PHIL STYLES & ASSOCIATES

ABN: 70603097730

Philip Styles

Principal Engineering Geologist

SUMMARY

An engineering geologist with more than 35 years of experience, he has worked extensively in Australia and overseas and has very broad experience in geotechnical investigations including design and construction of roads, rail, tunnels, dams, slope stability studies, route assessments, pipelines, wetlands, retarding basins, treatment plant facilities, footings and foundations, piles, tailings facilities and contaminated sites.

Phil has managed geotechnical teams on a national basis and has worked extensively with the construction industry.

Qualifications

- BSc (Hons) Earth Science, Monash University
- Grad Dip Engineering Geology, RMIT
- Grad Dip Computing Studies, RMIT
- Grad Dip Education, SCV Rusden

Professional Affiliations

- Member Australian Geomechanics Society
- Member Australasian Institute of Mining & Metallurgy
- Member Australian Institute of Geoscientists
- Member Australasian Tunnelling Society
- Member Australian Water Association
- Associate Australian National Committee on Large Dams
- Registered Professional Geoscientist (Geotechnical and Engineering), RPGeo 10,087
- Registered Professional Engineer of Queensland (Geotechnical/Geological), RPEQ 10,771

Areas of Expertise

- Design and construction of tunnels
- Earth and rockfill dams
- Geotechnical and geological modelling
- Slope stability studies
- Route assessments
- Pipelines
- Wetlands
- Retarding basins
- Treatment plant facilities
- Footings and foundations
- Piles
- Rail infrastructure
- Tailings facilities
- Contaminated sites

Courses Attended

- RTA (NSW) “Guide to Slope Risk Analysis” V3.1 (2004)
- John Holland Rail “Track Awareness – Level 1” (2007)
- Coffey Projects “Project Management Fundamentals “ (2008)
- Insight People “Effective Delegation” (2010)Joint ACG & ANCOLD Workshop “Design of Tailings Storage Facilities for Seismic Loading Conditions: Operational and Long Term Considerations” (2012)

Appointments

- 2014- Current: **Phil Styles & Associates**, Principal Engineering Geologist and Director
- 2014: **NSP Geotechnics**, Principal Engineering Geologist
- 2013 – 2014: **SMEC Australia,** Principal Engineering Geologist
- 2011-2013: **SMEC Australia,** Manager Geosolutions, Vic/SA
- 2009-2011: **Halcrow Pacific,** Geotechnical Team Leader, Australia
- 1992-2009: **Coffey Geotechnics,** Associate Engineering Geologist
- 1982-1991: **Melbourne Water,** Engineering Geologist to Manager, Geotechnical Services

Publications

"Thomson Saddle Dam: Geological Considerations in Dam Stability", Thornton, P.N. & Styles, P.C., in 11th Australian Geological Convention, "Earth Sciences, Computers and The Environment", 1992 publ. Geological Society of Australia

"Rippability – A Case Study: Wivenhoe Alliance", Styles, P., Stephens, B., & Perrett, S., in ANCOLD/NZSOLD Conference 2005, "Managing Dams in a Climate of Change", 2005, publ. Australian National Committee on Large Dams

"The Provision of Engineering Advice for the Emergency Management of the Nathalia Foods, March 2012", Styles, P.C. & Garrard, A.L., in ANCOLD/NZSOLD Conference 2012, "The Importance of Dams in Our Developing Economy", 2012, publ. Australian National Committee on Large Dams

Project Experience:

Phil Styles & Associates Pty Ltd

Landslip Stabilisation

Preparation of design and provision of geotechnical advice for landslip remediation works in Victoria, New South Wales and Queensland. Work has included geotechnical investigation, preparation of concept and detailed designs, preparation of 'Issued for Construction' drawings and sign off on 'As Constructed Drawings'.

Projects Include:

- Jagera Court, Closeburn Qld
- Bundaberg Creek, Bundaberg Qld
- Riverside Drive, Nambucca Heads NSW
- Rowlands Creek Road, Uki NSW
- Coramba Road, Megan NSW
- Pilbeam Drive, Rockhampton Qld
- 7 Ilyara Avenue, Bayfield NSW

Foundation Assessments

Various site investigations and foundation assessments for medium to high rise residential and commercial developments. This work has comprised variously the ground investigation, development of foundation design parameters for slabs, strip footings, piles and wall anchors and wall retention systems and footing/pile inspections.

Projects include:

- 386 Spencer Street, West Melbourne
- PEQ Facility, Mickleham
- 615 Sydney Road, Brunswick
- Aspire Apartments, Zenith Rise, Bundoora
- 35 Dryburgh Street, West Melbourne
- 33 Racecourse Road, North Melbourne
- 13 Mason Street, Newport
- ETP Odour Treatment Facility
- WTP Pump Station No. 2 Trash Racks
- WTP 25W Biogas Cover Replacement
- Silvan Dam pH Correction Plant
- New Coles store, 97C Sydney Street, Kilmore
- 393 Swanston Street, Melbourne
- 23-31 Small Street, Hampton
- Forensicare/Thomas Embling Hospital, Fairfield

Riverside Park, Bundalong Vic

Conducted the site investigation and Land Capability Assessment for a small sewage treatment facility at a caravan park.

Kananook Creek Retaining Wall, Frankston, Vic

Conducted the site investigation for a section of retaining wall remedial works and verified the screw pile design.

Preliminary Landslide Assessments, Mt Buller, Victoria

Conducted the preliminary site stability assessments for the preparation of Schedule 1 for planning permit approval at the following sites:

- Altamont Lodge
- Chalet Hotel

- Fawlty Towers
- Whittaker Lodge
- Wallaby Lodge
- Crosscut Lodge
- Mt Stirling Microhydro Scheme
- Lot 59 Chamois Road
- Mansfield Ski Club
- Benmore Ski Club
- Chalet Apartments

Site Classifications/Stability Assessments

Carried out within the Shire of Yarra Ranges

- 18 Huntly Road, Mooroolbark
- 35 Station Road, Seville
- 22 Scenic Crescent, Kalorama

Maroondah Aqueduct Pipeline Replacement

Site investigation and provision of design parameters for 5km of aqueduct replacement with pipeline.

Road Replacement, Eastern Treatment Plant

Site investigation, provision of design parameters and construction advice for the Alan Bird Drive replacement and Frawley Boulevard duplication.

