

Cameron Wylie

EDUCATION B. Sc. Auckland University, New Zealand
M. Sc. (First Class Hons.) Auckland University, New Zealand.

PROFESSIONAL CHARTERS Chartered Professional Engineer (CPEng) (Geotechnical)
Chartered Professional (Mine Geotechnics)

AFFILIATIONS Member Institute of Professional Engineers NZ
Member Australian Institute of Mining and Metallurgy
Member International Association of Engineering Geologists
Member International Society for Rock Mechanics
Member New Zealand Geotechnical Society.
Member New Zealand Society for Earthquake Engineering
Member New Zealand Society for Large Dams
Member New Zealand Coastal Society
Member Civil Engineering Testing Association of NZ

EXPERIENCE

Oct 2006 - Present - **Resource Development Consultants Ltd** **New Zealand**
Principal and Director
Founder and Principal consultant providing technical and commercial consulting services including operational, planning and project development services.

2004- Oct 2006 - **Golder Associates (NZ) Ltd** **Christchurch, New Zealand**
2002 - 2004 *Associate and Managing Director New Zealand*
Responsible for Golder NZ Ltd. business in New Zealand. Conducts consulting support to mining and civil engineering operations throughout New Zealand and overseas.

1998 – 2002 **Coffey Philippines Inc.,** **Manila, Philippines**
Country Manager and Associate Engineering Geologist
Responsible for the overall management, profitability and development of the Coffey Philippines, Inc.

1997 – 1998 **Coffey Partners Pty Ltd** **Brisbane, Australia**
Senior Engineering Geologist

1994 – 1995 **Worley Consultants Pty Ltd** **Auckland, New Zealand**
1996 – 1997 *Engineering Geologist*
Senior Engineering Geologist

1993 – 1994 **Barret, Fuller and Partners** **Perth, Australia**
Engineering Geologist

1992 – 1993 **Porgera Gold Mine** **Papua New Guinea**
Underground Geotechnical Engineer

1989 – 1992 **Mount Isa Mines Ltd** **Mt Isa, Australia**
Rock Mechanics Engineer

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PROJECT RELATED EXPERIENCE – FOUNDATIONS

Various Clients

Hawkes Bay, New Zealand

Geotechnical assessment for a number of light industrial building developments.

Geopractica SA Ltd

Beira Coal Load-out Facility, Mozambique

Cross-hole geophysical investigations to assess ground conditions in very deep (100m) soft sediments.

Technical challenges included installation of sealed casing in bentonite filled drillholes to the full depth of the sediment pile.

Queensland Nickel Pty Ltd, ACT Nickel Project Detailed Geotechnical Investigations

Adlay, Philippines

Detailed investigations for final costing of conveyor foundations, barge docking (port) facility and haulroad digability using geophysical methods. Work was successfully completed in a remote environment over a short time frame.

Leighton Contractors Philippines, Philip Morris Greenfields Plant

Philippines

Provision of specialist advice for fill management and geophysical investigation and remediation of hidden open, fractures intersected during earthworks.

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Adlay, Philippines

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included specification of support options including piles and earth/rockfill foundations for a 300m long jetty, assessment of foundation stability for a 10m deep fill platform and earthworks specifications for the fill.

Pacific Nickel Philippines Inc.,

Surigao del Norte, Philippines

Nonoc Island Ni Project. Preliminary geotechnical assessment of foundation conditions and design for ore stockpile area, transfer station, plant site and ancillary structures.

JTCI Corp. / Carmelray Industrial Park

Laguna, Philippines

Engineering geological assessment of foundation and remedial requirements for single level warehouse developments on tuffaceous materials with large, buried voids. Voids assessed as a) being tree casts and b) fault or fracture related.

Pajara Construction Corp. Carmelray Industrial Park

Laguna, Philippines

San Juan Bridge (South) Abutment. Engineering geological assessment of the stability of a bridge abutment positioned at the crest of steep, deeply incised river valley within tuffaceous material. Recommendations were made on the appropriateness of the foundation design.

Bilfinger + Berger (Philippines), Construction

Alabang, Metro Manila, Philippines

Insular Life Building. Design of ground support, instrumentation and monitoring for this 20m deep basement excavation within loose soils and tuff. Ongoing input during excavation to optimize ground support installation, and long term ground deformation monitoring using inclinometers and piezometers.

Climax-Arimco Mining Corporation, Limited

Nueva Viscaya, Philippines

Didipio Project Copper-Gold Project. Drilling investigation for process plant and fill foundations.

Nelson Marlborough Hospital Board Nelson

New Zealand

Nelson Hospital Theatre Extension. Geotechnical investigation and assessment of foundation options for an extension on the surgical Theater at Nelson Hospital, New Zealand.

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PROJECT RELATED EXPERIENCE – FOUNDATIONS

Hauraki District Council

Paeroa, New Zealand

Waihi Netball Courts Settlement. Geological investigation into the cause of settlement below and around the town netball courts resulting in recommendations for remedial works. The key issue was settlement and entrainment of loose pumiceous subsoils due to fluctuating groundwater levels.

