



MACHEnergy

Mount Pleasant Operation

A JOINT VENTURE WITH
JCDA
Japan Coal Development Australia

Attachment 5

Peer Review Letters

17 December 2020

630.30085.00000-L01-v1.0.docx

MACH Energy Australia Pty Ltd
c/- Resource Strategies Pty Ltd
PO Box 1842
Milton QLD 4064

Attention: Chris Lauritzen

Dear Chris

Independent Peer Review of Mount Pleasant Optimisation Project Noise and Blasting Assessment (Report 15402-H Version A) Wilkinson Murray Pty Ltd

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by MACH Energy Australia Pty Ltd (the Proponent) to undertake an independent peer review of the specific environmental matter of noise and blasting impacts with respect to the Mount Pleasant Optimisation Project (the Project). Wilkinson Murray Pty Ltd (WM) was engaged as the Principal (Acoustical) Consultant by the Proponent to prepare the Noise and Blasting Assessment (NBA) in relation to the Project in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Industry and Environment (DPIE) dated 17 February 2020.

The review has been prepared and guided by the requirements of the DPIE's guideline *Preparing a Peer Review Report – Guidance for State Significant Projects* (the Guideline) dated June 2019. This letter presents the findings of SLR's peer review.

2 Requirements

The Project SEARs do not specify that an independent peer review should be undertaken for any specific environmental matter. However given the scale of the Project and the expected public and regulatory scrutiny the Proponent considered it prudent to arrange a peer review of the noise and blasting impact assessment for the Project by suitably qualified, experienced and independent personnel.

SLR's peer review team comprising Principal Consultant Martin Davenport (technical reviewer) and Director Glenn Thomas (lead reviewer) have significant experience in the specialist field of large scale mining and resource infrastructure environmental acoustics and vibration. CVs for Martin Davenport and Glenn Thomas are attached.

Prior to being engaged in October 2020 by the Proponent to undertake the peer review, SLR considered potential matters that may present a conflict of interest. SLR declared that it provides environmental services (excluding acoustics) to the Proponent in relation to its mining operations (such as the Mount Pleasant Operation 2020 Independent Environmental Audit). Martin Davenport declared that he had provided a study in March 2020 for Sedgman Pty Ltd concerning meeting their environmental noise obligations as the operator of the Coal Handling and Preparation Plant area, Train Load out Facility and associated infrastructure with respect to the approval conditions contained in Development Consent DA 92/97 (as modified) for Mount Pleasant Operation.

It is considered that the nature of this work does not create a conflict of interest for this peer review. Following this disclosure SLR and its peer reviewers acknowledged and agreed it would take all reasonable steps to avoid and or manage any conflicts of interest should they arise and make further declarations should it be necessary to do so. No potential conflicts of interests arose during the peer review period.

3 Description of the Project

The Project proposes extraction of additional coal reserves within Mount Pleasant Operation Mining Leases (MLs) and an increase in the rate of coal extraction from 10.5 Mtpa up to 21 Mtpa without significantly increasing the total disturbance footprint. The extraction of additional Project coal reserves would be supported by the use and augmentation of existing and approved infrastructure. The coal would be processed to produce thermal coal products and would be transported via the Muswellbrook–Ulan Rail Line to the Port of Newcastle for export, or to domestic customers.

The increase in extraction would be conducted as staged increases throughout the Project reaching project peak coal production from 2034. The Project would extend the life of the approved Mount Pleasant Operation by 22 years to December 2048.

4 Peer Review Procedure (Guideline Section 2.3)

The scope of the Peer Review was to review the NBA findings, prediction methodologies and assessment methodology considering the requirements of the SEARs.

SLR was initially provided with sections of the NBA detailing ambient operator-attended and unattended noise monitoring and the resulting grouping of receivers into draft Noise Assessment Groups (NAGs) being provided on 6 October 2020. The selection of NAGs was considered a critical aspect of the NBA given the likely change in ambient noise environment subsequent to the most recent modifications to DA 92/97 (previously assessed under the NSW Industrial Noise Policy (INP) (EPA 2000)) and the introduction of new updated assessment methodology in the NSW Noise Policy for Industry (NPfI) (EPA 2017).

SLR's initial feedback in relation to the draft NAGs was provided with regard to:

- The use of 2018 and 2020 ambient noise monitoring data;
- Consideration of underlying Local Environment Plan (LEP) zoning of receivers within draft NAGs;
- Impact of Mount Pleasant Operations noise contribution to ambient noise levels; and
- Impact of the Covid-19 pandemic on ambient noise levels;

A videoconference was convened on 9 October 2020 and 15 October 2020. In attendance were the following representatives:

- Principal (Planning) Consultant (Resource Strategies Pty Ltd): Mitch Kelly and Stirling Bartlam.

- Principal (Acoustical) Consultant (WM): Roman Haverkamp and John Wassermann (WM on 15 October 2020 only).
- Peer Reviewer (SLR): Martin Davenport and Glenn Thomas.

Following this feedback, the draft NAGs were revised by WM to consist of essentially three NAGs. NAG 1 represents, broadly, the Muswellbrook township in proximity to major roads and commercial areas. NAG2 represents receivers exposed to road traffic noise from the New England Highway between Muswellbrook and Aberdeen. The remaining receivers within the study area have been considered as an 'Outside NAG' with resulting noise assessment criteria based on minimum background noise levels applicable in the NPfI.

The resulting NAGs were derived using a conservative approach based on measured data and are considered appropriate and reasonable for the Project.

A full draft NBA was provided to SLR on 4 November 2020. Following an initial review of the draft NBA, SLR provided a schedule listing the key outcomes from the initial review including:

- Seeking further clarification that blast assessment parameters are consistent with available site blasting records;
- Seeking further clarification and justification of the meteorological conditions used in the noise modelling process;
- Clarification on the use of noise mitigation measures; and
- The calculation of road traffic noise and consideration of reasonable and feasible mitigation measures.

It was also noted that off-site construction noise from the Northern Link Road has not been explicitly modelled. WM advised this was due to the negligible noise impacts expected given the large separation distance to the nearest privately-owned receiver that did not have acquisition upon request rights of approximately 4 km. SLR considers this to be a reasonable assessment approach.

As part of the peer review process SLR reviewed the operational noise modelling and calculation procedures via videoconference. SLR interrogated a selection of key input parameters and is satisfied that ENM based operational noise model has been appropriately used to comprehensively predict construction and operational noise levels from the Project. Key findings from review of the noise model include:

- The sound power levels adopted are considered representative of the plant and equipment type and are implemented appropriately across the Project.
- The noise model considers seven (7) Project stages (including on-site construction activities where appropriate) to enable the assessment of impacts at surrounding receivers over broad representative operating scenarios throughout the Project life.
- Low frequency noise characteristics were appropriately considered and assessed in accordance with the NPfI.

SLR was subsequently provided with an updated draft NBA on 1 December 2020 and final version on 14 December 2020. SLR is satisfied that all the key comments were addressed either in the report or in follow-up discussion with WM.

