies an abandoned quarry in a densely populated portion of the county. The owners were concerned about the potential for wall failure as the pit was dewatered. The objective of the project was to establish safe set-back distances for new construction associated with the facility. The stability conditions were established by oriented core drilling, installation of extensometers in boreholes, and thorough structural mapping. The predictions of the investigation were later substantiated when a portion of the high wall gave way. No damage was sustained due to the construction set backs.

AMY S. GREENE
Principal Ecologist **ASCE Grade PIX**

YEARS OF EXPERIENCE: 28

EDUCATION:
M.S. Ecology, 1984, Rutgers University, New Brunswick, NJ;
B.A. Biology, 1974, Boston University, Boston, MA.

PROFESSIONAL REGISTRATIONS
Society of Wetland Scientists Certified Professional Wetland Scientist, 1995; Ecological Association of America Certified Senior Ecologist, 1995; USACOE Certified Wetland Delineator, 1994; NJDEP Bureau of Discharge Prevention Certified Ecologist/Ornithologist, 1992.

TRAINING
Pinelands Nursery Native Plant Symposium, 2002 and 2000; Wetlands Regulatory Workgroup National Hydric Soils Workshop, 2001; OSHA Certified Health & Safety Training (HAZWOPER), 1991; Wetland Training Institute's Wetland Functions and Values Training, 1990; USACOE Jurisdictional Delineation of Wetland Ecosystems in the Mid-Atlantic States, 1998; USFWS Habitat Evaluation Procedures, 1984; Cook College, Rutgers University Training Courses: Threatened & Endangered Species, 2000; Environmental & Ecological Risk Assessment For Hazardous Waste, 1999; Protecting Watersheds In Central & Southern N.J., 1999; Identification of Grasses, Sedges, Rushes, 1995; Advanced Wetland Delineation-South N.J., 1995. U.S. Fish and Wildlife Service (PA) Endangered Species Survey Course, 2002. Pennsylvania Association of Environmental Professionals Training In Section 4(f) Resource Evaluation, 2002.

Instructor At Cook College, Rutgers University, For Continuing Education: Environmental Impact Statement Preparation; Environmentally Sensitive Area Mapping.

KEY QUALIFICATIONS
Ms. Greene is President and owner of Amy S. Greene Environmental Consultants, Inc. (ASGECI). As such, she has been providing professional environmental services to private and public sector clients since February 1986. She is a recognized expert in the field of wetland science, natural resources inventory, and environmental impact assessment. Amy Greene is principal in charge of all projects for ASGECI. She has managed and performed wetland delineations, prepared successful State and Federal permit applications and prepared mitigation plans for coastal and inland wetlands. She has conducted vegetation and wildlife habitat evaluations, endangered and threatened species surveys, natural resources inventories, and environmental impact assessments. Projects have been performed in many eastern states for residential, commercial and industrial development, open space and recreation, wastewater, sludge, solid waste, port and transportation facilities. Environmental Impact Statements have been prepared in accordance with *National Environmental Policy Act* and state and local regulations.

Ms. Greene has been principally responsible for performance of the following representative projects:

NY City Department of Design and Construction/DeFino Contracting, Woodrow Road Sanitary and Storm Sewer Installation and Inspection, Borough of Staten Island, Richmond County, NY. Principal in charge of Wetland Restoration Specialists responsible for onsite monitoring of construction activities and oversight of wetland planting to ensure compliance with NYSDEC wetlands permit conditions including preparation of routine inspection and monitoring reports and onsite coordination with the prime contractor, the New York City Department of Environmental Protection (NYCDEP) and NYSDEC using Best Management Practices. The project included installation of a constructed wetland to provide treatment of stormwater prior to discharge to the Staten Island Blue Belt.

NY City Department of Design and Construction (NYCDDC)/Bedford Construction Corporation Eylandt Street/Jansen Street Infrastructure Project, Borough of Staten Island, Richmond County NY. This project includes installation of storm water and sewer facilities including construction of wetlands for water quality treatment of storm water. Ms. Greene is Principal in charge of over sight of the Wetland Restoration Specialists responsible for monitoring ecosystem restoration work performed by the contractor for adherence to New York State Department of Environmental Conservation (NYSDEC) permit requests and for consistency with the project plans and specifications. This includes mandatory implementation of the soil erosion control plan, coir fiber log installation, stream bank grading and the overseeing of all installation of restoration plant materials. Extensive knowledge of all conditions of the NYSDEC freshwater wetlands permit is required. Annual monitoring reports of the vegetative restoration and an inventory of trees, shrubs and invasive plants as well as inspection of erosion controls are required for the duration of this project. The use of Best Management Practices were employed on this project.