Expert Witness, Corn Hill Link Road Project, Mt Buller

Appeared as an expert witness at the VCAT appeal hearing regarding the proposed construction of the Corn Hill Link Road between Mt Buller and Mt Stirling.

Maroondah Aqueduct Pipeline Replacement, Dixons Creek, Vic

Conducted the site investigation and reporting for the proposed replacement of 5km of aqueduct with a pipeline.

NSP Geotechnics Pty Ltd

Foundation Assessments

Various site investigations and foundation assessments for medium to high rise residential and commercial developments.

Bundaberg Creek Bank Restoration

Preparation of design and construction specification for a creek bank restoration on Bundaberg Creek, Bundaberg.

Upper Wilsons Creek Stabilisation

Preparation of a tender design for micropiled creek bank and road stabilisation works at Upper Wilsons Creek, Mullumbimby.

SMEC Australia Pty Ltd

Member Queensland Transport and Main Roads Engineering and Technology Specialist Consultants Panel

Selected for membership of the specialist technical services panel to provide input relating to slope risk assessment and radiation. This is a 2 year appointment commencing July 2011 with an option of two 1 year extensions.

The roles and responsibilities for this role include:

- Provide high level specialist advice to the Director (of the relevant branch) – Engineering & Technology.
- Design and Project Manage projects for a range of circumstances and complexities, with likely focus to be on more complex matters.
- Scope and prepare Business Cases for the projects.
- Analyse designs, reports, and data and provide recommendations for action.
- Undertake studies and report on findings.

Nathalia Levee Banks – Provision of Technical Assistance During the March 2012 Floods

In March 2012, the township of Nathalia was inundated by flood waters from the rain swollen Broken Creek. Emergency Services crews from the State Emergency Services (SES), Country Fire Authority (CFA), Victoria Police and the Australian Army, assisted by the local residents, worked to maintain the integrity of the existing levee banks along the Broken Creek and to construct temporary levees and coffer dams through and immediately adjacent to the township.

Philip was one of the senior geotechnical professionals to provide technical assistance to the emergency relief effort. These professionals were able to identify weak, threatened and distressed sections of the levees (both temporary and permanent) and provide practical and timely advice with respect to appropriate remedial measures.

Baw Landslides 1 to 6 – Geotechnical Design

Project Manager for the design of remedial works for 6 landslides along the Yarragon-Leongatha Road. The scope of works included review of the concept design for the remedial works at each of these sites,

assessment for feasibility and long term stability, certification of the design, conduct of a detailed feature survey at sites 2, 3, 4 and 6, provision of geotechnical advice as required and conduct site visits during construction to confirm that site conditions were as anticipated during design.

Landslide Remedial Works on the Kennedy Highway (Kuranda Range) Qld

Project Manager for the design of remedial works for a number of landslides along the Kennedy Highway. The scope of works included review of the concept design for the remedial works at each of the sites, assessment for feasibility and long term stability and preparation of the detailed design of the remedial works.

Epsom Spring Gully Evaporation Lagoon

The works comprised the construction of an evaporation lagoon to the north of the existing winter storage, located at the Coliban Water Epsom Spring Gully Water Recycling Facility, Bendigo, Vic.

Project Manager for the:

- An assessment of the sub-surface and groundwater conditions at the site;
- Recommendations for lagoon excavation design and construction including
- materials suitability for structural earth fill placement; and
- Recommendations for general site earthworks.
- Detailed design of the works; and
- Provision of advice during construction.

Nyabarongo Hydroelectric Project

The Nyabarongo HEP is located in the western central part of Rwanda and will utilise the flows of the Nyabarongo river for the generation of 28 MW (2x14 MW) power as a run-of-the river scheme.

Took the role of experienced Dam Geologist to assist in assessing the conditions on the right abutment of the water supply dam with the aim of providing specific construction advice along with a Team of Experts to enable the works to progress.

The purpose of the site visit was:

- to conduct a geological assessment of Drift (Dam-Right Abutment) and to explore a solution for the Dam Right Abutment where poor rock conditions had been encountered
- to provide an assessment of geological conditions at various project components including Intake and Switchyard
- to overview the progress of works at site
- to oversee broadly the compliance of drawings
- to discuss the critical issues / problems encountered by the Contractor

The site visit comprised:

- A review of available relevant information including borehole logs and core for two bores located on the right abutment.
- Relevant geological sections and designs for the proposed works.
- Lugeon test results for the dam foundations.
- Inspection of a ‘drift’ excavated at approximately the dam crest elevation of 1501m.
- Inspection of the works and exposed foundation conditions at the dam site.

Remedial Works at Kiewa No.4 Headrace and Tailrace Tunnels, Kiewa, Victoria

The Kiewa No. 4 Headrace Tunnel extends for approximately 3.5km from the West Kiewa Power Station to Clover Dam. Geotechnical Engineering has been engaged by AGL to conduct an inspection of the Kiewa No. 4 Headrace Tunnel and, based on the results and recommendations from this inspection, to conduct remedial works as approved and appropriate.

Philip was the engineering geologist who conducted the visual inspection of the headrace tunnel with a view to indicating where unstable areas exist in the tunnel, identifying what treatment is required for these areas and preparing sketch design drawings and construction notes for the identified remedial works.

While conducting this work Philip also provided advice with respect to design of the stabilisation works required for the tailrace tunnel downstream of the power station.

Preliminary Landslide Assessments, Mt Buller, Victoria

Conducted the preliminary site stability assessments for the preparation of Schedule 1 for planning permit approval at the following sites:

- Alpine Retreat
- Snowmass 1
- Site 48
- Site 197
- Site 209
- Site 79
- Link Road, Mt Buller to Mt Stirling

Preparation of Trench Backfill Specification

Provided geotechnical advice and assistance in the revision of the sewer trench backfill specification for use by Yarra Valley Water, City West Water and South East Water.

AROWS Project, Darwin

Principal Geologist responsible for the investigation, assessment and preparation of designs for the proposed Adelaide River Off Water Storage (AROWS) Project, a new potable water supply reservoir for Darwin.

