



# Ronald H. Mullenex

## **Current Position**

Senior Principal

## **Profession**

Professional Geologist,  
Certified Ground Water  
Professional

## **Years' Experience**

40+

## **Joined MM&A**

1977

## **Education**

MS – Geology, West Virginia  
University, Morgantown, WV  
BS – Geology, West Virginia  
University, Morgantown, WV

## **Professional Registrations**

CPG  
CGWP  
PG – VA, SC, TN, PA, KY, NC  
LRS – WV

WVDEP Approved Person for  
preparing, signing and  
certifying surface mine  
permit applications

Competent Person for coal  
resource determination  
under JORC Code

## **Summary of Experience**

Mr. Mullenex is a Certified Professional Geologist and Certified Ground Water Professional with over 40 years' professional experience in resource and mining geology, hydrogeology, environmental issues, and engineering applications. At Marshall Miller & Associates, he directs geological and hydrogeological investigations, prepares and presents reports, and is frequently called upon in expert witness capacities in litigation concerning geological or hydrologic matters. He has authored a wide range of technical articles on coal resources, mining and mine drainage issues, groundwater and hydrogeology, environmental remediation, and geochemistry issues. He has also authored over 1,400 professional reports to clients in his consulting career.

A principal focus of his work in recent years has involved mineral resource evaluations and groundwater investigations in association with mining and other large earth excavation activities. Such groundwater studies include assessments of probable hydrologic consequences of mining; determination of existing and baseline hydrogeologic conditions; evaluation of hydrogeologic, geochemical, and geotechnical conditions and their potential impact on mining and construction activities; delineation of geochemical character of earth materials; design of acid drainage prevention and/or treatment measures; and investigations of water quality and/or quantity impacts resulting from past mining. In mineral resource studies, his work has focused on resource distribution and classification, geologic factors affecting mineability and accessibility, and coal and tailings quality.

Mr. Mullenex earned Bachelor of Science and Master of Science degrees in Geology from West Virginia University in 1971 and 1975, respectively. He serves on the Visiting Committee for the Department of Geology and Geography at West Virginia University. He holds certification, licensing, and/or registration as a professional geologist in seven states, and is a Licensed Remediation Specialist under West Virginia's Voluntary Remediation Program. He is a Competent Person in coal resource determination under the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Resources (JORC Code).

## **Affiliations**

American Institute of Professional Geologists  
Geological Society of America, Coal Geology and Hydrogeology Divisions  
Society of Mining Engineers of Association of Mining, Metallurgical, and Petroleum Engineers  
Sigma Gamma Epsilon (Earth Sciences Honorary Fraternity)  
Association of Ground Water Scientists and Engineers, Division of National Ground Water  
Association  
Association of Engineering Geologists  
American Society of Mining and Reclamation  
International Mine Water Association

## *Significant Projects*

- > Explore and evaluate geologic, hydrogeologic, and geochemical issues pertaining to large coal exploration, mine planning, and Definitive Feasibility Study (DFS) in virgin area of Western Australia, including water supply, mine inflow, water quality, and materials handling investigations, and delineation and assessment of resources and classification under JORC.
- > Joint coordinator and principal investigator in compilation of environmental audit for World Bank affiliate, for large mining project in the People's Republic of China.
- > Expert Witness in litigation and regulatory administrative proceedings. Qualified as expert in hydrogeology, geology, hydrology, water quality, and geomorphology.
- > Evaluate sources, extent, and nature of impact of selenium leaching from mine disturbances into receiving streams and develop mitigation through water management and enhanced passive reduction-adsorption processes.
- > Site characterization, monitoring, and implementation of enhanced bioattenuation remediation program in fractured bedrock aquifer.
- > Hydrogeologic investigations of potential hydrologic consequences (PHC) by mining operations (numerous studies, some involving large areas).
- > Hydrogeologic and geotechnical evaluations of conditions to be encountered, potential hydrologic impacts, and design of preventive measures for advancement of underground mines beneath stream valleys (numerous studies).
- > Investigated and served as expert in litigations concerning natural flow, transference, and water chemistry of brackish and saline waters from deep underground mine.
- > Water chemistry and contaminants investigations of alleged impacts to groundwater by gas well drilling and/or operations.
- > Investigations and assessments of causative and contributory factors regarding landslides, subsidence, and flooding events, including geomorphological analysis of features.
- > Hydrogeologic investigation and development of during-construction monitoring and preventive action to prevent adverse grout migration through the aquifer during mine shaft pre-grouting and construction project.
- > Assessment of potential impact of high-extraction underground mining upon stream conditions, and worked with mine design engineering personnel to devise alternative mine plan to avoid impact to stream.
- > Investigation of acid-producing rock materials and acid drainage for large highway construction program, and work with design engineers to develop materials handling plans, drainage structures and treatment plans.
- > Hydrogeologic and geotechnical investigation of large pre-Subtitle D landfill located in karstic terrain to evaluate impact on environment and develop plans for closure.
- > Remedial Investigation and Feasibility Study of a state superfund office site, involving groundwater impact by dissolved trichloroethane and related compounds in fractured bedrock aquifer. Coordinated and critiqued baseline risk assessment.
- > Served on Tazewell County, Virginia, Comprehensive Plan Committee, assessing karst impacts and groundwater concerns for land use planning.
- > Developed numerous Subtitle D landfill groundwater monitoring programs for solid waste and CDD facilities, and managed the implemented programs; to include sampling, analyses, data evaluation, and reporting.
- > Development of landfill gas migration mitigation measures at sites complicated by karstic conditions and by underground mine workings.
- > Utilized groundwater modeling to design extraction/injection system for aquifer remediation.