Bay of Plenty Meatpackers Corporation

Tauranga, New Zealand

Foundation investigation and analyses for a light frame, single story extension to an existing meatpacking facility. The key design constraint was differential settlement of loose pumiceous materials distributed across the site.

Electricity Corporation of New Zealand

New Zealand

Wairakei Binary Cycle Plant Project. Geotechnical investigation and analyses to determine indicative foundation parameters for a design and build contract.

Tauranga City Council

Tauranga, New Zealand

Tauranga Car Parks. Foundation investigations and analyses for one multiple, and one single story carpark buildings constructed on compressible materials in the CDB area.

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PROJECT RELATED EXPERIENCE – ROADS AND PIPELINES

Oceana Gold Philippines Inc.

Didipio Cu-Au Project, Philippines

Lead geotechnical consultant for the development of this greenfield, porphyry, mine. Project components of particular interest are a deep open pit, underground mine, 22km long access road through complicated materials and extensive hydro-geological test work. This project is situated in a remote mountainous area of northern Philippines.

Golder Associates (Indonesia) Pipeline Risk Assessment Study

Kalimantan, Indonesia

Geotechnical investigations and mapping of landslides and effect of weak ground on pipeline stability including risk of rupture. Client was Vico a major oil producer and project included 180km of main delivery liners with pipe diameters 48" to 10".

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Queensland, Australia

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included specification of granular pavements for a 6.9km haulroad with 20T and 40T haultrucks operating over a 10 year mine life, specification of cut and fill slope designs and earthwork handling specifications, and recommendations for surface water management within highly erodable materials.

Kaiser Overseas Engineers, Inc. Zambales-Tarlac Toll Road

Philippines

Scoping level geotechnical, hydrological and environmental feasibility studies for the Zambales- Tarlac Road, Central Luzon. The road is proposed as a 4-lane toll road to serve the proposed Masinloc Port Project.

The aim of the work was to assess the primary geotechnical, environmental and social factors and risks associated with the construction and operation of the proposed road. Work comprised site visits, desk-top and baseline community studies. The proposed route traverses volcanoclastic deposits from the most recent Pinatubo eruption, significant river systems, which have been highly altered by deposition of volcanoclastic materials and land designated as indigenous peoples areas. The preliminary assessment indicates geotechnical, hydrological and social development issues make this a challenging project.

CASCADE Project, European Union Nueva Viscaya & Various Provinces, Philippines

Road Access Masterplan. Economic and engineering assessment of farm to market access roads to identify roads where improvement in road quality could have significant positive impact on the livelihood of the people in each area. The comprised Phase 1: screening assessment based on consultation with LGU's and local stakeholders to identify priority roads, Phase 2: engineering and economic assessment of priority roads to assess costs for upgrade and economic viability of upgrade based on project benefit to agricultural production, tourism and livelihood of stakeholders, Phase 3: economic assessment of ability of LGU's to fund proposed road upgrades, and Phase 4: Presentation workshops to LGU's and project staff and development of training design.

Western Mining Corporation, Tampakan Copper Project South Cotabato, Philippines

Engineering geological assessment of a temporary access road and tunnel portal in steep topography and deeply weathered materials. Natural and cut-slope stability assessments based on observation of existing conditions with recommendations for cut slope geometry, drainage, ground support and protective measures.

Transit New Zealand, State Highway 3

Manawatu Gorge, New Zealand

Engineering geological based risk assessment of steep rock slopes along full length (8.5km) of the gorge. Design of remedial works including water relief drilling, meshing and removal of loose material, and preparation of contract documents.

Waitakere City Council, Various Road Slips

Auckland, New Zealand

Engineering geological investigation of numerous small road slips in the Waitakere Ranges, Auckland with preliminary recommendations for remedial works. Most failures were within saturated, deeply weathered volcanogenic materials and fill. Remedial options included cantilevered pole retaining walls, gabion basket retaining walls and road re-alignments.

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PROJECT RELATED EXPERIENCE – ROADS

Transit New Zealand, SH 60 Maisey Road to Trafalgar Rd Re-alignment **New Zealand**

Engineering geological investigation along 3.5km re-alignment including drilling for bridge abutment and slope design, and subgrade assessment (using portable falling weight deflectometer “Loadman”). Geotechnical analysis of fill embankment stability, provision of subgrade parameters for pavement design, and assessment of design requirements for interaction between road fill embankment and a farm dam.

Downer Construction (NZ) Ltd, State Highway 1 Managtawhiri Four Laning

New Zealand

Design and construction review following failure of a fill embankment deep, soft clay foundations, primarily to assist with contractual claims. The work involved research into appropriate construction practices, site investigation, stability analyses and report reviews.

Transit New Zealand, State Highway 3, Manawatu Gorge Rock Slope Failure

New Zealand

Geotechnical and geological slope stability investigation, design and supervision of remedial works to stabilise a 100,000m³ rock slope failure. The works involved reprofiling the slope by excavator, removal of loose debris by washing with helicopter born monsoon buckets, drainage drilling, stream diversion and slope monitoring using remote survey methods.