Sun Valley Reservoir – Assessment of Leakage, Mt Buller, Vic

Sun Valley Reservoir is the water storage facility for snow making at the Mt Buller Alpine Resort in Victoria. A leakage point exists on the eastern embankment of the reservoir. SMEC was commissioned to assess the likely source and mechanism for this leakage and to recommend appropriate remedial works. Principal Geologist and Project Manager for this project which comprised:

- Visual assessment of the reservoir, embankment and surrounds
- Attempted dye tracing of internal leakage points
- Visual assessment of the internal embankment walls subsequent to lowering the reservoir level
- Review of available geotechnical investigation reports and construction information
- Interviews with available workers from the dam construction
- Visual assessment of internal walls and liner by divers
- Excavation of test pits along the toe of the eastern embankment to assess the subsurface conditions in the area of the leakage
- Preparation of a risk assessment to assess the required actions to continue using the reservoir without conducting extensive remedial works.
- Design of a V-notch weir for monitoring seepage rates and turbidity and provision of advice with respect to installation
- Assessment of the initial readings from the V-notch weir
- Preparation of a completion report outlining the investigations carried out, an assessment of the likely causes and source of the leakage and a recommended remedial works strategy

Myponga Dam Safety Review, Myponga, SA

Myponga Dam is a concrete gravity Dam located on the Myponga River at Myponga, SA.

Principal Geologist responsible for the review of available geological and geotechnical conditions at site, mapping of existing geological conditions at the dam and spillway abutments and recommending appropriate geotechnical parameters for condition and stability reviews and design of remedial works.

Beetaloo Dam, Beetaloo, SA

Beetaloo Dam is a concrete gravity Dam located on Crystal Brook north of Beetaloo, SA.

Principal Geologist responsible for the review of available geological and geotechnical conditions at site, mapping of existing geological conditions at the dam and spillway abutments and recommending appropriate geotechnical parameters for condition and stability reviews and design of remedial works.

Greenvale Bund

Provision of geotechnical assessment and advice for the sourcing of construction materials and design of a diversion bund adjacent to Greenvale Reservoir, Melbourne.

Melbourne Water Levee Bank Assessments

Melbourne Water's asset portfolio is understood to include approximately 200 km of levees which are associated with an estimated waterway length of around 100 km. The condition of the levees varies widely and Melbourne Water wishes to understand the risk profile of the levees with a view to establishing a program of works to rehabilitate any levees where appropriate. SMEC has been engaged to undertake a risk assessment for around 30 km of levee banks which constitute approximately 10% of Melbourne Water's overall portfolio of levees.

The investigation comprised:

- An assessment of failure probabilities associated with hydrologic and static events
- An assessment of the consequences of failure
- An assessment of the risk associated with the levee banks
- Recommendations on the proposed risk treatment measures for the levees.

East-West Link Tender Design

Conducted the initial review of the geological model for the proposed East-West Link Tunnel between the Eastern Freeway exit at Clifton Hill and Western Ring Road at Sunshine.

Southern Mornington Peninsula Backlog Sewerage Scheme, Geotechnical Investigation

Project manager for the investigation to assess subsurface conditions relevant to the proposed development at five locations along the alignment. The pipework generally had an invert level about 3m to 4m below existing ground surface but with some sections up to 8m below existing ground surface at critical geographic high points. It is understood that the network will be constructed using a combination of open cut trenching and trenchless technology depending on site and project constraints. SMEC Geotechnics undertook the geotechnical site investigations, reporting and interpretation for KBR.

Halcrow Pacific Pty Ltd

Member Queensland Transport and Main Roads Engineering and Technology Specialist Consultants Panel

Selected for membership of the specialist technical services panel to provide input relating to slope risk assessment and radiation. This is a 2 year appointment commencing July 2011 with an option of two 1 year extensions.

The roles and responsibilities for this role include:

- Provide high level specialist advice to the Director (of the relevant branch) – Engineering & Technology.
- Design and Project Manage projects for a range of circumstances and complexities, with likely focus to be on more complex matters.
- Scope and prepare Business Cases for the projects.
- Analyse designs, reports, and data and provide recommendations for action.
- Undertake studies and report on findings.

M5 East Expansion – Geotechnical Management, NSW

Senior Geotechnical Engineer responsible for the tender preparation documentation.

Huski Ski Lodge Car Park – Geotechnical Investigation, Victoria

Principal Geotechnical Engineer responsible for geotechnical stability assessment for a new car parking area at the Huski Ski Lodge, Mt Buller.

Kemari Container Terminal, Karachi, Pakistan

The expatriate geotechnical engineer/engineering geologist mobilised to site to review the SI contractor's working methods and procedures along with giving a detailed briefing to Halcrow's local site supervision team. During the course of the visit it was requested that I also conduct an initial review of the factual report presenting the results from the Phase 1 SI, make recommendations with respect to the likely content of the final SI report (to be prepared by Halcrow), and to make broad recommendations with respect to possible ground improvement techniques that could be required for the newly reclaimed area.

Sha Tin to Central Line, Hong Kong

Review and further development for the geotechnical model for the 6.4km long proposed underground rail line. The review role included assessment of ground conditions, tunnel design, settlement and groundwater issues, tunnel and portal support and review of the stability and geotechnical engineering reports.

Preliminary Geotechnical Assessment For Roy Hill Package 3, Port Hedland, WA

Roy Hill Package 3 comprised 19km of rail spur extending from the main haul line to the mine into the ore handling area at Port Hedland, the ore handling area with a 2km long levee bank up to 4m high for tide protection, stock car dumping area comprising an excavation up to 18m deep and conveyor across the tidal flats to the port area. A preliminary geotechnical investigation had been completed indicating variable subsurface conditions formed of sand areas, tidal mud flats and possibly granite at depth. Prepared a preliminary geotechnical model and design parameters.

Mt Buller Landslide Assessments, Victoria

Heavy rainfall on 4 September 2010 resulted in landslides that affected the CSIR car park and Cornhill Road nearby. Several cars were damaged as a result of the CSIR landslide and two further landslides have affected the integrity and operational safety of Cornhill Road. Areas along Tip Access Road and Cornhill Road were also assessed.

The landslide assessment involved:

- Assess the extent and likelihood of reactivation of the landslides;
- Make recommendations as to appropriate remedial measures for the landslide affected areas;
- Prepare preliminary costings for the detailed design and construction of the proposed remedial works.

Kingston Park Slope Stability Assessment, South Australia

For the City of Holdfast Bay conducted a slope stability/erosion assessment on a section of coastal

slope approximately 400m long that extends above the Brighton Caravan Park at Kingston Park, Adelaide.