**Significant Projects  
(continued)**

- > Hydrogeologic assessment, aquifer testing, groundwater modeling, and expert witness testimony concerning DNAPL-related contaminants in bedrock aquifer.
- > Hydrogeologic investigation of impact of abandoned underground coal mine on adjacent stream and residential water supplies; developed successful remedial plan, and monitored results.
- > Investigation of impacts to hydrologic regime resulting from underground mining in areas beneath stream valleys.
- > Investigation and delineation of impacts and design inadequacies of several solid waste landfills for closure design. Led design team of geologists, hydrogeologists, and engineers in completing closure designs, and acted as Principal Investigator in the investigation and design phases.
- > Served as Principal-in-Charge of Construction Quality Assurance/Quality Control and field inspection for landfill closure construction projects.
- > Hydrogeologic investigation and litigation support in alleged salt impact to shallow groundwater.
- > Supervision and peer review of numerous investigative reports involving leaking underground storage tanks and similar contaminant releases to groundwater.
- > Detailed investigation of geologic factors controlling or influencing coal resource distribution and development potential, with analysis of potential hazards to be encountered in longwall mining.
- > Detailed depositional analysis and interpretation of coal resource distribution and factors impacting future development.
- > Regional investigation and exploration of deep coals.
- > Stratigraphic analysis and interpretation of depositional patterns responsible for producing extreme hazardous conditions encountered in mining.
- > Exploration and delineation of coal resources; prediction of mine roof hazard areas.
- > Exploration and delineation of stone resources and stone geochemical characteristics.
- > Detailed investigation and interpretation of small-scale depositional features impacting coal reserve development.
- > Study and interpretation of paleogeographic and depositional conditions controlling resource distribution in several different coal seams.
- > Geologic investigation and expert witness for properties and mining ventures involved in prosecution in Federal court.
- > Management of active oil and gas leaseholds.
- > Evaluations of oil and gas estates involved in condemnation.
- > Reserve and economic development feasibility evaluation of several thousand acres in widely scattered tracts. Served as expert witness in civil proceedings in Federal Tax Court, with beneficial results to client.
- > Mapping, investigation, and evaluation of geologic, hydrogeologic, and geomorphic features relevant to new highway construction.
- > Investigation of groundwater contamination susceptibility of a regional area involving largely karstic limestone and dolomite bedrock, incorporating assessment of multiple geologic and cultural components to delineate relative hazard potential at any point within the area. Study involved evaluation of stratigraphy and lithologic factors, structural geology, soil types, remote sensing analysis of fracture systems, water table levels, groundwater flow directions, recharge and discharge areas and points, and investigation of groundwater communication between wells. Results used for determining relative need for sewerage construction at different points within study area.