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PROJECT RELATED EXPERIENCE – RESIDENTIAL SUBDIVISIONS

Various Clients

Hawkes Bay, New Zealand

Geotechnical assessment of site suitability and requirements for geotechnical engineering.

Atawhai Syndicate

Atawhai Development Stage 3

Engineering geological and geotechnical assessment of a proposed development within an ancient landslide. Development of engineering geological model based on deep drilling and Project Director for geotechnical evaluation of mitigation and development works (ongoing).

Various Developers

Nelson, New Zealand

Site investigation and construction advice for development of various residential housing estates and lots. Nelson is characterized by very complex site conditions and local variability. Detailed engineering geological evaluation and understanding of geotechnical development is required in this area.

Gourdie & Ward

Nelson, New Zealand

Jackson Street subdivision. Site investigation and construction advice for a residential housing estate in the foothills north of Nelson. The site has been modified due to quarrying, and parts of the site are affected by past instability.

Gourdie & Ward

Nelson, New Zealand

Springlea Subdivision. Site investigation and geotechnical recommendations for small residential housing estate.

Norwood Road Subdivision

Paeroa, New Zealand

Site investigation and foundation recommendations for small residential housing estate.

Cawdor Properties Ltd

Opito Bay, Coromandel, New Zealand

Ohinau Drive Subdivision. Geotechnical and groundwater investigation of an extensive slope failure within the subdivision. Results included establishment of the failure model with recommendations for monitoring and additional investigations to scope remedial works. Additional advice to Council regarding affect on existing landowners and recommendations for issuing future building permits.

Wilbow Corporation

Auckland, New Zealand

Woodland Valley Subdivision. Engineering geological peer review of geotechnical design for an extensive cut and fill subdivision.

Cowley Place Subdivision

Albany, New Zealand

Geotechnical investigation for an industrial subdivision resulting in production of a land suitability assessment and detailed design of a retaining wall.

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PROJECT RELATED EXPERIENCE – DAMS AND HYDRO POWER DEVELOPMENT

Teresa-Crew Gold (Phils) Inc

Apex Tailings Dam

Dam Design Review and management of geotechnical investigation for this tailings storage facility at the Apex Mine, Philippines. A key feature of this project is the very rapid implementation of the job. The project comprises a 160m high tailings dam constructed in 3 stages. Stage 1 is currently under construction.

Lafayette Mining Ltd

Rapu Rpau Project, Philippines

Review and observation during construction of the tailings storage facility at Rapu Rapu Island, Philippines. This facility is being constructed as an APC contract and comprises 2 x embankments within the storage area. Acid mine drainage, high rainfall tropical environments and variation in material schedules against expected have been a feature of this project.

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Queensland, Australia

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included specification and design of multiple sediment retention structures comprising earth and rockfill embankments, and design of waste dump stockpiles on relatively steep slopes.

Lafayette Mining Pty Ltd

Albay Province, Philippines

Rapu Rapu Island Gold Project Feasibility Study. Geotechnical and hydrogeological investigations for the design of tailings dam comprising two primary embankments to 50m high and 3 saddle dam embankments.

Lafayette Mining NL

Albay Province, Philippines

Rapu Rapu Island Gold Project Pre-Feasibility Design of Tailings Dam. Hydrology and engineering geological assessment and design for earth and rock dam with ultimate storage of approximately 10 million m³, crest height of 85m (at deepest point) in high volume, high intensity rainfall area.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Routine (monthly) analysis of piezometer and precise level monitoring results with advice to ECNZ Technical group.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Geotechnical Investigations of Powerhouse Foundations. Geotechnical and hydrogeological investigations around the power including installation of piezometers. Geotechnical risk analyses for the power station including assessment of liquefaction potential, assessment of remedial options including depressurisation of the penstock slope and development of a geotechnical risk management strategy for the station.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Hydrogeological Investigations of Penstock Slope and Powerhouse. Supervision of drilling, hydrogeological testing and installation of deep multi-level piezometers for long-term monitoring. Glacial derived deposits and high artesian groundwater pressures meant rapid changes in downhole conditions requiring a number of drilling methods to successfully complete holes. This work was used to create geological, geotechnical and hydrogeological models for the site.

Electricite du Laos

Lao, PDR

Nam Ngum Hydropower Extension Project Feasibility Study (for World Bank). Rock mechanics analysis to assess the stability of a deep excavation adjacent to the dam and powerhouse. This was a desktop study for a proposed extension of an existing station.

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PROJECT RELATED EXPERIENCE - GROUNDWATER

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Queensland, Australia

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included specification of groundwater drainage and surface water control measures for strip mining and general development of general civil works.

Lafayette Mining Pty Ltd

Albay Province, Philippines

Rapu Rapu Island Gold Project Feasibility studies. Hydrogeological evaluation of mine pit dewatering requirements and design of initial de-watering system.

Climax-Arimco Mining Corporation Limited

Nueva Viscaya, Philippines

Didipio Copper Gold Project. Supervision of drilling and hydrogeological testing to assess aquifer characteristics and potential mine dewatering requirements. Development of conceptual hydrogeological model based on identification of hard rock aquifers from geology, drilling response, groundwater chemistry and pumping tests. Difficult logistics and deep drilling targets make this a difficult and challenging project requiring very good communication between field personnel, consultants and client. Commenced August 1997 – completed August 1998.