The project objectives were to assess the slope stability and provide management guidelines to stabilise the reserve slopes within the subject land in the context of:

- The objectives of the reserve's management/development plan.
- Ensuring the future stability of the Kingston Crescent/Strickland Road roadways and services infrastructure.
- The need to stabilise the monument infrastructure to ensure its future viability.
- The possible future options for the development and management of the caravan park, eg
- Maintain current size and setting;
- Expand further into the hill slope; or
- Reduce park size to provide buffer zones at the base of the hill.
- Recommend slope stability erosion management guidelines.
- Prepare a set of typical design drawings and indicative costs for the proposed remedial works.

Kerferd and Nil Gully Dam Design Reviews, Victoria

Conducted a dam safety and design review of these dams for North East Region Water Authority. These reviews comprised three components:

Part 1 – Engineering Standards

- Structural Integrity Evaluation – an examination and confirmation of the safety of the structures under normal operating conditions.
- Earthquake Integrity Evaluation – an examination of the resistance of the structures to earthquake events.
- Flood Capacity Evaluation – an examination of the ability of the structures to pass the Acceptable Flood Capacity and performance of an incremental damage assessment.

Part 2 – Risk Assessment

The risk assessment included the following components:

- Event trees showing the path to failure/non-failure
- Probabilities of failure for each individual failure mode. These would be assessed using Monte Carlo simulations in a limit equilibrium software package.
- Overall risk levels associated with the structures for societal and individual risks
- Economic risk levels associated with the structure (Overall & Incremental)

Part 3 – Possible Remedial Options

Identifying:

- Identification of practical remedial options
- Preliminary cost estimate of each remedial option
- Risk Assessment of the dam for each remedial option. Indicate how it will reduce risk

RMIT Swanston Academic Building, Victoria

During the course of the excavation works for the basement of the new Academic Building, a brick wall and old basement structure were encountered along the eastern and southern site boundaries. Studies were carried out to assess whether these brick walls were retaining walls and could adequately replace the proposed soldier piles in these areas.

Coffey Geotechnics Pty Ltd

Circle Line Project, Phase 3, Singapore

Senior Engineering Geologist responsible for the preparation of the preliminary geotechnical interpretation for 5km of cut and cover and EPBM tunnels with 5, deep level stations requiring extensive earthworks and earth retention systems. This work included assessing site geology and preparing a geological model along the route, assessment of the engineering properties of the materials, proposal of design parameters and a study of the geotechnical aspects of construction such as ground improvement, control of groundwater, uplift and any anticipated construction difficulties.

Emerald Tunnel, Victoria

Project Manager for condition assessment of a 2.65 km tunnel containing a 2.5m diameter water pipeline connecting the Silvan and Cardinia reservoirs, two of Melbourne's major water storage reservoirs. This work included the assessment of existing tunnel conditions, rock stability and support, which mainly comprises rock bolts, and likely risk to the pipeline through rock fall. Subsequent to completion of this assessment, provision of recommendations for remedial works and managing the scaling down of loose rock blocks likely to affect the operation and safety of the pipeline.

Upper Yarra Dam, Victoria

Project Manager for the provision of geotechnical advice for design and construction of a new outlet

tunnel and shaft through the right dam abutment at one of Melbourne's major water storage dams while continuing operation of the reservoir. This work involved the supervision of geotechnical investigations comprising boreholes and groundwater monitoring installations and liaison with design and construction engineers.

Conducting a peer review of the as constructed geotechnical information during construction and providing geotechnical advice with respect to tunnel support and the design of the intake structure at the upstream end of the tunnel.

Crafers Tunnel, Eagle on the Hill, SA

Project Manager for the assessment of geotechnical conditions and provision of geotechnical advice for the construction of a twin, 450m long road tunnel along one of Adelaide's major arterial roads. This study involved the drilling and logging of geotechnical boreholes, recommendations with respect to the design of tunnel and portal stability and support during construction, supervising and reviewing the as constructed geotechnical mapping and recommending changes to rock support systems as required based on the ongoing assessment of ground conditions.

Pretty Sally Reservoir, Wallan, Vic

Supervised and developed the design for the decommissioning of the Pretty Sally Dam, an earth fill embankment dam operated by Yarra Valley Water on the outskirts of Melbourne. Conducted site inspections during the decommissioning works.

Project managed the geotechnical investigation for the replacement tanks and tank pads located within the abandoned reservoir.

Ringwood South Branch Sewer, Victoria

Project Manager for the geotechnical assessment for a new 3.4km sewer tunnel to be constructed in an environmentally and socially sensitive area. Work included drilling, sampling, testing, geophysical surveys, hydrogeological testing, modelling and provision of geotechnical design parameters.

Outcomes included the preparation of factual and interpretive geotechnical reports and extensive interaction with the designers and construction advisors to achieve a functional design for the project and indicative project costings.

Base Metal Mine, Mehdiabad, Iran

Site geologist conducting the preliminary geotechnical investigation for site infrastructure associated with the conversion of an underground mine to an open cut operation. The GI included test pits, cored boreholes and in situ permeability testing. The only Anglo Saxon on site during the field period, taught the local mine geologists how to conduct slug permeability tests and to log bores geotechnically.

Potosi Open Cut Mine, Broken Hill, NSW

Senior Site Geologist conducting the orientation of drill cores and measurement of rock defect in this core for the design of cut slope angles and orientation at a new open cut mine development.

Epsom Road Main Sewer, Melbourne, Victoria

One of the team of geotechnical professionals who provided an assessment of the likely cause of subsidence to the surface over one of Melbourne's major sewer pipelines in a residential and commercial area. This assessment included the drilling of boreholes, installation of piezometers and conducting various geophysical surveys of the area using seismic refraction, ground penetration radar and radiowave techniques.

This team subsequently provided ongoing monitoring of the ground conditions during construction as well as providing regular geotechnical advice for the construction of pump wells, dewatering of the ground and shaft and tunnel support.

New Occidental Mine, Cobar, NSW

Conducted in situ permeability testing of a series of 900m deep boreholes to assess likely groundwater inflow rates in the proposed raise bored ventilation shafts. Made recommendations with respect to the grouting of the pilot bores.

Moranbah North Mine, Queensland

Conducted geotechnical testing in a 600m deep bore for a proposed ventilation shaft.