## **Significant Projects (continued)**

- > Investigation of karst sinkhole subsidence and triggering mechanisms, pertaining to damage to existing structures.
- > Utilization of geologic evaluation and remote sensing analysis to locate high-yield water wells for municipalities and industries.
- > Consultation to an engineering firm regarding dye-tracing applications to define groundwater flow characteristics.
- > Determination of karstic controls on groundwater in evaluation of suitability of construction site.
- > Conducting geologic evaluations and remote sensing analyses, and integrating these studies to define potential groundwater flow characteristics that may impact underground mining.
- > Supervision and analysis of packer testing techniques to determine permeability of formations in boreholes.
- > Utilization of geophysical logs to identify groundwater flow characteristics encountered in boreholes and select optimum horizons for piezometer installation.
- > Utilization of geophysical logs and analytical data to define geochemical characteristics of rock and coal strata.
- > Site evaluation of a planned large commercial landfill facility encompassing in excess of 500 acres. Acted as project manager for field activities including planning and executing of 58-borehole geologic and hydrogeologic exploration program; access road construction in very rugged terrain, with associated sediment and erosion control; and installation of single and nested piezometers and monitoring well construction. Performed analysis of geologic, geophysical, and hydrogeologic data to evaluate suitability of site, and determined post-construction monitoring requirements in relatively complex hydrogeologic setting. Acted as primary coordinator for report and permit application preparation, incorporating investigative reports from other consultants into a comprehensive permit application package.

## **Professional History**

2016 - Present

2014 - 2016

1979 - 2014

**Senior Principal** (*Marshall Miller & Associates, Inc. – Bluefield, Virginia*)

**Senior Principal, Practice Leader – Geology and Hydrogeology**

(*Cardno, Inc. – Bluefield, Virginia*)

**Senior Vice President** (*Marshall Miller & Associates, Inc. – Bluefield, Virginia*)

Responsible for office management and administration; project management, coordination, and supervision; and project reporting and presentation. Provided management oversight of drilling services division for several years. Projects involve all phases of geologic application to coal exploration, evaluation, and development in the United States and abroad; quarry stone resources and stone quality; construction and environmental site characterization; groundwater and surface water investigations; investigation of mining and hydrogeologic considerations in the United States and abroad; underground injection permitting and impact assessment; and writing of technical reports. Specific experience includes coal and geologic mapping; mineral property evaluation; management and supervision of exploration programs; study of geologic factors in resource minability (geologic hazards, depositional analyses); initiation and utilization of stratigraphic and depositional environmental studies as applied to exploration and development; groundwater availability, contamination, and monitoring studies; investigation of karst impacts on environmental considerations; utilization of remote



## Professional History

2017-Present  
(continued)

sensing techniques, including lineament and fracture analyses; development of groundwater monitoring strategies and systems for solid waste landfill facilities; assessment of monitoring data to determine impacts; coordination of full site investigation and remedial design teams for landfill closures and sites impacted by volatile organic compound contaminants in groundwater; investigations of hydrologic impacts resulting from mining; risk assessment and development of remediation designs for groundwater contamination; development of mitigative measures for landfill gas migration; geomorphic evaluations of flooding and earth movement issues, and serving as expert witness in cases concerning mineral properties, groundwater, and flood analysis.

1977 - 1979

### Project Geologist

*Geological Consulting Services, Inc. – Bluefield, Virginia (USA)*

Responsible for field and in-office project management, coordination, and supervision. Projects involved primarily coal property exploration and evaluation.

1974 - 1977

### Coal Geologist, West Virginia Geological and Economic Survey

*West Virginia Geological Survey – Morgantown, West Virginia (USA)*

Responsible for mapping, data collection, and correlation of coals in regional study of coal resources and development potential.