Cawdor Properties

Opito Bay, Coromandel, New Zealand

Ohinau Drive Subdivision. Geotechnical and groundwater investigation of an extensive slope failure. Development of conceptual groundwater model in recent volcanic environment based on geology, distribution of piezometric levels and drilling response.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Routine (monthly) analysis of piezometer and deformation monitoring (of the power house) results with advice to ECNZ Technical Group.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Geotechnical Investigations of Powerhouse Foundations. Geotechnical and hydrogeological investigations around the powerhouse including installation of piezometers. Development of conceptual hydrogeological model in glacial environments based on detailed geology and distribution of piezometric pressures. Geotechnical risk analyses for the power station including assessment of liquefaction potential, assessment of remedial options including depressurisation of the penstock slope, and development of a geotechnical risk management strategy for the station.

Electricity Corporation of New Zealand

New Zealand

Coleridge Hydropower Station Refurbishment. Hydrogeological Investigations of Penstock Slope and Powerhouse. Supervision of geotechnical drilling, hydrogeological testing and installation of deep multi-level piezometers for long-term monitoring. Glacial derived deposits and high artesian groundwater pressures meant rapid changes in downhole conditions requiring a number of drilling methods to successfully complete holes. This work was used to create geological, geotechnical and hydrogeological models for the site.

Climax-Arimco Mining Corporation

Nueva Viscaya, Philippines

Didipio Copper-Gold Project Feasibility Study (1994). Lugeon tests during Geotechnical drilling for groundwater modelling .

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PROJECT RELATED EXPERIENCE – OPEN CAST MINES AND SLOPE STABILITY

Oceana Gold Philippines Inc.

Didipio Cu-Au Project, Philippines

Lead geotechnical consultant for the development of this greenfield, porphyry, mine. Project components of particular interest are a deep open pit, underground mine, 22km long access road through complicated materials and extensive hydro-geological test work. This project is situated in a remote mountainous area of northern Philippines.

Indophil NL, Tampakan Cu Project

General Santos City, Philippines

Geotechnical design for mine pit slopes for a proposed 2 billion tonne deposit with mining rates of between 80,000 to 120,000 tonnes/day. The ultimate depth of the pit is expected to be in the order of 500m. Rocks are highly highly altered andesite with low strength and extensive clay alteration. Numerous regional faults cross-cut through the orebody and seismic hazard is considered to be high.

Solid Energy NZ Ltd

Maramarua, New Zealand

Geotechnical design for K1 proposed pit. Geotechnical assessment and analysis for the design of pit slopes up to 120m high. Geotechnical conditions comprise soft rocks (< 1MPa) large scale regional faults and high ground water pressure. Particular issues at Maramarua include very low strength bedding plane shears with a history of large scale failures in the region.

Solid Energy NZ Ltd

Ohai, New Zealand

Operational support for active coal pit with slope instability. Implemented total station robotic monitoring for slope management and developed 3D geotechnical models for operational support and predictive analyses. Geotechnical input for design of Pit 17, Pit 3 and Pit 6 open pits at same site. The project site is characterized by intensive structural deformation and complex geotechnical characteristics in the rock mass.

Solid Energy NZ Ltd

Huntly, New Zealand

Preliminary Evaluation Kimihia Resource comprising geological resource estimate and preliminary mine planning study. Geotechnical conditions comprise soft rocks and fill.

Queensland Nickel Pty Ltd, Caga 4 Nickel Project Feasibility Study

Surigao del Norte, Philippines

Feasibility level investigations geotechnical investigations for a proposed nickel laterite mining operation in a geologically active area with very high annual rainfall. This project followed the Adlay investigations (below) and included design and specification of temporary mine cut slopes and groundwater control measures within the proposed pit, design and specification of haul road cut slope configurations and design of a waste dump on a steep slopes with soft soil foundations.

PT Berau Coal, Binungan Area

Kalimantan, Indonesia

Pit slope hazard assessment. Walkover assessment of 6 operational pits to assess the hazard generally due to overall slope failure, rock fall and failure in soils at the pit crest. Key deliverables included a hazard register for each pit, and recommended adjustment in mining and planning practices to mitigating against the existing, and future hazard.

Luzon Hydro Corporation, La Union

Philippines

Lon-oy Power Plant. Slope stability assessment and design of mass wall for remedial works following large scale slope failure due to erosion as a result of flooding.

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PROJECT RELATED EXPERIENCE – OPEN CAST MINES AND SLOPE STABILITY

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Surigao del Norte, Philippines

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included design and specification of temporary mine cut slopes and ground and surface water control measures within the proposed pit, design and specification of granular pavements, batter slope cut angles, earthworks control and specification of compaction for a 6.9km haulroad, foundation assessment and earthworks specification for construction of a 10m thick fill stockpile, recommendations for support options for a 300m long jetty, design of numerous earth and rockfill embankment structures for erosion control and sediment retention basins, design of waste dumps on steep slopes with soft soil foundations, and specification of groundwater drainage and surface water control measures for strip mining and general development of general civil works.

