

Principal Hydrogeologist

Expertise Geology, Hydrogeology

Education PhD (Geology), 2002
Eotvos University, Budapest, Hungary

MSc (Geology), 1998
Eotvos University, Budapest, Hungary

Professional Affiliations International Association of Hydrogeologists.

Professional Experience

2023 – Present ITASCA Australia Pty Ltd, Brisbane, Australia
Principal Hydrogeologist

2022 – 2023 Australasian Groundwater and Environmental Consultants Pty Ltd,
Brisbane, Australia
Principal Hydrogeologist

2018 – 2021 Golder Associates Australia Pty Ltd, Brisbane, Australia
Hydrogeologist

2015 – 2018 Public Limited Company for Radioactive Waste Management,
Budapest, Hungary
Hydrogeologist

2012 – 2015 Golder Associates Canada Ltd, Vancouver, BC, Canada
Geoscientist

2001 – 2012 Golder Associates (Hungary) Kft., Budapest, Hungary
Hydrogeologist

Project Experience

Mining:

Lihir, Newcrest, Papua New Guinea, 2021

Managing and leading the hydrogeological characterization of pit extension. Involved in the evaluation of existing conceptual models, QAQC of VWP data, analysis of hydrographs, development of a pore pressure assessment method to support slope design, reviewing previous and ongoing multi-phase modelling work. Position: technical leader, project manager.

Wards Well, BHP, Queensland, Australia, 2020

Developed a pumping test design for various purposes: 1) to assess hydraulic parameters of the basalt aquifer and other rock formations, 2) to assess flow regime characteristics in the basalt aquifer, 3) to understand hydraulic connectivity between and within the basalt aquifer, Suttor Formation, Quaternary

sediments, Permian rocks, and coal seams, 4) testing feasibility of basalt dewatering, and 5) to support conceptual and numerical models. Position: project engineer, project manager.

Goonyella, BHP, Australia, 2021

Development of a hydraulic conceptual model for a tailing facility system in Central Queensland to understand potential interaction of tailings water with underlying natural groundwater system. The HCM formed a direct input into the site's numerical modelling to assess: 1) long-term evolution of the phreatic surface at the site, 2) long-term seepage to perimeter drains, and 3) long-term seepage through the foundation of the TSF. Output of simulations supported the development of multi-criteria analysis to compare alternative TSF closure options including surcharge material, wick drains, installation of pumping bores, horizontal drains. Position: hydrogeologist, modeller, project manager.

Wards Well, BMC, Australia, 2021

BMC requested Golder to assist in the hydrogeological aspects of its progressive rehabilitation and closure plan (PRCP). Golder considered all potential features, elements, and processes (FEP) to consider the whole system in a long period of time. Based on the FEP catalogue, Golder derived several alternative scenarios (concepts) to assess to site's evolution in the future. This approach formed the basis of base case and alternative scenario selection. BMC required Golder to provide a detailed description of hydrogeological conceptual models under various conditions to assess the likely range of site's future states. Position: hydrogeologist, modeller.

Eagle Mine, USA, 2014, 2019

Reviewing structural data and developing a 3D DFN model for the crown pillar. Stress magnitudes and orientations were imported into FracMan for each mining step and fracture hydraulic properties were correlated to changing stress conditions. The varying hydraulic properties of the DFN were upscaled to a grid and the upscaled properties were used for transient dynamic calculations to assess flow rates into the mine. Position: modeller.

Esperanza Mine, Chile, 2014-2015

One of the main objectives of the project was to assess the transmissivity of fractures. Two methods were tested: OXFILET approach and size - transmissivity approach. Both methods resulted in very low fracture transmissivities which was consistent with local hydrogeological measurements and observations. These interpretations were tested with well test simulations and DFN upscaling. Based on the simulation results the OXFILET approach was recommended to use. Position: modeller, project manager.

Chuquicamata Mine, Chile, 2014-2015

Developed DNF model based on deterministic mapped and stochastic background fracturing. The DFN model was parametrized with geomechanical properties to carry out block stability calculations. Also, a risk map was developed by running several model realizations and counting unstable blocks on an underlying grid. Position: modeller.