AIG/Baker, International Trade Center, Route 206 and 46, Retail Center and Regional Connector Road Wetland Mitigation Project, Mt. Olive Township, Morris County, New Jersey. Principal in charge of oversight of Environmental Restoration Specialist performing environmental monitoring of the wetland mitigation project at the site. The project entailed establishment of forested and emergent wetlands to satisfy NJDEP conditions for an Individual Wetlands Permit under the NJ Freshwtaer Wetlands Protection Act. This has included inspection of the sub-grade elevations and clay liner installation to insure the establishment of the proper wetland hydrology; inspection of topsoil placement; monitoring of wetland plant installation; construction of outlet weir; providing guidance on excavation activities to protect adjacent wetland hydrology; monitoring of soil erosion and sediment control measures; and long term plant survivability. Reports are prepared and submitted to NJDEP after each inspection.

New York City Department of Design and Construction (NYCDDC) and New York City Department of Environmental Protection (NYCDEP)/CARP Construction, Foster Road Infrastructure Project, Staten Island Borough, New York. Principal responsible for oversight of Wetland Restoration Monitoring Services for the onsite monitoring of construction activities using Best Management Practices to ensure compliance with applicable environmental regulations and NYSDEC wetland permit conditions, including the inspection of erosion controls.

The Whitman Companies, West Mile Run Stream Corridor Restoration, City of New Brunswick, Middlesex County, NJ. The project included preparation of successful applications for NJDEP Wetland General Permit #4 and a Stream Encroachment Permit application. ASGECI designed the Stream Corridor Restoration Plan to be implemented following removal of PCB contaminated soils from the wetlands and floodplains. Principal responsible for oversight of monitoring of the restoration plan implementation including installation of erosion control measures, topsoil placement and native plant establishment. Post construction monitoring of plant survival and colonization is currently being performing.

New Jersey Transit Kearny Connection Project, Hudson County, NJ. Principal in charge of staff's performance of a wetland delineation, environmental assessment, and mitigation site selection and plan for project in the NJ Meadowlands. ASGECI obtained the development approval from the NJ Meadowlands Commission. Wetland mitigation was required as a condition of the USACOE Individual Permit obtained for the project. A site for wetland enhancement was selected and approved by the USACOE and USFWS. A WET analysis of the mitigation site was performed to demonstrate the improvement in wetland functions before and after enhancement.

CURTIS W. HELM

Project Manager **ASCE Grade PVI**

YEARS OF EXPERIENCE: 15

EDUCATION: M.S. Forestry and Horticulture, Rutgers University, New Brunswick, NJ 1986-1988; B.S. Forestry, Cook College, New Brunswick, NJ.

CERTIFICATIONS and TRAINING: New Jersey State Approved Forester; New Jersey Certified Tree Expert (CTE #296); Restoration of Disturbed Sites; Cook College Continuing Ed. 2002

KEY QUALIFICATIONS

Mr. Helm has 15 years of experience in various aspects of environmental consulting services. He has performed numerous wetland delineations, and prepared applications for various freshwater and tidal wetland permits in for approval by the NJDEP and USACOE, as well as applications for projects under the jurisdiction of the NJDEP Coastal Program Permit rules (CAFRA & Waterfront Development). He has designed tidal and freshwater wetland mitigation projects. He has supervised and monitored construction projects for compliance with environmental permit requirements. Mr. Helm has applied site restoration and bioengineering techniques, utilizing native species to provide shoreline stabilization and riparian habitat restoration. Mr. Helm has prepared habitat restoration plans for upland endangered and threatened species. Mr. Helm has researched and prepared numerous Environmental Assessments (EA) and Environmental Impact Statements (EIS) for projects in New Jersey and New York. As a NJ Certified Forester and NJ Certified Tree Expert, Mr. Helm is familiar with all aspects of forestry and Forest Management Plan development. As well as urban forestry issues. He has been qualified as an expert witness in NJ Superior Court.

Mr. Helm has received two awards from the NJ Native Plant Society (1994 and 1997) for excellence in the use of native plants and bioengineering techniques. He also received an award for Ecological Restoration from the Firman E. Bear Chapter of the Soil and Water Conservation Society and Pinelands Nursery (December 2000).