Lafayette Mining Pty Ltd

Albay Province, Philippines

Rapu Rapu Island Open Pit. Feasibility level assessment of open pit slope design and dewatering requirements for a 150m deep, 1.5km long pit.

Luzon Hydro Corporation, La Union

Philippines

Bakun Hydro Project. Risk based and specific stability assessment of rock slopes along newly excavated access road within remote, steep terrain and complex hard rock geology.

Lafayette Mining NL

Albay Province, Philippines

Rapu Rapu Island Open Pit. Pre-Feasibility level assessment of open pit slope design and dewatering requirements for a 150m deep, 1.5km long pit.

Climax-Arimco Mining Corporation

Nueva Viscaya, Philippines

Didipio Project Copper-Gold Project. Investigation and design of a decline box-cut with slopes up to 25m high within deeply weathered soils.

Bilfinger + Berger (Philippines), Construction

Alabang, Metro Manila, Philippines

Insular Life Building. Design of ground support, instrumentation and monitoring for this 20m deep basement excavation within loose soils and tuff. On going input during excavation to optimize ground support installation, and long term ground deformation monitoring.

BHP Coal

Cataract River, Australia

Developed a risk assessment procedure for steep slopes affected by mining induced subsidence.

Transit New Zealand

State Highway 3, Manawatu Gorge

Engineering geological based risk assessment of steep rock slopes along full length (8.5km) of the gorge. Design of remedial works including water relief drilling, meshing and removal of loose material. Preparation of contract documents and tender assessment.

Solid Energy North Ltd (formerly Coal Corporation of New Zealand)

New Zealand

Weavers Pit Instrumentation and Monitoring. Geotechnical investigation and installation of piezometers (pressure transducers) to monitor foundation conditions during construction of a bund to control a failed slope.

Cawdor Properties Opito Bay

Coromandel, New Zealand

Ohinau Drive Subdivision. Geotechnical and groundwater investigation of an extensive slope failure. Results included establishment of the failure model with recommendations for monitoring and additional investigations to scope remedial works.

Cameron Wylie

PROJECT RELATED EXPERIENCE – OPEN CAST MINES AND SLOPE STABILITY

Waitakere City Council

Auckland, New Zealand

Various Road Slips. Engineering geological investigation of numerous small road slips in the Waitakere Ranges, Auckland with preliminary recommendations for remedial works. Most failures were within saturated, deeply weathered volcanogenic materials and fill. Remedial options included cantilevered pole retaining walls, gabion basket retaining walls and road re-alignments.

Transit New Zealand

New Zealand

State Highway 3, Manawatu Gorge Rock Slope Failure. Geotechnical and geological slope stability investigation, design and supervision of remedial works to stabilize a 100,000m³ rock slope failure. The works involved re-profiling the slope by excavator, removal of loose debris by washing with helicopter born monsoon buckets, drainage drilling, stream diversion and slope monitoring using remote survey methods.

Solid Energy North Ltd (formerly Coal Corporation of New Zealand)

New Zealand

Weavers Pit Instrumentation and Monitoring. Supervision and reporting of a drilling programme to install inclinometers and piezometers in the walls of an abandoned coal mining pit. The pit was rehabilitated by filling to form a lake. Monitoring was ongoing during this period and resulted in additional remedial works to stabilize the pit walls.

Reynolds Yilgarn Gold

Marvel Loch, Western Australia, Australia

Marvel Loch Operations. Drillcore based investigation for portal design and to provide an estimate of pit wall stability.

Goldfan Ltd

Coolgardie, Western Australia, Australia

Tindalls Underground. Two dimensional stress analyses to provide a stability assessment and estimate of ground support requirements for an in-the-wall haulroad.

Cameron Wylie

PROJECT RELATED EXPERIENCE – MINE WASTE

Teresa-Crew Gold (Phils) Inc

Apex Underground Mine

Dam Design Review and direction of geotechnical investigation for this tailings storage facility at the Apex Mine, Philippines. A key feature of this project is the very rapid implementation of the job. Stage 1 is currently under construction.

Lafayette Mining Ltd

Rapu Rpau Project, Philippines

Review and observation during construction of the tailings storage facility at Rapu Rapu Island, Philippines. This facility is being constructed as an APC contract and comprises 2 x embankments within the storage area. Acid mine drainage, high rainfall tropical environments and variation in material schedules against expected have been a feature of this project.

Solid Energy

Kimihia Project, Huntly, Waikato

PAG Level 3 design and costing for the potential Kimihia pit Waste Storage facility. The key issues in this project are the need to schedule waste rock quality with structural design needs, and to recover waste of various standards. Design includes a proposed haulroad and construction on deep, soft sediments.

Queensland Nickel Pty Ltd, Caga 4 Nickel Project Feasibility Study

Surigao del Norte, Philippines

Feasibility level investigations geotechnical investigations for a proposed nickel laterite mining operation in a geologically active area with very high annual rainfall. This project followed the Adlay investigations (below) and included design of a waste dump on a steep slopes with soft soil foundations.