## Publications & Presentations

- > "Kinetic Testing Results of Variable Alkaline Addition Rates in Preventing Acid Generation from Pyritic Materials", 16th Annual Technical Forum for Geohazards Impacting Transportation in Appalachia, Knoxville, Tennessee, August 2-4, 2016.
- > Comparative Performance of Different Alkaline Addition Rates in Kinetic Test Results, Proceedings of the 37th Annual West Virginia Mine Drainage Task Force Symposium, Morgantown, West Virginia, March 29-30, 2016
- > "Selenium – Sources and Considerations for Treatment or Prevention" Wastewater Treatment and Water Quality for Indiana Coal Mines Workshop, 26th Annual Surface Mined Land Reclamation Technology Transfer Seminar, Jasper, Indiana, December 9, 2013.
- > "A Cost-Effective Approach to In Situ Bioremediation in Fractured Bedrock," The Ninth International In Situ and On-Site Bioremediation Symposium, Baltimore, Maryland, May 7-10, 2007.
- > "Stratigraphic Distribution of Selenium in Upper Kanawha-Lower Allegheny Formation Strata at a Location in Southwestern West Virginia," 22nd Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, September 14, 2005.
- > "The Floods of July 8, 2001: A Review of Characteristics, Distribution and Contributing Factors," Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, April 2002.
- > "Subsidence Impacts on Ground Water," Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, June 2000.
- > "Recognition of Paleosols From Wireline Logs," Predictive Stratigraphic Analysis Workshop, U.S. Geological Survey, Reston, Virginia, April 1996.

**Publications &  
Presentations  
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- > "Mitigation of Environmental Impacts Resulting From Mine Pool Build-up," Mine Drainage Task Force Symposium, Morgantown, West Virginia, April 1996.
- > "Integration of Hydrogeologic and Geophysical Techniques for Identification of AMD Seepage and Remedial Design," R.H. Mullenex, C.P.G., C.G.W.P., V.P. Wiram, C.P.G., H.E. Naumann, P.E., Mine Drainage Task Force Symposium, Morgantown, West Virginia, April 1995.
- > "Remedial Measures," Business and the Environment Seminar, Bluefield, West Virginia, July 1993.
- > "Hydrogeology of the Appalachian Plateau," Ground Water Hydrology, Contamination and Management: Wellhead Protection in the Appalachian Plateau, USEPA and Cook College of Continuing Education, National Mine Safety and Health Academy, Beckley, West Virginia, June 1993. "Remedial Measures: Planning and Managing Closure and Post Closure Activities at your Sanitary Landfill," Business and the Environment Seminar, Bluefield, Virginia, 1993.
- > "Downhole Camera Brings Visible Benefits to Ground Water Monitoring," *World Wastes*, Vol. 35, No. 12, December 1992.
- > "Ground Water Monitoring at Sanitary Landfills – Sampling and Analysis Considerations Under Subtitle D," *World Wastes*, Vol. 35, No. 6, June 1992.
- > "Ground Water Monitoring at Sanitary Landfills – System Design Considerations Under Subtitle D," *World Wastes*, Vol. 35, No. 2, February 1992.
- > "Water-Bearing Fracture Identification Through High-Resolution Density Logging Techniques," presented at National Water Well Association Exposition Forum on Ground Water Technologies for the 1990's, October 23, 1991, Washington, D.C. "Ground Water Issues," Business and the Environment Seminar, Bluefield, Virginia, 1991.
- > "Geological and Environmental Impact on Development and Construction in Our Area," Business and the Environment Seminar, Bluefield, Virginia, 1991.
- > "Preparing for an Environmentally Safe Landfill," Business and the Environment Seminar, Bluefield, Virginia, 1991.
- > "Lithologic Indicators of Geochemical Conditions of Sedimentation in Pennsylvanian Age Rocks of the Appalachian Basin," C. Blaine Cecil, U.S.G.S.; Ronald W. Stanton, U.S.G.S.; and Ronald H. Mullenex, Geological Consulting Services, Inc.; American Association of Petroleum Geologists Symposium, Charleston, West Virginia, September 1988.
- > "Geological Modeling Techniques for Evaluation of Productivity-Related Longwall Mining Roof Conditions: A Case Study," Longwall U.S.A. Conference, Pittsburgh, Pennsylvania, co-author, September 1988.
- > "Prediction of Coal Continuity, Quality, and Mining Conditions as Afforded by Depositional Analysis," Society of Mining Engineers of AIME, Fall Meeting, St. Louis Missouri, 1986.
- > "Use of Depositional Models and Stratigraphic Mapping Techniques to Determine New Coal Reserve Potentials in the Appalachian Region," AIME Annual Meeting, Chicago, Illinois, published in *Transactions*, the permanent technical literature of the Society of Mining Engineers of AIME February 1981.
- > "No. 3 Pocahontas Coal in Southern West Virginia – Resources and Depositional Trends," *West Virginia Geological Survey Bulletin B-38*, co-author 1981.
- > "Case Histories and Depositional Modeling for Classifying Reserves in the Appalachian Region," Miller, M. S., and Mullenex, R. H., American Association of Petroleum Geologists Meeting, Morgantown, West Virginia, October 1980.
- > "Major Cross-Strike Structures of the Central Sedimentary Appalachians," *Proceedings of the West Virginia Academy of Science*, Vol. 46, No. 2, 1974.