RELEVANT EXPERIENCE

NJ Transit/Bechtel Infrastructure Corporation, Southern New Jersey Light Rail Transit System (SNJLRTS) Design Build Operation and Maintenance Project, Town of Pennsauken, Town of Riverside, Town of Hamilton, Camden, Burlington, and Mercer Counties, New Jersey. Project Manager responsible for performance of final wetland mitigation design and oversight of construction and preparation of an application for environmental permit modifications. The project involved the design of two freshwater tidal wetland systems and one aquatic wetland mitigation project. ASGECI participated in meetings with the USACOE and NJDEP and provided technical memoranda. Mr. Helm assisted with preparation of requests for modifications to the Waterfront Development and Individual Wetlands permits that resulted from changes in the alignment of the light rail tracks. Mr. Helm presented wetland mitigation plan final designs and requested permit modifications at Interagency meetings. ASGECI also performed fish surveys, vegetation assessments, and hydrologic monitoring in the fall of 2000 and 2001 and will continue to survey for 5 years during post-construction. Mr. Helm co-authored the recently published article “Rising Tide” found in *Civil Engineer* (February 2002, Vol. 72, No. 9), which chronicles the development of the final design for the three mitigation sites.

Day Engineering, Inc./Metro North Railroad, Revised Wetland Mitigation Plan, Cortlandt, NY. Project Manager responsible for preparation of a revised wetland mitigation plan for impacts associated with a parking lot expansion project at the Cortlandt train station. The construction contractor had failed to complete the project and a completely revised wetland mitigation plan was required. The revised plan included removal of invasive purple loosestrife that had colonized the site, replanting with fast growing native species to ensure displacement of loosestrife and herbivory protection.

Woodrow Road Sanitary and Storm Sewer Installation and Inspection, Borough of Staten Island, Richmond County, NY. Restoration Specialist responsible for onsite monitoring of construction activities and oversight of wetland planting to ensure compliance with NYSDEC wetlands permit conditions including preparation of routine inspection and monitoring reports and onsite coordination with the prime contractor, the NYC Department of Environmental Protection and NY State Department of Environmental Conservation. The project included installation of two constructed wetlands to provide treatment of stormwater prior to discharge to the Staten Island Blue Belt.

NJ Department of Transportation/Goodkind & O'Dea, Inc., Route 35-Victory Bridge Replacement, Middlesex County, NJ. Project Manager responsible for performance of wetland delineation and preparation and submission of LOI application for the combined Victory Bridge, Victory Circle and Route 9 Edison bridge portions of the project. A report was prepared on wetlands, vegetation and wildlife that was incorporated into the LOAA (CED) for Rte 35. ASGECI prepared the combined NJDEP Waterfront Development/Coastal Permit and NJDEP Individual Wetlands Permit applications for Rte 35. All permits were issued by the NJDEP in September 1998. Due to delays during the design/build process, ASGECI prepared NJDEP Permit Extension/Modification for a revised bridge design during 2002. ASGECI also performed the wetland mitigation site search and prepared the Mitigation Plan for an approximately 15 acre site in Sayreville for the combined bridge projects. The mitigation plan was approved in 1999. The site was constructed in 2000 and planted in 2002.

Merck and Co., Inc., Geosyntec Consultants, Environmental Services for Range Road Landfill Closure, City of Linden, Union County, NJ. Project manager responsible for all aspects of wetland and coastal permitting relating for landfill closure. Mr. Helm performed a wetland delineation and obtained a new NJDEP LOI for the site based on problems observed (wetlands overmapped by previous firm) with the original LOI. Mr. Helm prepared an application for a General Permit #4 and Waterfront Development Coastal General Permit to obtain NJ State approval of the landfill closure. Mr. Helm also prepared an Essential Fish Habitat Assessment for the National Marine Fisheries and a Nationwide Permit #38 for submission to the ACOE. A detailed tidal wetland mitigation plan was prepared to address wetland impacts.

Hercules, Inc., Geosyntec Consultants, Old York Road Site, Burlington City and Burlington Township, Burlington County. ASGECI will prepare and submit an application to the Jersey Department of Environmental Protection (NJDEP) for General Permit (GP) #4 for site remediation in wetlands to authorize proposed activities in wetlands for cleanup or removal of hazardous substances. For this project, the GP #4 is needed for landfill capping. An application for a Waterfront Development Permit will also be submitted to the NJDEP. An application for authorization under U.S. Army Corps of Engineers (USACOE) Nationwide Permit (NP) # 38 is also in preparation. Mr. Helm worked with Hercules to explore options to satisfy the wetland mitigation requirement of GP #4. A wetland mitigation site has been identified and design is ongoing. Mr. Helm attended a pre-application conference with NJDEP to identify the permitting requirements for the project.