Solid Energy South

Ohai Mine, Southland

Design and advice for construction of engineered landform ELF 3B. The landform is being built over 2 sediment retention ponds with sludge in the foundation. In addition the north side of the ELF incorporates a previously built bund to divert a significant stream.

Ravensdown Fertiliser Coop.

Kakahu Quarry, New Zealand

Investigation and design of engineered landform and including surface water drainage to contain stripped overburden. The landform was built in a valley in which previous instability had been recognised, over soft foundation materials. In order to buttress the slope the landform was constructed from the toe up with under-drains and compacted by truck movements in order to buttress. Quality control was provided by the contractor with training assistance from Golder.

Queensland Nickel Pty Ltd, Adlay Nickel Project Feasibility Study

Surigao del Norte, Philippines

Feasibility level investigations geotechnical, ground and surface water investigations for this proposed nickel laterite mining operation in geologically active area with very high annual rainfall. Key deliverables included design and specification of temporary mine cut slopes and ground and surface water control measures within the proposed pit, design and specification of granular pavements, batter slope cut angles, earthworks control and specification of compaction for a 6.9km haulroad, foundation assessment and earthworks specification for construction of a 10m thick fill stockpile, recommendations for support options for a 300m long jetty, design of numerous earth and rockfill embankment structures for erosion control and sediment retention basins, design of waste dumps on steep slopes with soft soil foundations, and specification of groundwater drainage and surface water control measures for strip mining and general development of general civil works.

Lafayette Mining Pty Ltd

Albay Province, Philippines

Rapu Rapu Island Gold Project Feasibility Study. Geotechnical and hydrogeological investigations for the design of tailings dam comprising two primary embankments to 50m high and 3 saddle dam embankments.

Rapu Rapu Island Gold Project Pre-Feasibility Design of Tailings Dam. Hydrology and engineering geological assessment and design for earth and rock dam with ultimate storage of approximately 10 million m³, crest height of 85m (at deepest point) in high volume, high intensity rainfall area.

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PROJECT RELATED EXPERIENCE – TUNNELING AND UNDERGROUND MINING

Oceana Gold Philippines Inc.

Didipio Cu-Au Project, Philippines

Lead geotechnical consultant for the development of this greenfield, porphyry, mine. Project components of particular interest are a deep open pit, underground mine, 22km long access road through complicated materials and extensive hydro-geological test work. This project is situated in a remote mountainous area of northern Philippines.

Pike River Coal Co Ltd

Pike River Coal Project

Geotechnical support for design of ventilation shafts and large scale openings for underground infrastructure, and advice for project development.

Oceana Gold Ltd

Frasers Underground Mine

Geotechnical support and mentoring for producing mine. This is an on-going support role.

Genesis Energy

Mokau Coalfield project

Pre-feasibility level geotechnical review of this Greenfield coal project.

Tamaya Resources

Lichkvas Gold Project, Armenia

Geotechnical support for the development of this brownfield project. This is a narrow vein project currently being mined at low tonnage using hand held methods. The intent is to update the project using modern techniques and “benching” to produce at modern production levels.

Roa Mining Co Ltd

Roa Underground Mine, NZ

Geotechnical investigations and support for production.

Department of Labour, West Coast NZ

Mine Incident, NZ

Investigation of geotechnical factors associated with a fatality at this mine.

Teresa-Crew Gold (Phils) Inc

Apex Underground Mine, Philippines

Geotechnical support including ground support recommendations for the development of the Apex mine. This projects involves new development and rehabilitation of a previously worked hard rock mine. Mining techniques are to be narrow vein sub-level stoping. Development is by jumbo and hand-held.

Energetica

Pupunahue Coal Mineability Assessment, Chile

Project review to assess mineability options for extracting a large (est 60 million tonne) resource comprising 2 coal seams approximately 4m thick, separated by 0.5m thick clay band, to depths below 150m.

Oceana Gold Ltd

Blackwater Underground Mine, NZ

Geotechnical and hydrogeological evaluation of ground conditions along the proposed Snowy Decline to access the historical Blackwater mine. Evaluation was based on geological domain modeling and limited geotechnical drilling.

Provision of operational support to rehabilitation of the historical Prohibition Shaft including recommendations for support based on site inspection and numerical modeling.

Feasibility level geotechnical evaluation of proposed underground mine based on exploration drilling and numerical modeling to assess stope spans, and support requirements. The Blackwater deposit is very close to the Alpine Fault, a major tectonic plate boundary. Particular issues relate to the evaluation of stress conditions and potential impact on mining.

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PROJECT RELATED EXPERIENCE – TUNNELING AND UNDERGROUND MINING

Oceana Gold Ltd

Frasers Underground Mine, NZ

Geotechnical and hydrogeological evaluation of ground conditions along two decline alignments to access the proposed Macraes underground mine and geotechnical assessment of shaft stability for ventilation raise development. Provision of operational support during decline development and establishment including participation in blasting and ground support improvement workshops.