Loombah & McCall Say Dam Design Reviews, Victoria

Conducted a dam safety and design review of these dams for North East Region Water Authority. These reviews comprised three components:

Part 1 – Engineering Standards

- Structural Integrity Evaluation – an examination and confirmation of the safety of the structures under normal operating conditions.
- Earthquake Integrity Evaluation – an examination of the resistance of the structures to earthquake events.
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Part 2 – Risk Assessment

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- Probabilities of failure for each individual failure mode. These would be assessed using Monte Carlo simulations in a limit equilibrium software package.
- Overall risk levels associated with the structures for societal and individual risks
- Economic risk levels associated with the structure (Overall & Incremental)

Part 3 – Possible Remedial Options

Identifying:

- Identification of practical remedial options
- Preliminary cost estimate of each remedial option
- Risk Assessment of the dam for each remedial option and indicate how it will reduce risk.

Wivenhoe Dam Spillway Augmentation, Wivenhoe, Qld

Senior Site Geologist during construction of a new fuse plug spillway for Brisbane's main water supply reservoir. Excavation through soil and rock with cuts up to 18m high with batter angles of 1(H):10(V) and the construction of a 170m long road bridge spanning the cut. Responsible for reviewing and upgrading the geological model, advising on excavatability and blasting requirements and reviewing and designing soil and rock support requirements including rock dowels and shotcrete.

Carried out 'as-constructed' geological mapping for the auxiliary spillway.

Reviewed inclinometer results.

Reviewed grout curtain design and supervised the installation of the grout curtain.

Provision of other geotechnical advice as required.

Yan Yean Dam, Melbourne, Victoria

Project Manager for the field and laboratory investigation program for the dam design review of the dam embankment at Yan Yean Reservoir. This project included an extensive drilling and testing program to assess the current embankment and foundation conditions at site together with the establishment of a groundwater monitoring system for the dam.

Water Storage Reservoir, Daylesford, Victoria

Project Manager/Site Geologist for the Investigation, design and preparation of earthworks specification for 140ML earthen effluent storage dam. Subsequent to this, preparation of the specification for raising the embankment.

Monbulk Saddle Dam, Victoria

Project Manager for the dam safety review of the Monbulk saddle dam (Silvan Reservoir saddle dam) including filed and laboratory testing together with subsequent stability and safety assessment and reporting.

Mornington and Dromana Service Reservoirs, Victoria

Project Manager for the Investigation and assessment of reservoir condition and dam safety at Mornington and Dromana reservoirs. Combined borehole investigation, site mapping, laboratory testing and subsequent embankment and cut batter stability assessment.

Kelynack Dam, Plenty, Victoria

Project Manager/Senior Geologist for the dam safety assessment for the 27m high Kelynack Dam. This project included investigation and recommendations for remedial works and a surveillance monitoring program. The project comprised the investigation of current dam embankment and abutment condition, construction of a groundwater monitoring network, stability and erosion assessment and subsequent design of the remedial works which included treatment of severe erosion of the dam abutments.

Olympic Dam, Roxby Downs, SA

In 1997, conducted the field geotechnical investigation for the detailed design of the proposed new tailings dams Tailings Storage Facility (TSF) 4 and TSF5. This work included the assessment of likely foundation conditions and possible sources of borrow materials for the tailings dam embankments and low permeability liners. The work also included the assessment of cuts for the new evaporation ponds being constructed at the time and assessment of the likely suitability of this excavated material for use in construction of the new tailings dams.

In 1998, returned to supervise the initial stages of construction of TSF4. This initial construction was commenced while the design was being finalised. Work carried out included the identification of appropriate borrow sites, the recommendation of appropriate construction techniques and methodologies and recommendations for placement and compaction of materials.

In 1999, conducted geotechnical investigations to source borrow materials for a low permeability, low carbonate content clay material for use in the reconstruction of a storage basin to be used for low pH liquids. Also provided advice on appropriate

construction methodologies and placement of materials for construction of the new basin liner.

In 2006, project manager for a geotechnical investigation for the pre-feasibility study being conducted for the proposed mine expansion. This geotechnical investigation included:

- a literature review of available geotechnical information for the existing TSF;
- investigation, sampling and assessment of the tailings materials in the existing TSF;
- investigation, sampling and assessment of the foundation materials for the existing TSF;
- preliminary geotechnical investigation of three possible Greenfields sites for the proposed new TSF.

These studies comprised a drilling, sampling, geotechnical and geochemical testing and the installation of groundwater monitoring installations.

This project comprised 1,300 man hours of field time completed without incident.

In 2007, project manager for a seepage and stability assessment of the existing TSF area. This study was commissioned due to the need to increase the volume of tailings liquor to the TSF without adversely affecting the operating safety and stability of the TSF area.

The project included:

- Collection and review of existing data.
- Geophysical testing to assess the likely existence of leakage or seepage zones associated with the TSF. This testing included the use of electromagnetic (conductivity) profiling, electrical resistivity imaging and self potential profiling.
- Investigation of the embankment condition by a combination of shallow excavator pits in the embankment and toe areas and boreholes through the embankments
- Associated in situ geotechnical and permeability testing.
- Installation of pneumatic piezometers to assist with long term monitoring and assessment of the pore pressures within the embankments.
- Geotechnical laboratory testing of tailings and natural material properties.
- Seepage modelling and global embankment stability assessment under both existing conditions and full embankment height including assessment of an expanded tailings liquor pond.

Completed an on-site audit of the existing piezometer monitoring system for functionality and made recommendations for required remedial works and changes to the monitoring system.

In 2008, project manager for the geotechnical study of seepage at localised points through and under the tailings dam embankments. The aims of the project are to and assess the likely causes and possible effects on embankment stability and recommend appropriate remedial works comprising the design of a stabilising toe berm.

Prepared an emergency response plan for use should specific trigger points be reached as the seepage continued.

Provision of ongoing geotechnical advice related to monitoring of the seepage.

Ancillary to this project is the design and re-establishment of the piezometer monitoring network in and around the existing TSF.

In 2008, project manager for a stability assessment of the tailings dam embankments at site. This project included assessments of the embankments at their current height, at projected final height and at 'stretch' heights to extend possible working life.

These stability assessments considered normal operating conditions, stability under seismic loads, deformation analysis and liquefaction potential of the embankment materials.

All work was conducted in accordance with the relevant ANCOLD Guidelines.

In 2008/09, project manager for the provision of QA/QC services for the raising of the walls on Evaporation Ponds 1 and 2. This work included the investigation for and proving of sources of suitable borrow materials for construction, site geotechnical services including ongoing monitoring of the operation of the borrow areas and provision of geotechnical advice and Level 1 supervision of construction activities.

Johns Hill Reservoir, Kallista, Victoria

Site Geologist for the surveillance and safety assessment of the Johns Hill Reservoir, a 30m high earth embankment dam, in accordance with ANCOLD guidelines.

