

Amanda Ludlow Principal Scientist

Technical Specialties:

Wetland Services: Delineation, Assessment, Remediation, Habitat Design, Mitigation, Monitoring, Permitting and Regulatory Support; Low Impact Development Stormwater Management; Stormwater runoff analyses, Soil and Sediment Characterization, Water Quality. Engineered Natural Systems: Constructed Treatment Wetlands, Natural Media Filtration, Phytotechnologies.

Experience Summary:

Eleven years of experience: Principal Scientist, Senior, Project and Staff Engineer with Roux Associates; Research Assistant with the Utah Water Research Laboratory at Utah State University, Logan, UT; Research Assistant with Ocean Arks International, Falmouth, MA; Research Assistant at the Marine Biological Laboratory in Woods Hole, MA.

Credentials:

M.S. Civil and Environmental Engineering, Utah State University, 2003
M.A. Marine Biology, Boston University, 1995
B.S. Bio-Engineering, Syracuse University, 1994
Wetland Delineation Certification, Rutgers University, 2000
Hydric Soil Certification, Rutgers University, 2000
Winter Plant Identification Certification, Rutgers University, 2000

Professional Affiliations:

Society for Wetland Scientists
Soil Science Society of America
New York State Wetlands Forum
International Phytotechnologies Society

Publications/Abstracts/Presentations:

Sprayfield Application of Process Water. 2007. Ludlow, A.B., W. Eifert, K. Kitzman, L. Schmelter, S. Courtney, and J. Fu. 4th International Phytotechnologies Conference. Denver, CO. September 25, 2007.

Treatment Wetlands for Water Quality Improvement. 2006. Ludlow, A.B. and M. Harris. Lorman Constructed Wetlands Seminar Series July 25, 2006.

Pond, Creek and Wetland Restoration using Constructed Wetlands for Municipal Stormwater Treatment. 2002. Ludlow, A.B. and C.J. McGuckin. New York State Wetlands Forum, Inc. 2002 Annual Conference and Meeting. Liverpool, NY.

Identification of the Biogeochemical Processes Controlling Metal Distribution in Contaminated Sediments Receiving Mine Drainage. 1999. Ludlow, A.B., J.E. McLean, P.R. Grossl. ASA, CSSA, SSSA 91st Annual Meeting, Salt Lake City, UT.

Evaluation of a Wetland System Receiving Mine Drainage for the Natural Attenuation of Toxic Trace Elements. 1999. Ludlow, A.B., J.E. McLean, P.R. Grossl, R. Gecy. Battelle Wetlands Remediation Conference, Salt Lake City, UT.

Living Machines. 1996. Ludlow, A.B., J. Todd, B. Josephson. 1st Italian Eco-Village Conference, Allessano, Italy.

Key Projects:

Wetland Assessment, Delineation, and Mitigation

- Engineer and wetland specialist for the design and permitting (local, state and federal) of a sediment remediation plan for metal impacts to an emergent and forested wetland located in Gloucester, MA. Remediation included the removal of impacted sediment, followed by restoration with a native emergent, shrub and forested wetland plantings.
- Engineer and wetland specialist for the design and permitting (local, state and federal) of a sediment-capping plan for impacts to a former lagoon and drainage swale located in Middleborough, MA. The former lagoon and swale were officially designated as a jurisdictional emergent and forested wetland. Remediation included the capping of impacted sediment and raising the grade to the adjacent wetland areas, followed by restoration with a native emergent, shrub and forested wetland plantings.
- Wetland specialist for the evaluation of a bordering vegetated wetland located in Marlborough, Massachusetts. The evaluation included quarterly field monitoring of vegetation and hydrology to assess potential impacts to the wetlands from a nearby remediation system.
- Wetland specialist for the delineation of vernal pools and forested wetlands in Stoughton, Massachusetts. Delineation of the vernal pool followed the guidelines set forth by the NHESP. Verification of the presence/absence of vernal pools required multiple field visits and inspections of water levels (depth of standing water), wildlife and habitat within and adjacent to the potential vernal pool areas.
- Wetland specialist for the design and permitting (local, state and federal) for the restoration a forested wetland temporarily disturbed due to emergency remediation activities in Raynham, Massachusetts.
- Project Principal for the environmental assessment and wetland design of a 110-acre park facility in Staten Island, NY. Major project elements include the delineation of 35 acres of jurisdictional wetlands, preparation of an environmental assessment statement, design of stormwater wetlands and other low impact BMPs to manage the runoff generated from a LEED certified 70,000 ft² athletic facility.
- Project Principal for the grassland restoration over a 70-acre island located in Brooklyn, NY. Major project elements include the delineation and preservation of warm season grasses, eradication of the invasive species *Phragmites australis*, landfill cap design, procurement and grading of 120,000 cy of sand across the island and habitat design for ground nesting birds.