Diavik Diamond Mines, Canada, 2012

Analysed available information about fracture properties (orientation, size, intensity, spatial model) and built up a combined deterministic (large scale faults) and stochastic (background fractures) DFN model. Based on the model, a series of DFN analyses was carried out to estimate slope stability along the open pit wall. Position: modeller, project manager.

BC, Canada, 2013

Responsible for the interpretation and reporting of well tests. Evaluated formation transmissivity (conductivity) and static formation pressures. Position: well test interpreter, project manager.

Saskatchewan, Canada, 2013

Responsible for the interpretation and reporting of well tests. Evaluated formation transmissivity (conductivity) and static formation pressures. Position: well test interpreter.

Perth, Australia, 2014

Evaluated preliminary hydrogeological conditions by using numerical and analytical techniques. Developed a three-dimensional FEFLOW model to evaluate the dewatering strategy of an open pit mine and to predict likely groundwater flow rate into the pit at several mining stages. Also formulated several recommendations to improve mine dewatering and for additional data acquisition. Position: modeller.

Alaska, USA, 2014

Developed a 3D DFN model to predict seepage along the tunnel system. Responsibility included building a stochastic fracture system, mesh generation, and flow estimation. Stochastic parameters were applied for either fractures or elements of the finite element mesh. The model was calibrated against the frequency of seepage points and the measured flow rates. Position: modeller.

Various mining sites, Australia, 2018-2020

Responsible for the interpretation and reporting of well tests. Evaluated formation transmissivity (conductivity) and static formation pressures. Position: well test interpreter.

Martabe, Indonesia, 2020

Development of 2D SEEP/W model to assess seepage rates from drains under a tailing facility. The model used various scenarios by changing hydraulic parameters, geometry, and boundary conditions to understand system uncertainty and to better formulate ideal conditions. Inputs were provided for tailing dam design. Position: modeller.

North Sands, Queensland, Australia, 2018

Updating a 2D SEEP/W model to assess seepage under a dam to geological layers. The model considered alternative scenarios of dredge placement and was calibrated to transient transport processes (varying salt concentration in groundwater). Position: modeller.

Sunrise, Australia, 2020

Two 2D SEEP/W models were updated and developed to assess hydraulic connectivity of a tailing storage facility and the underlying natural groundwater regime. Various scenarios were tested to assist the final design of the facility. Position: modeller.

Sepon, Laos, 2019

Development of 3D FEFLOW model to assist Environmental Social Impact Assessment (ESIA). The primary goal of the model was to estimate potential drawdowns caused by open pits in the area and to evaluate overall uncertainty of model simulations. Also, based on client's requirement the recovery period of groundwater level in post-mining period was assessed. Position: modeller.

Rio Tinto, Queensland, Australia, 2020

In artesian bores a pressure relief trial test was implemented. Based on the flow measurements and pressure transducer data the hydraulic connectivity and hydraulic properties of the subsurface domain were evaluated numerically and conceptually. Additional investigations were proposed based on the trial test results. Position: modeller.

Peabody, Queensland, Australia, 2019

Manager of a field investigation program in Central Queensland. The project aimed to assess hydraulic properties and connectivity of some strata and to provide direct input into mine and monitoring system design. Numerous bores were drilled and tested hydraulically. Also, two long-term pumping tests were conducted on site. Results, observations were summarized in a factual report. Position: project manager.

Ferihegy, Hungary, 2011

The primary goal of the project was to evaluate the geothermal potential of the Budapest Airport area. The combined interpretation of hydraulic, thermal, and geophysical information resulted in a geothermal concept. Based on that concept, potential new well locations were evaluated; and recommendations were given to the client. Position: project manager.

Gödöllő, Hungary, 2011

Integrated hydraulic, geophysical, and tectonic information of the Gödöllő region. Based on this information, a simplified conceptual model was developed for the deep geothermal reservoir. The concept was tested against some numerical calculations; and based on the results, a new well location was suggested. The new well location is closer to the surface than older wells and located on a local upwelling of high temperature fluids. Position: project manager.

Cadia, Australia, 2023

Two pumping tests were completed on the site to study the potential hydraulic interaction of a local creek and the future developments of a TSF (tailing storage facility). The tests were evaluated by using the pressure change and derivative data of the two tests (numerical hydraulic test simulation), and the hydraulic responses of some monitoring bores. Results suggested a compartmented hydraulic flow regime in the project area and very limited hydraulic connections towards the pit lake. The results increase our client's confidence that the proposed design of the TSF extension.