Patrick M. Starr
Bio

Patrick Starr currently serves as Vice President of the Pennsylvania Environmental Council's southeast regional office (covering Berks, Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties) located in Center City Philadelphia. Since 1970, the Council has served as a catalyst for improving Pennsylvania's environment by finding common-ground and forging action partnerships. The Council embraces an inclusive approach to problem-solving and counts among its members and partners numerous businesses, municipalities and non-profit organizations.

With a staff of 14 employees and an annual budget exceeding $1.3 million, the regional office manages 20 project initiatives. Major projects under Starr's direction include sustainable and transit-oriented development education, brownfields redevelopment technical assistance, promotion of Delaware Riverfront redevelopment, watershed planning/education, as well as the GreenSpace Alliance of Southeastern Pennsylvania, a metropolitan open space project.

Related to his work, he serves as the Chair of the Delaware Valley Regional Planning Commission's Regional Citizens Committee. Additionally he serves on DVRPC's Land Use Committee, and 10,000 Friends of Pennsylvania's Urban Task Force and State Spending Task Forces. He is a member of the Growth Management Leadership Alliance and of the Philadelphia chapter of the Urban Land Institute. Formerly he served on the Executive Committee of the Philadelphia Urban Resources Partnership, the Steering Committee of the RISA Project for sustaining agriculture in Southeastern Pennsylvania, on the Select Committee on the Reuse of Vacant Land, and on numerous other project teams, committees and advisory groups.

His volunteer activities include past participation on the Board of Directors of the Schuylkill River Development Council and more than 15 years of involvement with the Spruce Hill Community Association, a highly active civic group with more than 400 household members. He served the SHCA as an officer for more than seven years, completing two years as President in 1998.

Prior to joining the Council, Mr. Starr worked as the Public Affairs Director of the Philadelphia Streets Department where he served as a policy advisor to the Streets Commissioner and as the primary department contact for the media, community leaders and elected officials. Before that he was Director of Civic Issues and Editor of *CitySITES*, a magazine on urban design issues in Philadelphia, at the Foundation for Architecture.

Today, Mr. Starr resides in Center City Philadelphia (without a car). He holds a B.A. from the University of Pennsylvania with a major in Urban Studies. He is a lifelong Pennsylvanian having grown-up in Chambersburg, the county seat of Franklin County in the beautiful Cumberland Valley.

Ann Elizabeth Smith

Education

Bachelor of Business Administration — University of Wisconsin-Oshkosh 1981
Major in Finance and Minor in Economics

Master of Science — University of Michigan 1997
School of Natural Resources and Environment

Resource Policy and Behavior Program with an emphasis on water resource issues. Course work included:

- Forest Hydrology and Watershed Management
- Water Pollution Ecology
- Water Quality Management
- Environmental Policy and Administration
- Negotiating Skills for Environmental Policy
- Analytical Tools for Environmental Policy
- Natural Resource Economics

The Pennsylvania Environmental Council

September 1998 to present: Director of Watershed Programs
Responsibilities include:

- Manage projects relating to water resource policy and education
- Create synergy among the various water resource programs and projects
- Coordinate with other Pennsylvania Environmental Council programs that relate to water resources
- Develop new programs/projects
- Identify and obtain new sources of funding for water resource programs

Other Work Experience

The MEDSTAT Group

December 1992 to June 1995 and May 1997 to Present Account Executive for clients of the Managed Care and Insurance Division. Responsibilities include:

- Continuation and expansion of the MEDSTAT relationship with assigned clients
- Delivering new services, products and technology to meet client business needs
- Establishing relationship with executive staff of client organizations

Electronic Data Systems

1989 to 1992 Account Executive for large health insurance client with two contracts totaling nine million dollars in annual revenue. Responsibilities included:

- Complete operational and financial performance of client contract
- Meeting client business needs through new services, products and technology
- Establishing relationship with executive staff of client organizations
- Negotiating contract renewal, modifications and new services

1986 to 1989 Project manager for health insurance clients. Responsibilities included:

- Direct implantation of clients on to new processing systems
- Leadership of onsite project team and the remote systems engineer support group
- Primary contact for client management with regards to operational issues
- Provided client training and business support

1981 to 1986 Held several roles including business analyst, systems engineer and business analyst team leader.

- Developed and installed system changes to meet client business needs
- Trained and advised client on system features, organization and workflow
- Created documentation for system changes

Contact Information

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