## Continuing Education

- > West Virginia Surface Mine Drainage Task Force Symposium, Morgantown, West Virginia (Annually).
- > Passive Treatments for Sulfate and Metals in Mine Water, American Society of Mining and Reclamation Conference, June 8, 2015, Lexington, Kentucky.
- > Environmental Considerations in Energy Production, Society of Mining Engineers/Virginia Center for Coal & Energy Research, Virginia Tech, April 14-18, 2013.
- > Landfill Leachate and Gases, Midwest Geosciences Group, February 5, 2013.
- > Calculation and Use of Time of Concentration, American Society of Civil Engineers, December 20, 2012.
- > Wastewater Treatment and Water Quality for Indiana Coal Mines Workshop, 26<sup>th</sup> Annual Surface Mined Land Reclamation Technology Transfer Workshop, Jasper, Indiana, December 9, 2013.
- > Applications of Groundwater Geochemistry, National Ground Water Association, Nashville, Tennessee, October 17-18, 2011.
- > Ground Water Geochemistry and Isotopes, National Ground Water Association Web Seminar, November 17, 2009.
- > Pump/Yield Testing Design and Transducer Data Collection, National Ground Water Association Web Seminar, April 7, 2009.
- > Geologic Sequestration Research Activities and EPA Requirements, Air & Waste Management Association Web Seminar, February 18, 2009.
- > Environmental Geochemistry of Metals: Investigation and Remediation, National Ground Water Association, Las Vegas, Nevada, March 13 – 15, 2007.
- > Basics of Natural Stream Design on Mined Lands, American Society for Mining and Reclamation/West Virginia Surface Mine Drainage Task Force, April 18-22, 2004.
- > Regional Coalfield Water Resource Symposium, Virginia Water Resource Research Center and Virginia Tech, Wise, Virginia, September 4, 2002.
- > Environmental Remediation in Coal Mining, Virginia Center for Coal and Energy Research and the Central Appalachian Section of SME, Abingdon, Virginia, June 8, 2000.
- > Low-Cost Remediation Strategies for Contaminated Soil and Ground Water, National Ground Water Association, Baltimore, Maryland, June 1-2, 1998.
- > Defining Coalbed Methane Exploration Fairways and Resources, 1997 International Coalbed Methane Symposium, Tuscaloosa, Alabama, May 1997.
- > Advanced Applications of Borehole Geophysics to Hydrogeological Investigations, National Ground Water Association, Natick, MA, October 3, 1995.
- > Capture Zone Analysis Techniques Applied to Ground Water Protection and Remediation, Environmental Education Enterprises, Columbus, Ohio, June 1993.
- > Analysis and Design of Aquifer Tests, National Ground Water Association, Columbus, Ohio, March 1992.
- > Selection and Analysis of Shallow Aquifer Tests, Association of Engineering Geologists, Chicago, Illinois, September 30, 1991.
- > Remote Sensing Applications to Hydrogeology, National Water Well Association, 1988.
- > Borehole Geophysics: Applications to Hydrogeology, National Water Well Association, 1988.
- > Modeling Ground water Flow in an Aquifer, University of Kentucky, Institute of Mining and Minerals Research, 1988.
- > Expert Witness Short Course, National Water Well Association, 1987.
- > Ground Water Monitoring in Karst Terrains, National Water Well Association, 1987.



***Continuing Education  
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- > Ground Water Monitoring Principles and Sampling Techniques, University of Kentucky, Institute of Mining and Minerals Research, 1986.
- > Applied Hydrology and Sedimentology for Disturbed Areas, University of Kentucky, Institute of Mining and Minerals Research, 1985.
- > Economic Evaluation and Investment Decision Methods, Colorado School of Mines, 1984.
- > Roof Control and Pillar Design, University of Kentucky, Institute of Mining and Minerals Research, 1983.
- > Technical Communications, Colorado School of Mines, 1981.
- > Handling, Preparation, and Use of Coal, American Coal Testing Institute, 1980.