5 Conclusion

Based on the peer review procedure described in **Section 4** of this letter, SLR confirms that the Noise and Blasting Assessment for the Project has been prepared in accordance with the appropriate requirements of the SEARs, including:

- The Noise Policy for Industry (NPfI)
- Voluntary Land Acquisition and Mitigation Policy (VLAMP)
- The Interim Construction Noise Guideline (ICNG).
- NSW Road Noise Policy (RNP)
- Rail Infrastructure Noise Guideline (RING)
- Assessing Vibration: A Technical Guideline
- Australia and New Zealand Environment Council's (ANZEC) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

Notwithstanding, several points of clarification were identified during the peer review period. SLR is satisfied that these have been addressed in subsequent revisions of the NBA through the peer review process.

In summary, this peer review confirms that the Noise and Blasting Assessment for the Project has been conducted in accordance with the relevant guidelines. The report is comprehensive in nature, implements reasonable and feasible mitigation measures and details best practice noise management to minimise potential noise impacts from the Project. The NBA has been undertaken in a professional manner and the conclusions reached are supported by appropriate assessment methodologies, calculation and assumptions where necessary to do so.

Yours sincerely



MARTIN DAVENPORT
Principal - Noise and Vibration



GLENN THOMAS
Director

Checked/
Authorised by: Glenn Thomas

CURRICULUM VITAE



GLENN THOMAS

COMPANY DIRECTOR

Acoustics and Vibration, Asia Pacific

QUALIFICATIONS

BSc, CA(Cert)

Bachelor of Science (Geophysics and Atmospheric Science)
Certificate Corporate Governance

EXPERTISE

- Development approval process and compliance requirements for resource infrastructure and major industrial developments.
- Environmental noise and vibration impact assessment and control for resource projects and major industrial developments.
- Environmental noise and vibration impact assessment and control from rail and road transport systems.
- Weather effects on noise propagation

Glenn has been employed by SLR for over thirty years and has been integral in developing the company's expertise in assessing and controlling noise, vibration and blasting impacts from resource infrastructure projects (ie coal and metalliferous mines, hard rock quarries), rail and road transport systems, large scale developments, major landfills and associated construction works.

A Company Director of SLR, a firm of professionally qualified engineers and scientists specialising in acoustical engineering and noise and vibration control. He has particular expertise in liaising with NSW Department of Planning and Environment (DP&E), the NSW Environment Protection Authority (EPA) and Local Councils and is fully conversant with current assessment requirements, development approval processes and licence negotiations.

Glenn has prepared and presented evidence at Commissions of Inquiry (CoI) and Planning Assessment Commission (PAC) hearings and has been commissioned by DP&E as an Independent Expert Review Panellist (IERP), prepared peer review noise reports and is regularly involved in community presentations.

PROJECTS

Dendrobium Coal Project Department of Planning

Independent Expert Review Panellist (IERP) reviewing noise impact of underground coal project with rail access within close proximity to dwellings

Mount Arthur North Project Department of Planning

Independent Expert review and assessment of project and cumulative noise and vibration emission impacts at Muswellbrook including community briefings, regulator meetings and Commission of Inquiry presentations

Power Station Review Department of Planning

Independent Expert review of proposed power station modification and approvals including provision of expert report and department briefings

Ravensworth East Review Department of Planning

Independent Expert review and assessment of project and cumulative noise and vibration emission impacts at Ravensworth including community briefings and regulator meetings

Moolarben Coal Complex various Modification NIAs Moolarben Coal Operations Pty Ltd

Assessment of construction, operation, cumulative, road traffic and rail traffic noise impacts for the OC4 South-West Modification and the UG1 Optimization Modification

Stratford Coal Mine various NIAs Stratford Coal Pty Ltd	Assessment of construction, operation, cumulative, road traffic and rail traffic noise and blasting impacts from inception to present including community briefings and regulator meetings
Duralie Coal Mine various NIAs Duralie Coal Pty Ltd	Assessment of construction, operation, road traffic and rail traffic noise and blasting impacts from inception to present including community briefings, regulator meetings and Commission of Inquiry presentations
Wilpinjong Coal Mine various NIAs Wilpinjong Coal Pty Ltd	Assessment of construction, operation, cumulative, road traffic and rail traffic noise and blasting impacts from inception to present including community briefings, regulator meetings and expert licence negotiation
Wambo Coal Project Wambo Coal Pty Ltd	Noise, transportation and blasting impact assessment for a proposed open cut coal mine near Singleton NSW including preparation for Land and Environmental Court proceedings prior to approval
Terminal 4 Project PWCS Ltd	Assessment of construction, operation, cumulative, road traffic and rail traffic noise and vibration impacts for the fourth coal terminal in Newcastle including community and regulator meetings and anticipated PAC hearing
Newcastle Coal Export Terminal NCIG Ltd	Assessment of construction, operation, cumulative, road traffic and rail traffic noise and vibration impacts for the third coal terminal in Newcastle including Independent Expert Review Panel (IERP) presentations
KCT Stage 3 and Stage 4 NIAs PWCS Ltd	Assessment of construction, operation, cumulative, road traffic and rail traffic noise and vibration impacts for the second coal terminal in Newcastle including consultative committee and regulator meetings
Liddell Coal Operations Umwelt (Australia) Pty Ltd	Assessment of noise and vibration impacts associated with construction, road traffic, rail traffic, operation and blasting impacts from the expansion
Metropolitan Coal Project Helensburgh Coal Pty Ltd	Noise and transportation impact assessment for the proposed expansion and noise reduction program for surface infrastructure for development in the township of Helensburgh, NSW
Donaldson Coal Mine Donaldson Coal Pty Ltd	Noise, transportation and blasting impact assessment for a proposed open cut coal mine near Newcastle NSW including regulator meetings.
Abel Coal Mine Donaldson Coal Pty Ltd	Operational noise and vibration impact assessment, including road and rail traffic and processing near Beresfield NSW
Ridgeway Project Newcrest Mining Ltd	Noise, transportation and blasting impact assessment for proposed underground copper/gold mine near Orange, including regulator meetings
Cadia Gold Mine Newcrest Mining Ltd	Noise, transportation and blasting impact assessment for a proposed open cut copper/gold mine near Orange, including presentation at Commission of Inquiry
Cowal Gold Mine various NIAs Barrick Australia Ltd	Noise, transportation and blasting impact assessment for a proposed open-cut copper/gold mine near West Wyalong, NSW

MEMBERSHIPS

Member	Professionals Australia (PA)
Affiliate	Chartered Secretaries Australia (CSA)

CURRICULUM VITAE



MARTIN DAVENPORT

PRINCIPAL

Acoustic and Vibration, Asia Pacific

QUALIFICATIONS

M.Des.SC	2009	Design Science (Acoustics) from University of Sydney
MAAS	2018	Member of the Australian Acoustical Society

EXPERTISE

- Noise and vibration measurement, prediction and assessment for industrial and commercial developments and design of mitigation measures.
- Road noise impact assessments and design of mitigation measures.
- Building acoustics measurement and assessment including sound insulation, impact isolation and reverberation time.
- Investigations of occupational noise exposure.