Yambuk Wind Farm, Victoria

Project Manager for the geotechnical investigation for a 20 turbine wind farm located at Yambuk near Portland, Victoria. The geology of the site comprises calcareous sands and calcrete. The investigation comprised boreholes, test pits and geophysical surveys to assess for the likely presence of caves or cavities.

The geotechnical report presented an assessment of site conditions, geotechnical design parameters for

the turbines, an assessment of likely settlement and crushing effects and groundwater assessment.

Three Capes Wind Farm, Portland, Victoria

Project Manager for the Stage 1 geotechnical investigation of a 104 turbine wind farm to be constructed at Capes Bridgewater, Nelson and Sir William Grant at Portland, Victoria. The geology at the sites comprised variously calcareous sands and calcrete and basalt. The investigation comprised boreholes, test pits and geophysical surveys to assess for the likely presence of caves or cavities.

The geotechnical report presented an assessment of site conditions, geotechnical design parameters for the turbines, an assessment of likely settlement and groundwater assessment.

Clements Gap Wind Farm, SA

Conducted the fieldwork and reporting for a 30 turbine wind farm at Clements Gap, south east of Port Pirie, SA. The geology comprised metasedimentary rocks (phyllite and psammite). The fieldwork consisted of deep boreholes with associated rock strength testing.

Prepared the geotechnical report presented an assessment of site conditions and geotechnical design parameters for the turbines.

Snowtown Wind Farm, SA

Prepared the geotechnical report for the preliminary geotechnical investigation for the Snowtown wind farm.

Hallett Wind Farm, SA

Conducted the field geomorphologic and visual stability assessment for the proposed 20 turbine wind farm at Hallett near Jamestown, SA.

Mt Bryant Wind Farm, SA

Prepared the geological model for the Mt Bryan wind farm, SA.

Berrimal Wind Farm, Victoria

Project Manager for the geotechnical investigation of a 16 turbine wind farm to be constructed at Berrimal near St Arnaud, Victoria. The geology at the site comprised schist. The investigation comprised boreholes and test pits.

The geotechnical report presented an assessment of site conditions, geotechnical design parameters for the turbines, an assessment of likely settlement and groundwater assessment.

Mt Selwyn Access Road, Alpine NP, Victoria

Site Geologist conducting the assessment of the likely cause(s) of a forestry access road slope failure and design of remedial works to enable long-term safe access for forestry and logging vehicles.

Wellington River, Alpine NP, Victoria

Site Geologist conducting the assessment of the likely causes of a landslip along the Tamboritha Road above the Wellington River. The landslip affected approximately 100m of road providing sole access to a major area of the Alpine NP. Work included the investigation and mapping of the landslip area and design of remedial works to provide safe access.

Tamboritha Road, Alpine NP, Victoria

Risk assessment of 32km of access road into the Alpine NP. This road was constructed as cut and fill with side cuts in rock up to 30m high with cut faces up to 70° and fill benches up to 25m high.

Work included an initial assessment of slope stability, an assessment of likely hazards and risks and recommendations as to appropriate remedial works. The study was made using a modified version of the RTA “Guide to Slope Risk Analysis”.

Walhalla Historic Area, Victoria

Geotechnical assessment of several rock fall and landslip sites within the Historic Area. Recommendations for remedial works and the preparation of preliminary costings for the remedial works.

Preparation of a tender specification for construction of the remedial works which included rock fall protection, rock fall clean up and adit closures.

Various Gas Pipelines

Review of geotechnical/geological conditions information and site walkover assessments for major LPG pipelines extending from Peterborough to Orford (Vic), Melbourne to Peterborough(Vic) and Longford to Sydney.

Whroo Historic Reserve, Rushworth, Victoria

Ongoing assessment of rock wall and tunnel stability for a disused gold mine comprising both open cut and underground workings.

Recommendations for viewing platform set backs and foundation design.

Recommendations for remedial works to reduce stability hazards for visitors.

Preparation of the tender specification for proposed remedial works (including, rock fall protection, rock, fall clean up, adit closures and fencing) with subsequent letting and contract supervision for Parks Victoria.

Various Coastal Parks, Victoria

Geotechnical assessments conducted at:

- Bunarong Marine Coastal Park, Cape Paterson
- The Punchbowl, Anderson
- Twin Reefs, Cape Paterson
- Mallacoota
- Genoa
- Bemm River

Work included:

- stability assessments of the rock faces at these sites;
- recommendations for safe set backs of viewing platforms and access tracks;
- recommendations for remedial works.

Western Treatment Plant, Werribee, Victoria

Project Manager for the risk assessment of all of the earthen embankments at Melbourne Water's Western Treatment Plant, at Werribee. The work comprised a site assessment and measurement of the entire lagoon system at the plant together with a risk rating for each lagoon and embankment and recommendations as to appropriate remedial works.

Various Parks and Reserves, Victoria

Geotechnical assessment of viewing platforms and access tracks. Recommendations for safe set backs, remedial works, foundation types and occasionally, provision of preliminary costings for remedial works.

Tara Bulga NP, Gippsland, Victoria

Assessment of the likely causes of two landslips on access roads in the National Park and provision recommendations for remedial works.

Kelly Caves and Show Cave, Kangaroo Island, SA

Assessment of overall cave stability, including stalactites, and general geotechnical risk assessment of the Show Cave and adventure caves on Kangaroo Island.

Yarra River, Wallen Road, Hawthorn, Victoria

Project Manager for the geotechnical investigation and assessment of a landslide on the banks of the Yarra River adjacent to a pedestrian pathway. The project comprised a drilling program combined with in situ and laboratory testing followed by stability analysis and the preparation of recommendations for remedial works.

Standard Gauge Rail Upgrade, Melbourne to Sydney

Primary technical reviewer for the project and the primary contact with the client regarding contractual agreements for all Coffey – SIA (South Improvement Alliance) projects.

Supervision of the geotechnical team working on the various geotechnical aspects of the project during the design and construction process, and liaison with design and construction engineers.

Work with contractor on subgrade preparation options including stabilisation using lime to achieve the required design parameters. Assisted with the submission for waiver from standard specification.

Involvement in a route options study for over 100 km of rail duplication, through variable ground conditions.

Involved in site walkovers to scope the geotechnical aspects of the project including rail formation foundation and construction, bridge and culvert foundation design, and cut batter slopes through variable topography.