Feasibility level geotechnical evaluation of proposed underground mine based on exploration drilling and numerical modeling to assess stope spans, pillar widths and extraction sequence. The Fraser's orebody dips at approximately 15° with dimensions 450m x 450m x 10m to 20m thick. Particular challenges relate to maximizing extraction ratios and reducing development costs.

Milford Light Rail Tunnel

Queenstown, New Zealand

Preliminary assessment of technical feasibility of developing 2 TBM driven tunnels between Queenstown and Milford. Work comprised a walkover of portal sites and approaches, and assessment of published information.

GRD Macraes Ltd

Reefton and North Otago, New Zealand

Preliminary assessment to assess technical feasibility for underground mining as an extension to the open pits at the Macraes mine, and to re-access an abandoned mine at Reefton.

Opus Consultants Ltd

Auckland, New Zealand

Preliminary assessment to assess technical feasibility for 2 tunnels within the Waitemata Group to be excavated as part of the second Harbour Crossing.

Lepanto Mining

Benguet Prov. Philippines

Victoria Access Decline. Assessment of mining conditions in twin tunnels through very closely fractured ground with high water flows. Recommendations made for integration of additional drilling investigations, dewatering and rock support strategies.

Western Mining Corporation

Tampakan, South Cotabato, Philippines

Tampakan Copper Project. Engineering geological assessment of a tunnel portal in steep topography and deeply weathered materials. Portal cut-slope stability assessments based on observation of existing conditions with recommendations for cut slope geometry, drainage, ground support and protective measures. Underground support assessment and design (based on core) for small diameter exploration adit.

Climax-Arimco Mining Corporation Limited

Nueva Viscaya, Philippines

Didipio Copper Gold Project (1997-1998). Design and supervision of geotechnical drilling investigations to assess portal box-cut for decline access to the underground mine, decline ground conditions, and ventilation and access shafts. Design of portal box-cut slopes and underground support. Photo- and geophysical lineament interpretation to assess ground conditions along a proposed 6km drainage tunnel. Additional project work includes input into structural geological model for geotechnical purposes and reporting of the overall geotechnical feasibility study a potential for block cave mine and training of site personnel in geotechnical investigation procedures. Ongoing.

South Blackwater Coal Ltd.

Kenmare Mine, Australia

Fault Drivage. Geotechnical monitoring and advice to operators on secondary ground support requirements during trial drive through faulted ground (primary support previously specified using design techniques developed by Coffey). The trial was successful and gave the operators access to a previously inaccessible mine block at reasonable cost.

Hauraki District Council

Waitakaruru, New Zealand

Waitakaruru Tunnel Inspection. Underground inspection to assess the stability of this small hydro (setting) tunnel excavated through weathered greywacke. Key results included recommendations for remedial works and safety procedures for entry to the tunnel.

Cameron Wylie

PROJECT RELATED EXPERIENCE – TUNNELLING AND UNDERGROUND MINING

Climax-Arimco Mining Corporation Limited.

Didipio Project, Philippines

Dinkidi Feasibility Study. On-site supervision of drilling and down hole testing to establish geotechnical parameters for a feasibility assessment of a proposed large open pit and underground mines. The site is remote and good communication is required at all levels to successfully complete allotted tasks.

The investigation involved deep (800-1000 m) holes, all of which were oriented when drilling through the ore zone. All holes were logged and down hole work included Lugeon tests at key locations.

The large database generated was managed using dBASE and Micro-Lynx (mine design) software.

St Ives Gold Mines

Kambalda, Western Australia, Australia

Revenge Gold Mine. Geotechnical investigation and analysis to review mine layout and stope sizes for room-and-pillar and alimak raise stopping. A primary aim of the study was to analyze crown pillar dimensions using two- and three-dimensional stress modelling techniques. This work was ongoing and involved close liaison with the on site production team.

Reynolds Yilgarn Gold

Marvel Loch, Western Australia, Australia

Marvel Loch Operation. Feasibility level investigation of geotechnical aspects to assess the potential for large scale underground mining beneath the Marvel Loch pits. This included recommendations for stope sizes, ground support requirements, and an assessment of barrier pillar stability.

A further study was made for portal design and to provide an estimate of pit wall stability.

Goldfan Ltd

Coolgardie, Western Australia, Australia

Tindalls Underground Mine. Diamond drillcore based assessment of underground stope stability, decline orientation, and ground support requirements for preliminary planning.

A detailed study was also made using two dimensional stress analyses to provide a stability assessment and estimate of ground support requirements for an in-the-wall haulroad.

Wiluna Gold Mines Pty Ltd

Wiluna, Western Australia, Australia

Happy Jack and Bulletin Mines. Design level study to assess geotechnical aspects of underground mining at the proposed Bulletin and Happy Jack mines. A detailed geotechnical model was established and stope sizes, ground support requirements, and proposed extraction sequences were recommended.

A further study was initiated to develop a spreadsheet based model to estimate dilution. This was completed and accepted as a design tool.

Forrestania Nickle Mines

Hyden, Western Australia, Australia

Diggers Rocks. Geotechnical investigation and analyses to design level to help determine stope sizes, mine layout and support requirements. This was complicated by the presence of swelling ground.