Martin Davenport has over 10 years' experience in acoustic consulting for SLR in their Newcastle office. Martin has gained experience in a broad range of projects including the measurement, prediction and assessment of noise and vibration from the operation and construction of a range of transport, commercial, extractive and industrial developments. He is experienced in the assessment of noise associated with road systems and on land uses near such systems. Martin has also been involved in building acoustics projects including acoustic design reviews, the measurement and assessment of sound insulation, impact isolation and reverberation time. Martin has experience in the use of noise modelling software such as ENM and SoundPLAN, which are used in the prediction of mining/industrial/commercial noise and road traffic noise.

Martin also has been endorsed as a specialist acoustics and vibration independent auditor for large scale resource developments by the NSW Department of Planning and Environment.

PROJECTS

Mining and Quarries

Karuah Quarry,
Mannering Colliery
Lynwood Quarry
Angus Place Colliery
Springvale Colliery
Bloomfield Colliery
Wilpinjong Mine
Moolarben Mine
Stratford Coal Mine
Duralie Coal Mine

Commercial / Industrial	Newcastle Coal Export Terminal - Newcastle Coal Infrastructure Group Carrington Coal Terminal - Port Waratah Coal Services Kooragang Coal Terminal - Port Waratah Coal Services Narellan Concrete Batching Plant Goulburn Concrete Batching Plant Onesteel Oil and Gas Pipe – Kembla Grange. Maitland / North Rothbury Water Supply Upgrade. Harpers Hill Reservoir Construction Noise Impact Assessment.
Building Acoustics	Cardiff South Public School - New hall acoustics Redhead Public School - New hall acoustics New Lambton Community Centre - General acoustics Hunter Water - Foyer acoustics NSW WorkCover Gosford- Foyer acoustics
Occupational Noise	Boral Transport - noise dose testing, Industrial Galvanizers – Hexham OHS noise assessment and training.
Road / Rail	Southern Sydney Freight Line Project, New Residential Area – Macksville. Hexham Relief Roads Muswellbrook Junction Upgrade
Specialist Acoustic and Vibration Auditor	Chain Valley Coal Mine Malabar Resources Bengalla Coal Mine

13 January 2021

Attn: Chris Lauritzen

MACH Energy Australia Pty Ltd
Suite 1, Level 3
426 King Street
Newcastle West NSW 2302

Re: Mount Pleasant Optimisation Project: Peer Review of Air Quality Assessment and Greenhouse Gas Calculations Report

Dear Chris,

Katestone Environmental Pty Ltd (Katestone) was engaged by MACH Energy Australia Pty Ltd to conduct an independent peer review of the draft Air Quality Impact Assessment (Draft AQIA) and draft Greenhouse Gas Calculations Report (Draft GHCR) that have been prepared as part of the Environmental Impact Statement (EIS) for the Mount Pleasant Optimisation Project (the Project).

I, Simon Welchman, am suitably qualified and independent to conduct this peer review (refer credentials and independence summaries attached and my curriculum vitae enclosed).

Todoroski Air Sciences (TAS) prepared the Draft AQIA and separate Draft GHCR in response to the Secretary's Environmental Assessment Requirements (SEARs) for the Project.

To conduct the peer review, Katestone considered the following information:

- Air quality assessment
 - Draft Mount Pleasant Optimisation Project Air Quality Impact Assessment, Todoroski Air Sciences, 17 September 2020 (Draft AQIA).
 - Emissions inventory file provided by Todoroski Air Sciences.
 - Dispersion modelling files provided by Todoroski Air Sciences.
- Greenhouse Gas Assessment
 - Draft Mount Pleasant Optimisation Project Greenhouse Gas Calculations, Todoroski Air Sciences, 17 September 2020 (Draft GHCR).
 - GHG emissions calculation spreadsheet provided by Todoroski Air Sciences.

The peer review examined the adequacy of the:

- Draft AQIA against:

- The Department of Planning and Industry and Environment's Secretary's Environmental Assessment Requirements (SEARS) and the requirements of other relevant organisations.
- NSW Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, EPA 2016.
- Draft GHCR against:
 - The Department of Planning and Industry and Environment's Secretary's Environmental Assessment Requirements (SEARS) and the requirements of other relevant organisations.
 - State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

The peer review was conducted in accordance with the Department of Planning, Industry and Environment's draft Peer Review Guideline and evaluated whether:

- the consultant's assessment has been performed in accordance with the relevant standards, ethical requirements, and applicable legal and regulatory requirements
- significant matters have been identified, and appropriate consultations have taken place
- there is a need to revise the nature, timing and extent of the assessment performed
- the assessment evidence obtained is sufficient and appropriate to support the assessment report
- the assessment supports the conclusions reached and is appropriately documented.

A letter summarising the initial findings of the peer review was sent to MACH Energy Australia Pty Ltd on 2 November 2020 that identified that both the Draft AQIA and Draft GHCR were technically sound, were conducted in accordance with industry standards, have identified the significant matters in relation to emissions to air from the Project and made an assessment of these matters against the relevant standards and the outcomes of the assessment are supported.

Katestone's peer review identified various instances where the documentation of the Draft AQIA and Draft GHCR could be improved. These instances are summarised below.

Air quality

- NSW EPA requires best practice mitigation measures to be identified. It was recommended that this be provided so that the potential for further mitigation (if any) could be understood.
- NSW EPA requires mitigation measures including monitoring to be detailed in the AQIA. It would be beneficial for clarity and transparency of the AQIA to re-iterate the monitoring and air quality management plans that are currently in place and will continue to be in place through the life of the Project. It was acknowledged that the specifics of the mitigation strategies and monitoring could be addressed elsewhere in the Development Application. Notwithstanding, it was recommended that the Draft AQIA be updated to include additional cross-referencing to documents detailing monitoring information.
- Muswellbrook Shire Council requires the EIS to provide a feasible, real-time air quality monitoring protocol. It was recommended that the AQIA be updated to include additional details about real-time monitoring.
- The Draft AQIA lacked clarity in regard to the other mines that have been included within each cumulative assessment scenario. It was recommended that the AQIA specify which of the other mines are included in each cumulative assessment scenario and the relevant emission tables and associated text be revised to reflect this.

- The Draft AQIA generally assessed the maximum 24-hour average concentration of PM₁₀ against the relevant air quality standard. However, in relation to the VLAMP, the Draft AQIA compared the 6th highest 24-hour average ground-level concentration of PM₁₀ to the air quality standard. It was recommended that the AQIA provide relevant contextual information to support this difference in approach.
- Section 7 of the Draft AQIA was difficult to follow with respect to the limits or air quality standards that were applied to each assessment scenario. It was suggested that the AQIA would benefit from an overview statement that defines the approach to the presentation of dispersion modelling results so the reader is clear as to what limits / air quality criteria are being assessed against and the approach undertaken for cumulative assessment in each instance.