Works include the construction of new rail lines with associated drainage, cut batters, bridges, other piled structures and retaining walls. Provided advice for soil nail wall design and for materials source and usage.

The geotechnical team provided piling inspection services during construction, advised on suitable fill materials and provided advice and design services for cut slope stability assessments and temporary retention works.

Calder Freeway Upgrade, Harcourt North, Victoria

Provided geotechnical advice for the design and construction of the approximately7km Calder Freeway extension from the Midland Highway, Harcourt to Ravenswood South. Specific issues covered included:

- Assessment and advice on the treatment and use of cut materials as Type A and Type B embankment fill.
- Excavatability of granite and sandstone encountered during construction.
- Advice and recommendations with respect to safe slopes and retaining wall design.
- Pile and pad footing inspections for bridge foundations.
- Advice, design and recommendations for appropriate drainage measures during construction.

Eastlink, Melbourne, Victoria

Project Manager for the Site Conditions Investigation (SCI) for the Scoresby Section of the MFF (now East Link) extending 17km from the Monash Freeway Interchange to the Frankston Freeway Interchange.

The fieldwork comprised approximately:

- 300 boreholes;
- 400+ test pits;
- 5 excavator pits;
- 700+ dynamic cone penetrometer tests; and
- 50+ pavement dippings.

An extensive laboratory test program was also conducted comprising:

- Atterberg limits testing;
- Particle size distribution;
- Density tests;
- Emerson dispersion tests;
- Triaxial testing (UU and CU);
- Consolidation tests;
- California Bearing Ratio (CBR) tests;
- Standard compaction tests; and
- Preliminary soil contamination assessment.

A team of up to 30 professional geotechnical engineers, geologists, environmental scientists, drilling and earthworks subcontractors completed the project within 15 weeks.

Final Factual and Opinions reports were issued presenting the results and an assessment of the likely subsurface conditions along the route together with an assessment of potential construction issues and problems.

Optic Fibre Cable, Telstra Corporation, Australia

Conducting a study into the effectiveness of reinstatement practices for the installation of optic fibre cables together with:

- recommendations for test procedures to assess the degree of compaction achieved in reinstated trenches;
- recommended standards to be achieved for soil compaction;
- recommendations as to practically achievable compaction standards for trenches;
- outlining specific practices to apply to achieve the recommended standards.

Review and certify the reinstatement practices as presented in Telstra's Work Instruction NCP-GAW-002, "Route Restoration & Erosion Control - Cable & Conduit Installation". This included recommending necessary additions and variations to the Work Instruction based on the review and the results of a desktop study of the results from helicopter surveys of the major OFC route.

Conducting an audit of at least 10% of the known serious erosion faults along the OFC routes as at September 1997 to assess the effectiveness and compliance of the remedial works with the modified Telstra Work Instruction.

To provide advice to Telstra staff involved in OFC works as requested. This has included:

- preliminary route survey and assessment;
- provision of specific construction advice related to potential and existing problem areas;
- review and assessment of completed works;

throughout Australia.

Conducting training in the use and application of the revised Telstra work instruction together with the application of sound and effective construction and reinstatement techniques.

Provision of geotechnical and construction advice together with recommendations for reinstatement and remedial works associated with optic fibre cable routes throughout Australia.

NextGen OFC Project, Visionstream, Australia

Coordinated the desktop study route assessment of the proposed optic fibre cable routes from Brisbane to Sydney (2 routes), Sydney to Melbourne (2 routes), Melbourne to Adelaide and Adelaide to Perth including the identification of likely materials types, terrain and excavation conditions. Conducted the subsequent route walkouts to further refine the desktop study and identify areas of expansive soils.

Developed a route Hazard Assessment Rating for the routes with respect to expansive soils based on the results from the desktop study and route walkouts.

Provided advice on the excavatability of the rock likely to be encountered in areas of potential concern.

Victoria to Queensland OFC, Optus Communications

Desktop assessment of materials and construction conditions likely to be encountered for the Melbourne to Brisbane optic fibre cable link.

Ernst Henry Mine Water Supply Pipeline, Cloncurry, Qld

Assessment of foundation materials and their effect on construction techniques and performance for a 1200mm water pipeline.

Kangaroo Ground and Plenty Landfills, Nillumbik Shire, Victoria

Project managed the design, installation, monitoring and assessment of leachate monitoring bore systems in two existing landfills in Melbourne's north east.

Green Gables Estate, Sunbury, Victoria

Conducted the site investigation for a landslip and erosion assessment study for the Green Gables Estate, Phillip Drive Sunbury. This project included a site assessment, test pits, sampling and laboratory testing of soil samples to assess existing and likely stability and erosion issues for the site and to recommend appropriate remedial actions.

Sanctuary Sunbury Estate, Sunbury, Victoria

Project Manager and Technical reviewer for a land capability assessment and erosion study for a proposed development site at Enterprize Drive, Sunbury. The study comprised a site walkover with associated drilling sampling and testing to assess the suitability of the area for onsite dispersal of effluent and to assess likely causes of erosion and to recommend appropriate remedial actions.

Western Treatment Plant, Werribee, Victoria

Project Manager for numerous geotechnical investigations at Melbourne Water's WTP, including:

- Investigation and provision of advice for design of the proposed 105W Lagoon and Lagoon 5 systems at the Western Treatment Plant.
- Investigation and provision of advice for the proposed effluent reuse scheme at the Western Treatment Plant.
- Investigation and provision of construction advice for the redevelopment of the 15E Outlet Drain at the Western Treatment Plant.
- Geotechnical investigation, provision of design and construction advice for the 55E Lagoon upgrade at the Western Treatment Plant.
- Embankment condition assessment program for all lagoon embankments at the Western Treatment Plant.
- Investigation, provision of geotechnical design parameters stability and erosion assessment for the Wet Weather Capacity Upgrade. This project included:
  - duplication of the Main Southern Carrier
  - identifying a suitable source of borrow material for construction and assessing material volumes
  - site investigation for a new access road
  - upgrading the 15E Outlet
  - new flow control structures for the 55E and 25W Lagoons
  - input to a risk management workshop for the project
  - provision of construction advice.

Eastern Treatment Plant, Carrum, Victoria

Project Manager for numerous geotechnical investigations at Melbourne Water's WTP, including:

- Design and installation of a groundwater monitoring system for the Eastern Treatment Plant.
- Design and specification of a sampling and laboratory testing program for the reuse of biosolids as geotechnical fill.
- Implementation of the biosolids testing program.