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- Engineer and wetland specialist for the design and permitting of a sediment remediation plan for impacts to a 3.2-acre pond located in the Massapequa Preserve on Long Island, New York. Remediation will include the removal of impacted sediment from the pond, followed by the installation of replacement wetland substrate and restoration with native emergent wetland plantings. The ultimate goal of the mitigation plan was to maintain the primary function of the pond as a storm water detention unit, and replace the former pond marsh with a structurally complex emergent low marsh surrounded by a shrub/forested adjacent area.
 - Conducted detailed investigations of numerous freshwater and tidal wetlands covering a 440-acre site in Staten Island, New York. Investigations included sediment, surface water, and groundwater sampling, data evaluation, and wetland delineation. Prepared wetland assessment report and corrective action plan. Current activities include the development of a remedial design to address wetland impacts.
 - Completed delineation and assessment of emergent and forested freshwater wetlands located along the Peconic River on Long Island, New York for Brookhaven National Laboratory. Prepared sediment removal and wetland restoration work plan for the remediation of metal contaminated sediments in the wetland system. Plans were approved by NYSDEC, USEPA and DOE. The remediation project was completed in Spring 2002. Current activities in the restored wetland include monitoring and maintenance.
 - Prepared wetland mitigation and monitoring plan for unavoidable impacts to emergent tidal wetland resources due to remediation activities in Staten Island, New York. The mitigation plan was designed to use and promote the growth of native vegetation and replace the existing *Phragmites* community with a structurally complex intertidal salt marsh. Prepared wetland permit submittals and regulatory support for NYSDEC/ACOE Joint Permit Application and NYSDOS Coastal Management Program.
 - Project Manager for a two-year evaluation of forested and emergent wetland areas located in Smithtown, New York. The evaluation includes quarterly field monitoring of vegetation and hydrology to assess potential impacts to the wetlands from a nearby remediation system.
 - Completed multiple delineations of freshwater wetland resources located on an active bulk storage, receiving and transfer facility for petroleum and chemical products in New Jersey. Due to numerous historical Site alterations, the Disturbed Area Evaluations delineation methodology was applied in order to identify the presence/absence of each wetland criteria. The delineation was field verified and approved by the New Jersey Department of Environmental Protection. Prepared wetland permit application, submittals and regulatory support to obtain the required state approvals to perform regulated activities within and adjacent to the delineated wetlands.
 - Conducted delineation of forested wetland resources located adjacent to an active cleaning and sanitizing product manufacturing and distribution facility in New Jersey.
 - Conducted site inspection and ecological risk evaluation of impacts to a riparian wetland and stream in Avenel, New Jersey. Evaluation additionally included the identification of dominant riparian vegetation.
 - Led the environmental assessment of a natural wetland at an abandoned silver/lead mine in the Uinta Mountains, Utah. Evaluated the efficiency of the wetland/pond system to remove and retain toxic trace elements found in mine drainage. Responsibilities included sampling plan design, surface water, plant, and sediment collection, water quality evaluation, laboratory and data analysis including various metal extraction procedures, annual and final report preparation. The U.S. Forest Service used the results in the overall remediation design of the mine site.
 - Led laboratory investigations into the stability of metal retention mechanisms in wetland sediment. Responsibilities included routine sediment sampling and analysis, quality control procedures, data interpretation, geochemical modeling (GEOCHEM and MINEQL) and final report preparation. Results suggested alteration of the wetland sediment environment would result in the large release of contaminants to the overlying surface water.
 - Application of statistical analyses for data interpretation, including split/split plot design (proc GLM), ANOVA, regression and correlation analyses (SAS and PJMP).
- Sustainable Site Design
- Designed an alternative stormwater management strategy for a 538-acre redevelopment project in Webster, Texas. The stormwater management approach was designed to manage runoff (both quantity and quality) onsite through the integration of stormwater management into site design, with the ultimate goal of maintaining both natural hydrologic and ecological functions, and minimizing impacts to down gradient resources. The stormwater management design was composed of drainage canal enhancements, constructed treatment wetlands, riparian preservation and bank enhancement.
 - Designed an alternative stormwater management strategy for a 95-acre redevelopment project in LaGrange, New York. The stormwater management design utilized the New York State stormwater credit program to reduce water quality treatment requirements while at the same time incorporating alternative treatment designs such as bioretention for the treatment of stormwater runoff from rooftops and parking areas. The alternative strategy enabled the developer to refrain from infringing upon the adjacent wetland buffer zones, thus ultimately providing long term protection of the downgradient jurisdictional wetlands.