Two dimensional stress analyses was used to determine stable barrier pillar dimensions and extraction sequences.

Phillips Range Joint Venture

Northern Western Australia, Australia

Phillips Range. Geotechnical assessment of drill core and site inspection to investigate options to access a proposed underground mine. Decline and shaft options were analysed and positioned with respect to surface earthworks, hydrological constraints and ground support requirements.

Reynolds Yilgarn Gold

Western Australia, Australia

Transvaal Mine. Underground site inspections to quantify damage and stress analyses to allow extraction of a highly stressed, isolated pillar. This work lead to changes in the mining and ground support practices at the mine.

Cameron Wylie

PROJECT RELATED EXPERIENCE – TUNNELLING AND UNDERGROUND MINING

Aztec Mining

Western Australia, Australia

Bounty Mine. Major review of ground support options in a variety of underground geotechnical environments. Recommendations made for alternative support types and designs. Analysis and design of support requirements for a crusher chamber to be located 800 m below surface in high stress conditions.

Porgera Joint Venture

Papua New Guinea

Porgera Gold Mine. Staff Position. Geotechnical investigations to assist the engineering design and extraction sequencing using open stopes.

Principal Duties and Work Undertaken included:

- structural analyses to determine principal geological controls on geotechnical parameters;
- large excavation design and monitoring;
- measurement and analysis of the full three dimensional stress field about the orebody using CSIRO 9 and 12-gauge stress measurement cells;
- three dimensional numerical stress modeling of the orebody and proposed mining sequences;
- investigations to raise mine productivity through increasing slope sizes and adoption of innovative mining techniques;
- optimization and design of ground support systems;
- support of operations through regular underground site inspections with all levels of operating staff;
- management of drilling programmes involving four underground diamond drill rigs and three surface rigs;
- upgrade and redesign of geological mapping procedures to ensure higher quality data collection.

Mount Isa Mines Ltd

Queensland, Australia

Mt Isa and Hilton Mines. Staff Position. Responsible for all rock mechanics aspects associated with production from cut-and-fill, modified Avoca, and large open slopes. Particular problems included extraction from closely spaced, highly stressed stopes, mining through a crown pillar using hand-held methods, and conversion of hand-held cut-and-fill to bulk mining (modified Avoca).

Principal Duties:

- detailed structural geological studies within the orebodies engineering design;
- design and monitoring of large underground excavations;
- design, implementation and analysis of extensive ground monitoring programmes using multipoint rod extensometer, borehole camera surveys, stress change (Geokon) monitors, and ground support load cells;
- design of all ground support systems underground,
- use and interpretation of three dimensional numerical stress analyses programmes to aid in the engineering design;
- inspection of underground workings and changes in ground conditions due to mining.

Auckland Regional Council

Manukau City, New Zealand

Redoubt Road No. 2 Inlet Tunnel. M.Sc. Thesis. Subcontracted to the Auckland Regional Council during the driving and construction of this 650 m long hydro-tunnel. Materials encountered included soft, weak rock to moderately dense, unconsolidated sands.

Detailed work included geological and geotechnical mapping/logging, structural analyses, geotechnical test, mineralogical investigation and SEM analysis of all rock types.

In addition, advice was given to contractors as to expected ground conditions, an engineering analysis was made of the efficiency of the mining methods used, and the stability of the Redoubt Road Reservoir site was assessed.

Cameron Wylie

CONTINUING PROFESSIONAL DEVELOPMENT

2008

ICEHOUSE Growth Seminar run by the Auckland University to help facilitate business growth
SESOC Fundamentals of Seismic Design 1 day course

2007

AusIMM Conference attendance and presentation of paper
AusIMM Project Evaluation conference

2006

NZ Earthquake Engineering workshop
AusIMM Conference attendance and presentation of paper
Project Management, in-house course run by Golder Associates
Golder Associates, in-house Principles and Associates conference
Golder Associates in-house "Friday afternoon" technical sessions
Golder Associates 3 day course on Block Caving presented by Prof. Ted Brown

2005

AusIMM Conference attendance.
Golder Associates, in-house Principles and Associates conference
Golder Associates in-house "Friday afternoon" technical sessions

2004

AusIMM Conference attendance and presentation of paper
Golder Associates, in-house Principles and Associates conference

2003

Golder Associates, in-house Principles and Associates conference

Prior to 2003

- Financial Analysis 3 day course
- Coffey Gescience in-house Management Development course (3 days) as part of senior corporate team
- Australian Groundwater course 3 days
- Effective report writing
- Effective negotiation

Ongoing

Technical papers and bulletins from professional memberships

- Australasian Inst Mining and Metal,
- NZ Geotechnical Society,
- NZ Society for Large Dams,
- NZ Sustainability,
- NZ Soc for Eq Engineering,
- NZ Coastal Society,
- International Assoc of Engineering Geologists,
- International Society for Rock Mechanics

Articles and bulletins from management based publications:

- Main Business Report
- Unlimited Magazine
- Numerous business texts