Greenhouse gas emissions

- It was recommended that the GHCR include an assessment of land clearing to the extent required to assess the GHG emissions associated with land clearing or justify the non-consideration of land clearing.
- It was recommended that the GHCR include additional information regarding the derivation of the emission factor for fugitive methane emissions.
- It was recommended that the GHCR clearly identify construction and decommissioning phases of the Project and their associated GHG emissions.

In response to Katestone's peer review, TAS has now revised the Draft AQIA and Draft GHCR and has supplied the following documents:

- Mount Pleasant Optimisation Project Air Quality Impact Assessment, Todoroski Air Sciences, 16 December 2020 (Final AQIA).
- Mount Pleasant Optimisation Project Greenhouse Gas Calculations, Todoroski Air Sciences, 11 January 2021 (Final GHCR).

Katestone has reviewed these documents. The review found that TAS has provided additional commentary in the Final AQIA and Final GHCR to address each of the items raised above. The additional information provided is adequate in addressing the items raised in Katestone's initial peer review comments.

In summary, the Mount Pleasant Optimisation Project AQIA and GHCR reports prepared by TAS are technically sound, conducted in accordance with industry standards, have identified and assessed pertinent matters against relevant standards and the reported outcomes of these assessments are supported by my review.

Please contact the undersigned on (07) 3369 3699 if you would like to discuss the review.

Yours sincerely,



Simon Welchman

A. INSURANCES

Katestone holds public liability insurance (\$20 million) and professional indemnity (\$10 million). Copies of current insurance certificates can be provided if required.

B. CREDENTIALS OF PEER REVIEWER

I, Simon Welchman, am a Director of Katestone Environmental, where I hold the position of Environmental Engineer. I have 25 years of work experience and I have worked at Katestone for 18 years. My CV is attached.

ACADEMIC QUALIFICATIONS

Bachelor of Engineering (Environmental) (Hons), University of Queensland 1994.

PROFESSIONAL AFFILIATIONS

Member of the Clean Air Society of Australia and New Zealand

Member of the Institution of Engineers Australia (NER)

Registered Professional Engineer of Queensland (RPEQ 19108)

Member of the Queensland Environmental Law Association (QELA).

C. INDEPENDENCE

I, Simon Welchman am suitably independent, and have not:

- Had any pecuniary interest in the Project.
- Worked for the proponent in the last 2 years.
- Worked or collaborated with the proponent's specialists in the last 2 years (other than in a peer review and expert witness capacity).
- Worked on the assessment of the impacts of another project that may result in material cumulative impacts with the Project.



Simon John Welchman — Director – Expert Witness Curriculum Vitae

Simon is an Environmental Engineer with a background of proven success over twenty-four years working as an air quality expert in the private sector and for the environmental regulator. Simon has been a Director of Katestone Environmental Pty Ltd since 2004 during which time he has conducted, managed, supervised or quality assured numerous air quality projects for clients across many sectors including: Local, State and Federal Government, heavy industry, refining, mining, construction, materials handling, intensive agriculture, land development, infrastructure, transport, road tunnels, manufacturing, electricity generation and distribution, waste treatment and disposal, aviation, LNG upstream collection infrastructure and LNG export facilities. Projects have considered the potential effects of many air pollutants on the environment and communities including: odour, dust, particulate matter, criteria pollutants, volatile organic compounds, air toxics, photochemical smog, secondary particulate generation, heavy metals, polycyclic aromatic hydrocarbons, dioxins and furans.

Simon has an extensive knowledge of air pollutants, their emission or formation in the atmosphere and the circumstances that contribute to their impact on the environment and people. Having worked in government and as an expert peer reviewer for Local and State Governments, Simon has a detailed and practical understanding of strategic planning, approval conditions and regulatory approaches to air quality management and control. Simon is expert in the use of regulatory dispersion models, interpretation of air quality data and a proficient and effective communicator of the sometimes complex science and concepts that underpin his work.

Simon is a member of the Institute of Engineers Australia and a Registered Professional Engineer of Queensland. Simon is an expert witness and has given evidence in the Queensland Planning and Environment Court, Queensland Land Court, Queensland Supreme Court, NSW Land and Environment Court, Supreme Court of Victoria and the Victorian Civil and Administrative Tribunal.

QUALIFICATIONS

Bachelor of Engineering (Environmental) (Hons), University of Queensland 1994

Registered Professional Engineer of Queensland (19108)

PROFESSIONAL AFFILIATIONS

Member of the Clean Air Society of Australia and New Zealand

Member of the Institution of Engineers Australia (NER)

Member of the Environmental Institute of Australia and New Zealand

PROFESSIONAL EXPERIENCE

Director of Katestone Environmental (2004-present)

New South Wales Environment Protection Authority (1999 – 2004):

- Acting Manager, Air Technical Advisory Services Unit
- Acting Principal Technical Policy Advisor
- Senior Technical Policy Advisor

Katestone Scientific Pty. Ltd. (1997 – 1999)

HLA Envirosciences Pty. Ltd. Mackay/Brisbane (1995 – 1997)

SPECIALIST SKILLS & EXPERIENCE

- Regulation of air pollutant emissions, benchmarking and assessment of best available control technologies
- Control, mitigation and management of air pollutant emissions and dust from industrial, mining and construction activities
- Air quality impact assessment of major power stations, refining, mining and industrial developments across Australian
- Air quality impact assessment of industrial and mining projects in the following countries: Papua New Guinea, Iraq, New Zealand, Indonesia, United States, New Caledonia, Bangladesh
- Air quality impact assessment of major roads and tunnel projects
- Air quality impact investigations to identify cause(s) of complaints, odours, reported health effects and residues

- Assisting government to develop policy for air quality and odour impact assessment; and, to develop environmental regulations
- Air quality modelling including TAPM, CALMET/CALPUFF, Ausplume, AERMOD, ISC3, Caline, CAL3QHCR
- Air pollutant emission estimation using: measurement, back calculation, mass balance, equipment specifications
- Air pollutant emissions monitoring and ambient air quality monitoring
- Design of air pollutant monitoring programs – equipment selection and siting, selection of pollutants and parameters, regulatory compliance, emissions control and feedback, trigger action response plans
- Risk assessment
- Application of novel techniques to environmental monitoring
- Development of air quality and dust management plans for construction activities and operations
- Odour impact assessment, odour control strategies and management plans for:
 - Agricultural industries: feedlots, mushroom composters, piggeries, broiler farms, poultry breeder farms, abattoirs and rendering plants
 - Waste and wastewater industries: sewage treatment plants, grease-trap waste treatment plants, transfer stations, waste composting and landfills
 - Small industries: food processing, manufacturing, printing and asphalt plants
 - Industry: coal-fired power station, breweries, manufacturing and pulp and paper mills

EXPERT ADVICE AND PEER REVIEW

Prepared expert advice to State and Local Government on:

- The impact of new industrial and infrastructure projects on air quality
- Regulatory and licensing requirements for new sources of air pollution

- Technical veracity of air quality impact assessments

Specific advisory roles have included:

- NSW EPA – Review of the Load Based Licensing Scheme – including inventory based health risk assessment, advice on assessable pollutants and pollutant weightings
- NSW EPA – Hazardous Air Pollutants Study
- NSW EPA – Coal Dust Benchmarking Study – International Best Practice measures to prevent and/or minimise particle emissions from coal mining
- NSW EPA – dust from coal trains
- Queensland Resources Council – dust from coal trains
- QR National – Environmental Evaluation – dust from coal trains
- ARTC – Review Particulate monitoring program
- Bulga Milbrodale Progress Assoc – Consulting advice on air quality and health on proposed expansion to Warkworth mine

LAND COURT QUEENSLAND

- LAND COURT QLD – PEMBROKE OLIVE DOWNS PTY LTD V SUNLAND CATTLE CO PTY LTD & ORS
- LAND COURT QLD – TAROOM COAL PTY LTD V RICHARD SHORLAND MOFFAT, MARGARET LINDSAY MOFFAT AND ANGUS SHORLAND MOFFAT
- LAND COURT QLD – TAROOM COAL PTY LTD V ROBERT GRAHAM ADAMS AND TERRI LORELLE ADAMS-MUNN
- LAND COURT QLD – COLTON COAL PTY LTD V ALDERSHOT AND DISTRICT AGAINST MINING AND ORS
- LAND COURT QLD – NEW ACLAND COAL PTY LTD V FRANK ASHMAN & ORS, AND DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION
- LAND COURT QLD - XSTRATA COAL QUEENSLAND PTY LTD & ORS V FRIENDS OF THE EARTH BRISBANE CO-OP LTD & ORS, AND DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT
- LAND COURT QLD – EDGARANGE PTY LTD V REDLAND SHIRE COUNCIL

LAND & ENVIRONMENT COURT NSW

- LAND AND ENVIRONMENT COURT NSW PROCEEDINGS NOS. 10605 TO 10609 OF 2014 - WOOLCOTT GROUP PTY LTD V ROSTRY PTY LTD & TAMWORTH REGIONAL COUNCIL
- LAND AND ENVIRONMENT COURT NSW PROCEEDINGS NUMBER 14015 OF 2014 - WILKS-GILBERT V WAGGA WAGGA CITY COUNCIL
- LAND AND ENVIRONMENT COURT NSW PROCEEDINGS NUMBER 10928/2010 - DELLARA PTY LTD V MINISTER OF PLANNING AND PENRITH CITY COUNCIL

PLANNING AND ENVIRONMENT COURT QUEENSLAND

- P&E COURT NO. 3437/19 QLD SHEILA BLIDGE PTY LTD AS TRUSTEE FOR WPG PROPERTY TRUST V LOGAN CITY COUNCIL
- P&E COURT NO. 4630/18 QLD JAMES FAMILY FUNERAL TRUST V LOGAN CITY COUNCIL
- P&E COURT QLD 786/16 PHIPPS PASTORAL V SOMERSET REGIONAL COUNCIL
- P&E COURT QLD 1204/15 COOMINYA PROPERTIES TRUST V SOMERSET REGIONAL COUNCIL
- P&E COURT QLD 3084/14 BORAL RESOURCES (QLD) PTY LTD V GOLD COAST CITY COUNCIL AND STOP THE GOLD COAST QUARRY ASSOCIATION INC

- P&E COURT QLD 920/13 DEENERYGOLD PTY LTD V SCENIC RIM REGIONAL COUNCIL
- P&E COURT QLD 625/14 HOLCIM (AUSTRALIA) PTY LIMITED V BUNDABERG REGIONAL COUNCIL
- P&E COURT QLD 920/13 EBBORN PTY LTD V SOMERSET REGIONAL COUNCIL
- P&E COURT QLD 1292/13 WOODWARD V MACKAY REGIONAL COUNCIL, BORAL CONSTRUCTION MATERIALS AND ORS
- P&E COURT QLD 11785/13 AUSTRALIA PACIFIC LNG PTY LTD V GOLDEN & ORS
- P&E COURT QLD 4500/12 WATTLEVILLA PTY LTD V WESTERN DOWNS REGIONAL COUNCIL & RUSSELL PASTORAL COMPANY
- P&E COURT QLD 5003/12 PHOENIX POWER RECYCLERS V GOLD COAST CITY COUNCIL
- P&E COURT QLD 975/11 MACKAY RESOURCE DEVELOPMENTS PTY LTD V MACKAY REGIONAL COUNCIL & ORS
- P&E COURT QLD D247/11 PARKLANDS BLUE METAL PTY LTD V SUNSHINE COAST REGIONAL COUNCIL
- P&E COURT QLD D166/11 MARQUETTE BOWEN V SUNSHINE COAST REGIONAL COUNCIL
- P&E COURT QLD 3356/11 KARTAWAY (QLD) PTY LTD V BRISBANE CITY COUNCIL
- P&E COURT QLD 83/2010 - AJK CONTRACTING PTY LTD V MACKAY REGIONAL COUNCIL & ORS
- P&E COURT QLD 92/10 MORGAN V TOOWOOMBA REGIONAL COUNCIL & ORS
- P&E COURT QLD 2606/10 WESTLINK PTY LTD V LOCKYER VALLEY REGIONAL COUNCIL
- P&E COURT QLD 99/09 DARRYL & CAROLINE PHILLIPS V CANNING DOWNS SOUTH PTY LTD & SOUTHERN DOWNS REGIONAL COUNCIL
- P&E COURT QLD 1834/09 REFAKA PTY LTD V SCENIC RIM REGIONAL COUNCIL
- P & E COURT QLD D124/2008 ROBERT HARRIS & CO ACITVE INVESTMENTS AND ORS V ROCKHAMPTON REGIONAL COUNCIL - CREMATORIUM IN ROCKHAMPTON
- P&E COURT QLD 3664/07 BASSINGTHWAIGHTE & ANOTHER V ROMA TOWN COUNCIL
- P&E COURT 1212/2007 BLUE EAGLE (RURAL) PTY LTD V BEAUDESERT SHIRE COUNCIL
- P&E COURT QLD BD3438/2007 BARRO GROUP PTY LTD V REDLAND SHIRE COUNCIL - MT COTTON QUARRY EXTENSION
- P&E COURT QLD BD940/2007 SINGH PROPERTIES PTY LTD V BEAUDESERT SHIRE COUNCIL & ORS
- P&E COURT QLD BD1758/2006 GARY PETERS AND PATRICIA PETERS V CABOOLTURE SHIRE COUNCIL - PETERS POULTRY FARM
- P&E COURT QLD BD3145/2006 ACLAND PASTORAL CO. PTY LTDV ROSALIE SHIRE COUCNIL & STATE OF QLD (King & Co)
- P&E 274/06 IPSWICH CITY COUNCIL – V – CHUWAR RECYCLING & LANDFILLING PTY LTD
- P&E 234/06 IPSWICH CITY COUNCIL – V – PARCEL ONE PTY LTD
- P&E COURT QLD 199/05 MLK NEWTON PTY LTD – V – MAROOCHY SHIRE COUNCIL
- P&E COURT QLD 3955/05 CABOOLTURE SHIRE COUNCIL – V – EVANS
- P&E COURT QLD 2/04 KA HALL & ORS – V – NANANGO SHIRE COUNCIL & RT AND VK CULLEN PLANNING
- P&E COURT QLD 3648/04 ACI GLASS PACKAGING (BRISBANE) AND ORS – V – NEO LIDO PTY LTD