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Constructed Treatment Wetlands (CTW)

- Project Manager and Engineer for the design of a multiphase ENS (CTW and phytotechnology sprayfield) designed for the cost effective management, treatment and consumption of stormwater runoff from a 3,500-acre aluminum manufacturing facility in Point Comfort, Texas. The system was designed to aid in reducing discharge from the Site through the consumptive use of water by the phytotechnology plot, with the ultimate goal of attaining zero discharge.
- Senior Engineer for the design of a 30-acre constructed wetland for the treatment of Site wastewater generated from a former refinery located in Wood River, Illinois. Primary constituents of concern in the Site waste streams included BTEX and MTBE.
- Senior Engineer for the preliminary design of a 35-acre constructed wetland for the treatment of Site wastewater generated from a 900-acre former refinery and active terminal located in East Providence, Rhode Island. Primary constituents of concern in the Site waste streams include BTEX, MTBE and various metals.
- Currently Project Principal for the design of a constructed wetland for the treatment of stormwater runoff generated from scrap metal recycling facility in Sayreville, New Jersey. Design challenges include size limitation and the locations the stormwater wetlands within regulated buffer zones of both coastal and freshwater jurisdictional wetlands.
- Senior Engineer for the preliminary evaluation of the use of constructed treatment wetland technology for the treatment of a shallow chlorinated solvent groundwater plume in Greer, South Carolina. Reviewed the biodegradation and transformation processes, bioavailability potentials; constituent fate, transport and storage dynamics; and the physical and chemical properties of each constituent of concern (VOCs and chromium). The resulting design was composed of a stormwater bypass, groundwater capture trench and an anaerobic wetland that would be composed of a substrate to promote sulfate-reducing conditions and reductive dechlorination processes.
- Project Manager and Engineer for an evaluation of ENS technologies for the management and treatment of stormwater runoff from a 6,244-acre aluminum manufacturing facility in Newburgh, Indiana. Based upon the findings of the hydrologic and treatability evaluations, a multi-staged ENS design was developed to manage and treat the Site-related runoff: stormwater retention pond, vegetated swales, and a two-stage stormwater CTW, all integrated into the surrounding environment in an effort to create a aesthetically pleasing, natural looking habitat.
- Project Manager for a pre-design analysis of constructed treatment wetlands and phytoremediation for the treatment and reduction of leachate generated from over

600-acres of wastebeds in Solvay, New York. The treatability evaluation will determine the ability of CTW and Phytotechnology to degrade, sequester, and/or evapotranspire the leachate COCs. The information gathered in this study will ultimately provide the basis to select those technically sound and cost-effective technologies that will facilitate Site closure.