Oil & Gas:

Barcs, Hungary, 2007

Designed an air sparging system to slow down the migration of hydrocarbon contamination and evaluated the results of a pilot study. Position: project hydrogeologist, project manager.

Nyirbogdány, Hungary, 2008

Designed a permeable reactive barrier at a highly acidic, hydrocarbon contaminated site. Responsibilities also included the design of a pilot test and evaluation of a 6-month monitoring period. Position: project hydrogeologist, project manager.

Dr Kalman Benedek – ITASCA Australia

NE BC, Canada, 2013

The initial goal of the project was to evaluate some hydraulic fracturing job in NE British Columbia. The study included the interpretation of natural fractures (image logs, orientation, intensity, flow logs, mud loss) and hydraulic fractures (micro seismic data), and their interaction during hydraulic fracturing. Based on the available data three alternative scenarios have been developed and FracMan's hydraulic fracturing simulator has been run to make difference between these scenarios. Results suggested that the injected fluid was dissipated by large natural fractures and faults. Position: modeller.

Queensland, Australia, 2014

Developed well scale and reservoir scale DFN model to evaluate the preliminary injectivity potential of the target formation. The main goal of the project was to find a suitable reservoir for the by-products of gas production. In the frame of the project, he developed a coupled mechanical-hydraulic model by using FracMan's macro capabilities. The model used the geomechanical properties (JNC, JRC, stress components, etc.) and hydraulic properties (aperture, transmissivity) of the fractures studied. Also, the model considered hydraulic fracturing, shearing, dilation with varying normal and shear stress. Also based on the lessons learned at the well scale model, he developed a reservoir scale model to evaluate the long term injectivity potential of the fractured basement rocks. Position: modeller, project manager.

CNRL, Canada, 2015

Analysed available static (orientation, site, intensity, architecture) and dynamic (mud loss, well test, temperature, aperture) data to compare two sites in terms of the fracture system. Data suggested that the fracture systems show minimal differences, but the interpreted faults are present only at one of the sites. Based on the data analysis a comprehensive conceptual model was developed which served as the basis for full scale DFN modelling. Pathway simulations through the stratigraphic column referred to the existence of a well-connected natural fracture system within layer and through layers. These results may explain why oil filled fractures and oil shows could be determined in each layer and this may also explain the presence of FTS (flow to surface) features. Position: modeller.

Santos, Bridgeport, Australia, 2018, 2019, 2020

Updating Underground Water Impact Reports to incorporate new extraction data in predictive simulations. Analytical models were developed and updated to better constrain future groundwater drawdown at various oil and gas tenements. Duties included: development of oil and water extraction charts, evaluation of trends and temporal variations, evaluation of new data and comparison with data considered during previous modelling phase. Position: modeller, project manager.

Northern Sea, UK, 2013, 2019

Developed a 3D, reservoir scale DFN model based on the available static (image logs, geophysics) and dynamic (PLT, DST) information. The project detailed the potential explanation of flow distribution along the well and its consequences on larger scale reservoir hydraulics. The challenge of the project was to find a difference between operational and real reservoir responses. Larger scale hydraulic behaviour of the reservoir was tested with numerical well test simulations. Position: modeller.

Empire Energy, Beetaloo Sub-Basin, Australia, 2022

A detailed re-assessment of an aquifer storage was carried out to support our client in its future gas development area. Previous studies suggested very limited available water resources in the study area. However, the new assessment found serious theoretical and numerical problems in the previous calculations. Using the correct theory and parameters resulted in 100 times more available water resources, which provided a huge business benefit to our client.

Waste:

Brisbane City Council, Australia, 2021

Managing a field campaign to assess geological and hydrogeological conditions around the perimeter of a historical landfill area. The project involved drilling, logging, hydraulic testing and water sampling of several bores. The field data supported the development of a site-specific hydrogeological, contaminant conceptual model, which served as a basis of numerical models. These models were built to support the optimal seepage mitigation design.