SUPREME COURT OF QUEENSLAND

- PN 932/16 FOXLEIGH LAND PTY LTD V KEVIN KENNY AND ORS

SUPREME COURT OF VICTORIA

- AMACA PTY LTD & ORS ATS SWIA TEK

VICTORIAN CIVIL AND ADMINISTRATIVE TRIBUNAL

- VCAT P790/2017, P794/2017, P795/2017, P805/2017 & P877/2017, MELTON CITY COUNCIL & ORS V ENVIRONMENT PROTECTION AUTHORITY

AWARDS

- CASANZ Clean Air Achievement Award – 2011 (Katestone)
- Australian Bulk Handling Excellence Award – Dust Management – 2008 (Katestone)

PUBLICATIONS

- Burchill M., Welchman S., 2017, Air Quality and the Law: A Historical Review of Cases in the Queensland Planning and Environment Court, Presented at the 23rd CASANZ Conference, Brisbane, Australia, 15-18 October 2017.
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- NSW EPA Offensive Odours Operations Guidance Manual, co-author
- NSW EPA Draft Policy: Assessment and Management of Odours from Stationary Sources in NSW, review
- NSW Department of Environment and Conservation, Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW, review and preparation of revised draft

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Subject	Groundwater Impact Assessment Review	Project Name	Mount Pleasant Optimisation Project
Attention	Chris Lauritzen	Project No.	IA236700
From	Brian Barnett		
Date	08 December, 2020		
Copies to			

1. Introduction

This document provides final peer review comments on the Mount Pleasant Optimisation Project – Groundwater Impact Assessment Report by Australasian Groundwater and Environmental (AGE) Consultants Pty Ltd., versions 01.06 dated December 2020 (the Report). My review also includes an assessment of the Numerical Modelling Report included as Appendix A of the Report (the Appendix). The Appendix provides a detailed description of the groundwater modelling undertaken to support the impact assessment as presented in the Report.

I am a hydrogeologist and groundwater modeller with more than forty years of consulting industry experience. My qualifications and experience are summarised in Appendix A: Curriculum Vitae.

I believe I am suitably independent as I:

- Have no pecuniary interest in the project.
- Have never worked for the proponent either as an employee or consultant.
- Have never worked or collaborated with the proponent's specialists (AGE Consultants), other than in a peer review capacity.
- Have never worked on another nearby project that may have material cumulative impacts with the Mount Pleasant Operation, other than in a peer review capacity.

My review is aimed at assessing the groundwater modelling that has been undertaken to support the environmental impact assessment of the project. Accordingly, I have focussed on those aspects of the conceptualisation and modelling that may influence the simulation of drawdown and flux impacts on the important aquifer systems, and the hydrogeological and environmental assets they support.

As a result of my initial review of an earlier version of the Report, there were a number of issues raised as to how the work was reported, and these have been addressed by the authors. My comments pertained to the following:

- Calibration statistics, in particular the terminology used and inappropriate reference to the Australian Modelling Guidelines in the discussion of the SMRS statistic.
- Presentation of drawdown contours.

- Clarification of the rainfall recharge assumptions implemented in the post-mining period.
- Further details on predicted changes in groundwater flux to the alluvium and accounting of water budget changes in the alluvium.
- Effect of faulting in reducing the potential for cumulative impacts.
- Comparison of the hydraulic conductivity – depth relationship for coal seams to the available hydraulic data.
- Clarification of the approach to post-mining recovery modelling.
- Presentation and discussion of various modelling parameters to improve report clarity.

In addition to the above, the following videoconferences were held with AGE Consultants:

- 19 August 2020: Discussed AGE Consultants' proposed approach to uncertainty analysis.
- 25 November 2020: Discussed and resolved residual review comments.

The Mount Pleasant Operation is an open cut coal mine located approximately 3 km from Muswellbrook in the Upper Hunter Valley, New South Wales. The current mine owner, MACH Energy, has been mining since late 2017. The proposed Project includes a progressive expansion of mining operations from the current 10.5 million tonnes per annum (Mtpa) to 21 Mtpa run-of-mine (ROM) coal over the Project life.

The area has been extensively developed for coal mining with Bengalla Mine, Muswellbrook Coal Mine, Dartbrook Mine, Mt Arthur Coal Mine and Mangoola Coal all located within about 10 km of the Project. Most of the coal mines in the area extract coal from the Wittingham Coal Measures. With so many nearby coal mining operations, the assessment of cumulative (all approved coal operations combined) and incremental (just the Mount Pleasant Operation) is complex and requires the simulation of numerous operations. In this case, cumulative impacts have been assessed from the proposed Mount Pleasant Operation superimposed on the approved operations of the Bengalla Mine, the Mount Arthur Coal Mine and the Dartbrook Mine.

The mine is located in close proximity to groundwater resources of the Hunter River Alluvium, a highly productive, shallow unconfined aquifer system that is used extensively for domestic and stock water supplies. The primary Groundwater Dependent Ecosystems (GDE's) in the area include aquatic GDE's generally associated with the Hunter River and relatively small stands of River Red Gums located in the northern part of the Mining Lease Area.

2. Modelling Objectives

The modelling objectives as stated in Section A1 of the Appendix are to:

- replicate the historical behaviour of the groundwater regime;
- predict the changes in groundwater levels and flows due to the proposed mining at the Mount Pleasant Operation (incorporating the Project);
- predict the cumulative changes to groundwater levels and flows due to the Mount Pleasant Operation (incorporating the Project) and surrounding mines;
- predict potential impacts to existing users including GDEs; and
- predict take from various water sources for estimating licence requirements.

3. The Appendix

The Appendix is a comprehensive groundwater modelling report that covers all tasks undertaken in the development and use of the numerical model. It follows the work flow recommended by the Australian Groundwater Modelling Guidelines (Barnett *et al.*, 2012) except for the hydrogeological conceptualisation, predictive model results and uncertainty analysis results which are described in some detail in the Report.

As noted above, the mine is located in close proximity to a number of similar coal mines, many of which have had numerical groundwater models developed for impact assessment purposes. The work described in the Appendix draws from earlier modelling investigations including AGE, 2013a/2013b/2014, and HydroSimulations 2015.

The model has been developed in the MODFLOW USG numerical code using unstructured Voronoi elements to discretize the model domain in a manner that provides refined model cells in the region of the mine and hydrological features of interest. Twenty model layers have been defined on the basis of the principal geological units present, including alluvial sediments and, consolidated sedimentary rocks representing the overburden, individual coal seams and inter-burden.