Various Wastewater Treatment Plants, Victoria

- Geotechnical investigation for the design and construction of sewerage reticulation systems at Tooradin, Cannons Creek and Blind Bight.
- Geotechnical investigation for the design and construction of sewerage reticulation systems at Koondrook and Lake Boga.
- Southern Towns Winter Storages. Provision of geotechnical services for the design and construction of winter storage lagoons at Seymour, Bonnie Doon, Mansfield and Yea, Victoria
- Provision of geotechnical services for the design and construction of winter storage lagoons at Numurkah and Euroa, Victoria
- Investigation, design and preparation of earthworks specification for 140ML earthen effluent storage dam.
- Installation of groundwater monitoring bores and assessment of potential pond leakage at the Port Campbell Wastewater Treatment Plant.
- Assessment of ground and groundwater conditions for the construction of a new pond and flood irrigation area at the Simpson Wastewater Treatment Plant.
- Provision of geotechnical and hydrogeological services for the design of the Dunkeld Sewerage

Scheme, including earthen lagoons, rising main and reticulation.

- Investigation, design and risk assessment for the Maryborough WWTP Winter Storage lagoon. This investigation included initial site assessment of 4 sites for final site selection, detailed assessment of the preferred site, embankment design and presence as an Expert Witness at a planning hearing.

Port Dickson Refinery, Shell Malaysia

Conversion, preparation and validation of geotechnical and environmental data for inclusion in the ERMA database for the Port Dickson Refinery, Malaysia

Shire of Yarra Ranges, Victoria

Provision of technical expertise and advice for the preparation and checking of CAD files and hill slope angles for inclusion in the Shire's slope stability assessment GIS.

Melbourne Water Corporation

Thompson Dam, Moe, Victoria

Investigation and as constructed mapping of the foundations for the spillway main and saddle dams, Thomson Reservoir. Investigation works included foundation assessment through the drilling of test boreholes and conducting in situ packer ('Lugeon') tests to check permeability for design of the grout curtain.

Post-construction, investigation of increased seepage and possible instability at the saddle dam Thomson Reservoir. Site investigation work comprised the drilling and in situ permeability testing of boreholes combined with site mapping of exposed outcrop. This was subsequently followed by assessment of the pre-construction and construction geotechnical information to conduct stability analyses and design a stabilising toe berm for the affected section of the saddle dam.

An augmented groundwater monitoring system was also designed and constructed for the saddle dam.

Maroondah Reservoir, Victoria

Investigation and provision of construction advice for the remedial works associated with the spillway and mass concrete dams at Maroondah. This work included drilling and logging of investigation boreholes for the post-tensioning anchors, field mapping of rock outcrop, recommendations with respect to cut rock batter angles, the design of rock dowels for stabilisation works and 'as-constructed' mapping of the final spillway cut. Provision of a "sign-off" on the safety of the pedestrian access path provided along one of the cut berms.

Western Trunk Sewer, Melbourne Victoria

Investigation of the ground conditions prevailing over the route of a major 15.3km tunnel, to be constructed by a 5m diameter Robbins tunnel boring machine through a mixture of hard basalt rock and soft silty soil. This required the use of diamond drilling techniques and extensive down hole testing of rock, assessment of rock, soil and groundwater characteristics throughout the route, to facilitate the provision of construction advice for the design of the tunnel boring machine and the tunnel.

Additional investigation work was carried out for the design of the deep shafts for the sewer access and installation of pump and penstock wells, some of which ranged up to 12m in diameter. This investigation work included the orientation of rock core and stability analysis of the results to assist with the design of temporary and permanent support for the shafts.

During the construction of the tunnel, the ground conditions at the tunnel face and within the shaft excavations were also continuously monitored from which documentation of "as constructed" ground conditions were prepared. Advice with respect to ground support and dewatering was provided as required.

Subsequent to the completion of the structures, settlement and movement monitoring points were installed and monitored on a regular basis to assess the ongoing effects of the structure on the surface and adjacent structures.

North Western Sewer, Melbourne Victoria

Involvement in a route options study for a major 11.5 km tunnel, 4m in diameter through ground variously comprising basalt, clays, silts sands and siltstone. This selection process included desktop studies of available geotechnical information together with limited scope field studies comprising the drilling of boreholes.

After finalisation of the route, detailed investigation of the complex nature of the ground to be encountered for the design of an earth-pressure balance tunnel boring machine, leading to compilation of reports providing construction advice. This investigation included the drilling of boreholes, installation and monitoring of groundwater piezometers and surface settlement monitoring points.

Supervision of the geotechnical team working on the various geotechnical aspects of the North Western Sewer during the design and construction process, and liaison with design and construction engineers.

Involvement in the collection of as-constructed geotechnical data through the mapping of ground conditions exposed within the tunnel and shafts. Provision of advice with respect to dewatering and support requirements on an ad hoc basis.

Participation during construction in an availability roster of senior geotechnical and construction engineering staff to monitor groundwater levels and settlement monitoring points and assess the data collected. This monitoring was required due to the excavation of the tunnel through sands below residential and commercial areas to check for potential subsidence of the ground over the tunnel.

Involvement in the callout and remedial works associated with the occurrence of subsidence to the surface, which occurred in one area post tunnel construction.

Various Tributary and Reticulation Sewers, Melbourne, Vic

Investigation of the ground conditions for various tributary sewers within the Melbourne area to be constructed as tunnels in rock. These tributary sewers were commonly constructed as 1.5m diameter “pot-and-drive” tunnels using manually operated excavation methods. The sewer routes were assessed by means of boreholes and piezometers to provide geotechnical information for the design of the tunnel. Onsite inspections were commonly conducted during construction to enable further assessment of the ground conditions and to modify support and dewatering recommendations as required.

Western Treatment Plant, Werribee, Victoria

- Investigation and assessment of groundwater leakage into the 115E sludge drying pan at the Werribee Farm.
- Investigation and provision of construction advice for the 25W Lagoon system at Werribee Farm.

Brooklyn Landfill, Brooklyn, Victoria

Conducted the preliminary geotechnical and hydrogeological investigations for a proposed quarry to landfill project at a former basalt quarry. The project comprised a series of boreholes with associated groundwater permeability testing and monitoring.

Database Preparation, Melbourne Water

- Preparation and integration of modelling data from the Techbase package into Microstation design files to produce interpretive geotechnical models.

Design and implementation of a relational DBMS for the collected geotechnical information at Melbourne Water.