CTSCO, Australia, 2021

Development of FEP catalogue to assess the behaviour of CO₂ sequestration storage system. A base case and a series of alternative scenarios have been developed to assess the structural uncertainty of the system, and measures and controls have been derived for each scenario. Also, potential gas release exposure pathways have been identified and assessed qualitatively and quantitatively. Position: team leader and project engineer.

Queensland Alumina Limited, Australia, 2020

Coordinating a field campaign to understand geological and hydrogeological conditions around historical landfill areas. The campaign consisted of drilling, logging, hydraulic testing and water sampling of five bores. Based on the results and considering historical records of the site a hydrogeological conceptual model was developed. This HCM formed the basis of numerical hydraulic model and streamline assessment which supported the development of a seepage interception system to mitigate groundwater contamination at the site. Also, the results of HCM and numerical simulations provided basic information to a multi-criteria assessment to compare various seepage interception systems. Position: hydrogeologist, modeller.

Nevada, USA, 2013

Developed a hybrid DFN/EPM approximation to estimate flow conditions at the site. The main fault zones and their damage zones were represented by 2D DFN elements, while the rock volume between them was represented with anisotropic EPM elements. Based on flow calculations, a transport model was built up to consider advective, dispersive, sorption, and diffusive processes by using the LTG algorithm. Concentration maps of H-3 and I-129 were created at different time slices for the client. Position: modeller.

Wisconsin, USA, 2013

Participated in the preparation of a safety assessment report for a planned isotope production factory. Evaluated the potential contaminant pathways, calculated travel times, and considered potential safety factors in site characteristics. Provided detailed description of the groundwater regime and interpreted potential transport processes. Position: modeller.

Bátaapáti, Hungary, 2012

This project intended to evaluate a new disposal concept for the Bátaapáti site. As a project manager the responsibilities included facilitation of communication between the power plant, waste management agency, and subcontractors. Developed scenarios for long-term and operational safety. Managed the interaction of different disciplines and developed numerical hydraulic models to assess flow rates through the EBS. Position: modeller, project manager.

Püspökszilágy, Hungary, 2004-2012

This near-surface repository storing low- and intermediate-level radioactive wastes lies above a thick unsaturated zone. The primary responsibility was to develop unsaturated and saturated models (FEFLOW) and to assess potential contamination pathways and to provide input information for the geosphere module of site's safety assessment. Position: modeller, project manager.

Bátaapáti, Hungary, 2004-2012

This project aimed to construct a safe, deep geological repository for Hungary's low- and intermediate-level radioactive wastes. Primary responsibility was to develop DFN (FracMan) and EPM (FEFLOW) hydraulic and transport models to provide input information into safety assessment codes. Actively participated in FEP analysis, scenario development, and safety assessment conceptualization. As a project manager, he was responsible to keep contact with the client, as well as more than 20 subcontractors. Position: modeller, project manager.

Amprior, Boeing, Canada, 2013

The fracture system was evaluated from different aspects based on well logs, ground surveys and well test information: orientation, size, intensity, transmissivity. The conceptual model developed demonstrated the dependency of fracture properties on the distance to larger scale faults. Based on the concept and data used a full 3D DFN model was set up and fracture parameters were upscaled at a EPM grid. The dynamic model was used to evaluate the potential migration pathways of contaminants. Position: modeller.

Cleanway, Australia, 2018

Assessment of groundwater quality included analysis for potential contaminants of concern associated with the waste types accepted at the landfill. This also included the analysis for emerging contaminants such as Per and poly-fluoroalkyl substances. This study was developed as a response to local authorities' requirements.

Infrastructure:

Confidential client, Australia, 2018-2020

Development and coordination of in-situ hydraulic testing campaign by using various packer testing configurations. Responsible to review field data, interpret hydraulic test results and to set up factual reports. Also, he was in charge to manage a large monitoring project (> 150 bores) to collect groundwater level data, sampling bores, reporting factual data. In the frame of this project, he managed two pumping test programs to assess hydraulic properties, connectivity of the flow regime at the scale of a few 10metres.

Confidential client, Australia, 2018-2019

Reviewing the Geotechnical Baseline Report of a large infrastructure project in NSW. Primary duty was to evaluate the general methodology of GBR in context of rock fracturing, stability, groundwater flow and uncertainty analysis. As an output of this project a series of recommendations was formulated to consider in the final version of GBR.