Given the location of the mine in relation to the Hunter River and its many tributaries, the assessment of potential impacts of mining on river baseflow is an important consideration for the work. Interaction between groundwater and the network of rivers and streams that drain the region is facilitated through the implementation of both the MODFLOW USG river package (RIV). For the permanent water courses, i.e., the Hunter River, Sandy Creek and Dart Brook, the stage (water depth) in the water body is estimated from an interpolation of levels measured in neighbouring gauging stations. The MODFLOW USG river package (RIV) has also been used to simulate groundwater discharge fluxes to all other water courses that are not gauged and many of which are ephemeral. For these water courses, the RIV package has been parameterised to ensure that the ephemeral water courses act as drainage features and do not allow groundwater recharge to occur. The approach is appropriate and, in my opinion, provides a reasonable basis for assessing surface water impacts that may arise from mining.

Climate stresses have been simulated through the application of the MODFLOW USG recharge (RCH) and evapotranspiration (EVT) packages in appropriate and standard methods. Recharge rates, defined as percentages of measured rainfall, have been assigned to three spatial zones aligned with the outcropping hydrogeological units, namely, alluvial sediments, Triassic Sandstone and Permian sediments. Recharge rates range from 0.5 to 3.2% of measured rainfall.

Evapotranspiration has been implemented in a standard MODFLOW USG approach in which the rate at which groundwater is extracted by vegetation depends on the depth to watertable. When the watertable is located at or above the ground surface, the rate of evapotranspiration is equal to potential evaporation rate of 600 mm/year. The rate at which groundwater is extracted as evapotranspiration decreases linearly with increasing watertable depth to a nominal extinction depth beyond which evapotranspiration is set to 0 mm/year. In this instance, extinction depths are varied spatially with the distribution of vegetation across the model domain.

Reducing hydraulic conductivity with depth and lithostatic pressure commonly observed in coal seams and inter-burden was estimated from a number of packer tests undertaken at various depths. An exponential equation fitted to the packer test results plotted against depth was used to define a relationship between depth and hydraulic conductivity applied across the model domain. The

reductions in hydraulic conductivity with depth in the coal seams is reasonably significant, being equivalent to about one order of magnitude decline in hydraulic conductivity for every 100 m depth increment. It is noted that there is a considerable degree of scatter in the measured data plotted in Figure A2.4 and that the apparent trend of hydraulic conductivity with depth in coal seams is less pronounced in Mount Pleasant Operations data than in similar data collected from tests conducted at the nearby Dartbrook and Mount Arthur Mines. The hydraulic conductivity with depth relationship applied to the model is therefore a compromise between conflicting trends seen in the various data sets. In my opinion the approach adopted in this instance is appropriate and that uncertainty introduced through the adoption of a uniform hydraulic conductivity with depth relationship across the entire model has been adequately addressed through the uncertainty analysis.

The packer test results for inter-burden (Figure A2.5) suggest that the hydraulic conductivity of the inter-burden is much less sensitive to lithostatic pressure and that the decrease in hydraulic conductivity is about one order of magnitude over a depth interval of about 350 m from the surface.

The hydrogeological disturbance associated with mining activities has predominantly been simulated using the MODFLOW USG package drain (DRN) that removes groundwater above a specified drain invert level. The model includes representations of the Mount Pleasant Operation along with mining of the Bengalla and Mount Arthur open-cut mines and the Dartbrook underground mine. For open-cut mining the drain cells are progressively lowered and expanded through the excavation to simulate the historic (calibration) and future (predictive scenarios) mining operations. Progressive backfilling of the voids is simulated with the removal of drain boundary conditions and with the initiation of increased hydraulic conductivity and recharge associated with the more transmissive nature of the spoil.

For the long wall mining of the Dartbrook underground mine the drain cells are introduced progressively to simulate the expanding underground void space predominantly within the coal seams. Disturbance to geological strata above the coal seams as the longwall panels collapse is simulated by increasing hydraulic conductivity (permeability enhancement) to the goaf and fracture zone with the magnitude of permeability enhancement assumed to depend on the height above the roof of the seam.

The approach adopted to simulate the mines and mining environment is standard in the coal mining industry and has been successfully implemented and perfected through numerous groundwater modelling investigations throughout Australia's coal basins.

Calibration has been undertaken in both steady state and transient approaches. A steady state calibration was undertaken to simulate pre-mining heads and this was followed by transient calibration that simulates mining operations undertaken between 1991 and 2016. The process has been undertaken with a combination of manual testing and automated (PEST) methods with pilot points used in the top three model layers to establish spatial variability in hydraulic parameters and recharge rates.

Calibration was aimed at reproducing measured groundwater heads and estimated pit inflows into the Mount Arthur and Bengalla Mines and into the Wynn coal seam of the Dartbrook Mine and into the Dartbrook Mine Hunter Tunnel. The model-predicted heads and fluxes provide an excellent representation of the measured heads and inflow fluxes indicating that the model is well calibrated.

By using both head and groundwater flux calibration data, the non-uniqueness in model parameters can be substantially reduced and the resultant model confidence improved. The approach described

in the Appendix represents an appropriate use of available data to constrain model parameters through calibration that uses historical observations at the site and elsewhere in the model domain.

Calibration results are presented in a series of charts and tables showing measured calibration targets and relevant modelled estimates. In general, there is a good correlation between computed and observed behaviour in all calibration data sets. Calibration statistics for groundwater heads are reported for the transient calibration in the form of the Scaled RMS Error of about 4% for all observed heads. Calibration matches to groundwater flux targets have not been quantified in terms of matching statistics, but a qualitative comparison suggests the model provides a reasonable replication of the estimated groundwater inflows.

I have concluded that the calibration approach and outcomes meet all reasonable expectations (including guiding principles outlined in Australian Groundwater Modelling Guidelines).

Four predictive scenarios have been assessed as follows:

- A baseline scenario (null case scenario) that includes no mining in the area.
- A scenario that includes neighbouring mines only and no Mount Pleasant Operation mining.
- A scenario that includes the approved and proposed extension to the Mount Pleasant Operation and mining at neighbouring mines.
- A scenario that includes the approved mining at Mount Pleasant only (i.e., the proposed extension is not included) and mining at neighbouring mines.

Comparisons of results from the various scenarios are able to yield the predicted cumulative impacts of all mines in the area including Mount Pleasant Operation and the incremental impacts that can be attributed to the approved and proposed extension to Mount Pleasant Operation mining and of the proposed extension of Mount Pleasant Operation in isolation. Results are not presented in the Appendix but are detailed in Sections 7 and 8 of the Report.

Additional modelling was undertaken to assess post mining impacts and this work is described in Section A4.2. The model was run for 1000 years post mining with an assumed average climate condition (as represented in the EVT and RCH packages) applied to the final land form. Pit Lakes were simulated as constant head boundary conditions assigned to the final void at the Mount Pleasant Operation as well to the final voids at Bengalla Mine and Mt Arthur Coal Mine. The work is aimed at quantifying groundwater drawdown (heads compared to steady state undisturbed heads) in the post closure equilibrium. The results are presented in Section 7.2 of the Report and are briefly described below.