- Staff Engineer for the evaluation of an existing constructed wetland treatment system in Williamsburg, Virginia. The evaluation included an assessment of removal rates, seasonal performance, hydraulic and metal loading analysis, and the development of volume and concentration based loading recommendations.
- Conducted quarterly water quality monitoring and assessments of a constructed wetland treatment system for the removal of metals and nutrients from a freshwater pond receiving landfill leachate on Cape Cod, Massachusetts. The pond effluent was used to irrigate neighboring cranberry fields. Metal and nutrient contamination resulted in low cranberry productivity. Following the project implementation, cranberry yields increased and remained high over subsequent years. Fish and macroinvertebrate species diversity and populations increased over 5-year of operation.
- Conducted water quality monitoring of a tidal influenced brackish pond, historical cranberry bog, on Cape Cod, Massachusetts. Due to septic system runoff, high nutrient loading (nitrogen) resulted in the accumulation of nutrients in the pond sediment, excessive algal growth, decreased dissolved oxygen levels, fish kills, and eutrophication. Designed, constructed and implemented a constructed wetland treatment system to reduce nutrient levels within the pond.

Natural Media Filtration (NMF)

- Project manager and Engineer for the design of a multiphase installation of NMF compost cells for the removal of PCB impacted stormwater at an active aluminum facility in Lafayette, Indiana. The site wide design includes three stormwater storage basins for capture and storage of the 2-year 24-hour design storm event and four NMF cells for PCB removal. Effluent PCB concentrations have remained below the NPDES goal (300 ppt) since implementation, and have even reached non detect levels (< 10 ppt). The design won a global achievement award in 2005.
- Project Manager and Engineer for the preparation of a remedial design for the remediation and restoration of a surface water body impacted from leachate generated from an upgradient former landfill located in Holtsville, New York. The remedial design includes the installation of a compost based permeable reactive barrier for the removal and treatment of the landfill leachate prior to discharge to the surface water, followed by restoration of the surface water body and surrounding wetlands.

**Amanda Ludlow
Principal Scientist**Phytotechnologies

- Designed and constructed the 2nd NYSDEC approved alternative landfill cover for closure of a 9-acre inactive landfill in Rensselaer, New York. The cover design includes multiple fill layers that will be vegetated with a mixture of phytotechnology and indigenous plant species in a configuration that will concomitantly meet or exceed equivalency requirements of a standard landfill cap, promote ecological diversity, and create a valuable wildlife habitat. The collective optimization of evapotranspiration mechanisms and surface and subsurface drainage improvements will provide similar water management as a conventional cover while providing for the continued remediation of the Landfill material via phytoremediation processes (i.e., rhizodegradation and phytostabilization).
- Project Manager and Engineer for the preparation of an alternative landfill cover design for closure of a former landfill located in Holtsville, New York. The alternative landfill cover design entailed improving stormwater conveyance, reducing permeability of the Landfill surface through the addition of recreational areas and lined stormwater storage ponds, and planting hybrid poplar trees to increase evapotranspiration. Thus, the overall goal of the design was to maximize the beneficial re-use of the Site, while instituting a remedial program that is protective of human health and the environment.
- Presently conducting evaluation of a 1.5-acre hybrid poplar phytoremediation plot located in East Providence, Rhode Island. The purpose of the phytoremediation plot is to hydraulically control and remediate contaminants from a dissolved-phase groundwater plume. The performance evaluation includes collection of monthly groundwater levels and quarterly groundwater samples; and seasonal monitoring inspections.
- Project Manager for seasonal monitoring inspections of a hybrid poplar phytoremediation plot as a component of a closure of an industrial landfill located in Wyandotte, Michigan. The overall goal of the phytoremediation is to minimize the infiltration of precipitation through the inactive landfill cells and significantly reduce leachate generation.