Greenuo Weir, Sunwater Ltd, Australia, 2022

Our client contracted us to investigate the groundwater system around the weir and to understand the impact of the weir on the local groundwater usage. The study included the collection and re-assessment of all geological and hydrogeological data. The conceptual model and the site-specific analytical models suggested that the weir impacts (in a positive way) a few local private bores. Also, if the "run to failure" scenarios will be adopted, these bores are likely to experience declining water levels. Our report helped our client to make well-informed decision about the future of Greenup Weir.

Confidential client, Australia, 2022-2023

Development of site-specific hydrogeological conceptual model and the numerical implementation of the concept in FEFLOW. The goal of the project was to assess the construction and operation impact of some tunnels and deep cuts in Queensland. The impact assessment included the estimation of groundwater level drawdown and inflow rates to the tunnels and cuts. The models were developed in a deterministic way, and additional uncertainty (controlled Monte Carlo) simulations were completed.

Confidential client, Australia, 2022

Development of site-specific conceptual model. The tunnel of interest intersected a series of high inflow locations in a fractured aquifer. Based on the site observations (including temporal variation of inflow rate, locations, fracture orientations, groundwater monitoring data, etc.) a series of analytical models were developed to assess local hydrogeological parameters (K and S) and their spatial variation. The parametrised conceptual model formed the basis of some numerical calculations to predict the potential hydraulic and transport interaction between the tunnel and some nearby contamination sources.

Papers and Publications

Benedek, Kalman, Zoltan Pecskey, Csaba Szabo, Jozsef Josvai and Tibor Nemeth. Paleogene Intrusive and Effusive Igneous Rocks in the Zala Basin Shear Zone (Western Hungary): Link to the Paleogene Magmatic Activity Along the Periadriatic Lineament. *Geologica Carpathica.*, 55 (2004), 43-50.

Balla, Zoltan, Istvan Horvath, Gyorgy Toth, Kalman **Benedek**, Gyula Mezo and Peter Molnar. Hydrogeological Pattern of the Bátaapáti (Üveghuta) Site. *Annual Report of the Geological Institute of Hungary, 2004* (2004), 449-472.

Kovacs, Istvan, Laszlo Csontos, Csaba Szabo, Eniko Bali, Gyorgy Falus, Kalman **Benedek** and Zoltan Zajacz. Paleogene-early Miocene Igneous Rocks and Geodynamics of the Alpine-Carpathian-Pannonian-Dinaric Region: An Integrated Approach. *Geological Society of America Bulletin*, Special Paper. 418 (2007), 93-112.

Benedek, Kalman, Zoltan Bothi, Gyula Mezo and Peter Molnar. Compartmented Flow at the Bátaapáti Site in Hungary. *Hydrogeology Journal*, 17 (2009), 1219-1232.

Benedek, Kalman and Gyula Danko. Stochastic Hydrogeologic modelling of fractured rocks: a Generic Case Study in the Mórággy Granite Formation, South Hungary. *Geologica Carpathica*, 60 (2009), 271-281.

Benedek, Kalman, Gyula Mezo, Zsafia Szabo, Peter Molnar, Zoltan Bothi, Janos Geiger, Tibor Sidlo and Gyula Danko. The Hydrogeological Modelling of the Bátaapáti Site. *Annual Report of the Geological Institute of Hungary, 2009* (2010), 149-165.

Benedek, Kalman and Peter Molnar. Combining structural and hydrogeological data: Conceptualization of a fracture system. *Engineering Geology*, 163 (2013), 1-10.

Benedek, Kalman, Zsolt Nagy, Istvan Dunkl, Csaba Szabó and Sandor Józsa (2001): Petrographical, geochemical and geochronological constraints on igneous clasts and sediments hosted in the Oligo-Miocene Bakony Molasse, Hungary: evidence for a Paleo-Drava River system. *Int J Earth Sciences (Geol Rundsch)*, 90, 519-533.

Benedek, Kalman, Zoltan Pécskay, Csaba Szabó, Jozsef Józvai, Tibor Németh (2004): Paleogene igneous rocks in the Zala Basin (Western Hungary): link to the Paleogene magmatic activity along the Periadriatic Lineament. *Geol Carpathica*, 55, 43-50.