The Appendix documents an uncertainty analysis that has involved a stochastic approach to explore predictive uncertainty within the bounding constraints of the information contained within the calibration data sets. The approach involves the formulation of multiple model realisations that pass defined calibration criteria (SRMS <10%) and are then used in predictive scenarios. The approach results in a population of predictive outcomes that can then be analysed and reported. Results of the Uncertainty Analysis are included in Section 9 of the Report. The method provides a comprehensive assessment of parameter uncertainty, is consistent with Barnett *et al.*, 2012, and Middlemis and Peeters, 2018 and is considered to meet current industry standards for uncertainty quantification.

4. The Report

The Report provides a thorough and comprehensive description of the hydrogeological environment within which the Project is located. Of particular relevance in terms of environmental impact assessment are the key environmental assets and values that maybe impacted by the Project including:

- Nearby surface water features including the Hunter River and its tributaries, Sandy Creek and Dart Brook.
- The alluvial aquifer system associated with the Hunter River and its tributaries and the existing groundwater users that rely on the aquifer for water supply.
- The Groundwater Dependent Ecosystems (GDE's) associated with the Hunter River and the alluvial aquifer system.

The modelling results presented in Section 7 of the Report illustrate significant levels of drawdown in the deep coal seams (specifically the Edderton Seam as illustrated in Figures 7.3 and 7.4) with the drawdown generated by mining at the Mount Pleasant Operation contributing to a large regional drawdown response when superimposed on the predicted impacts of neighbouring mines.

Of particular relevance for the environmental impact assessment are the predicted drawdowns on the shallow alluvial aquifer system as presented in Figures 7.2 and 7.4. The results suggest that predicted drawdown is limited to a small area immediately to the north of the mine in which drawdown to a maximum of about 2 m is expected. The result was initially a little surprising given that the open cut excavation to about 300 m below ground surface is in close proximity to the alluvial aquifers to the east and west. The result is consistent with historic monitoring of groundwater heads in the Hunter River Alluvium that has illustrated almost no drawdown from historic mining operations. The outcome appears to arise from the fact that the coal seams dip to the west and there is only poorly transmissive inter-burden and overburden sediments between the pit face and the alluvial sediments to the east. The transmissive coal seams are relatively thin and there is limited vertical movement of groundwater into the seams from the intervening poorly permeable inter-burden layers. As a result, the coal seams become de-saturated immediately behind the pit face and seepage faces in the coal seams are unable to sustain significant flows into the mining pit despite high pressure gradients. The behaviour predicted by the model appears consistent with observations in existing open cut mines in the region.

Impacts on flows in nearby rivers and creeks are predicted to be negligible with reduction in baseflow peaking at 27 ML/yr, 6 ML/yr and 2 ML/yr in the Hunter River, Sandy Creek and Dart Brook respectively. The outcome is consistent with the minimal predicted drawdown in the alluvial aquifers as discussed above.

Steady state post mining drawdown estimates indicate small areas of drawdown predicted to occur in Hunter River Alluvium immediately to the north east of the mine and a wider area in shallow regolith and Sandy Creek Alluvium to the west and northwest of the mine.

The Report provides an excellent summary of the groundwater modelling work described in the Appendix. Important groundwater modelling outcomes are clearly described and illustrated through a series of easily digested maps, charts and tables. The level of reporting is of a high standard and meets all requirements of the Australian Groundwater Modelling Guidelines (Barnett *et al.*, 2012).

5. Peer Review Findings

The groundwater assessment and supporting groundwater modelling work described in the Report and Appendix have been carried out in a professional and rigorous manner and meet or exceed current industry standards. The modelling work has been completed in line with the Guiding Principles included in the Australian Groundwater Modelling Guidelines and I have not identified any fundamental flaws in the work, both in terms of the approaches and assumptions that have been adopted and the interpretation of the outcomes. I have concluded that the model is fit for the purpose of impact quantification and assessment.

While the Appendix suggests that the model meets the criteria for a Class 2 Confidence Level Classification, in my opinion it is more consistent with a Class 3, high confidence level model. My opinion is not only based on the modelling as described in the Report and Appendix, but also on the fact that there is a long history of groundwater investigations and experience in mining and impact monitoring at nearby mines that helps support and increases confidence in the predictive outcomes obtained from the model.

6. References

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Appendix A: Curriculum Vitae

Brian Barnett



Qualifications:

Bachelor of Engineering (Civil), University of Auckland, 1980

Relevant Experience:

Jacobs Group (Australia) Pty Ltd. (Prior to December 2013 SINCLAIR KNIGHT MERZ, AUSTRALIA)

May 2000 to present

Senior Hydrogeologist and Geothermal Reservoir Engineer SKM, Melbourne, Australia.

Responsible for groundwater modelling and geothermal studies. Major projects include:

- ***Australian Groundwater Modelling Guidelines. National Water Commission.*** Project manager and principal contributor to an Australian Groundwater Modelling Guideline that is planned to supersede the current Murray Darling Basin Commission guidelines. The project was completed in March 2012 and the document was published in June 2012.
- ***Frieda River Mine Dewatering Investigations. Xstrata Copper.*** Groundwater modelling of a proposed copper mine in Papua New Guinea. Groundwater models were used to estimate the dewatering pumping requirement for the mine and to provide an assessment of the environmental impacts that may accompany mine dewatering.
- ***New Acland Coal Mine. New Hope Group.*** Developed a groundwater model of the New Acland Coal Mine to assist with gaining environmental and industry approvals for expanding coal mining operations. The model was used to predict the likely future inflows to the mining pits and to assess potential impacts that may arise from the inflows and associated drawdown in groundwater

heads. The work has included expert witness appearance in recent Queensland Land Court proceedings.

- ***Wards Well Coal Mine. BMA.*** Supervising the modelling of an underground coal mine in Queensland. The model includes time varying material properties that represent deformation of formations above long wall mine panels.
- ***Kulwin Mineral Sands Mine Dewatering Investigations. Iluka Resources Ltd.*** Detailed numerical groundwater models were developed to help design the mine dewatering system. Investigations were aimed at depressuring the local groundwater system to expose the mineral sand deposits to allow dry mining of the resource. The models paid particular attention to vertical flow processes in and around the deposit and hence incorporated multiple (27 layers in total) horizontal layers.
- ***Pardoo Iron Ore Mine Dewatering Investigations. Atlas Iron.*** Groundwater models were developed in the FEFLOW numerical modelling code to estimate the mine dewatering requirements of an iron ore mine in the Pilbara region of Western Australia.
- ***Northern Murray Basin Environmental Effects Statement. Iluka Resources Ltd.*** Preparation of a water management report that formed part of the EES for the Kulwin and WRP deposits in the Northern Murray Basin Project. Work included the development of regional groundwater flow models to assess environmental impacts of dewatering and water disposal.
- ***Mine dewatering for Murray Basin Titanium Ltd for the Wemen Mineral Sand Mine.*** Numerical groundwater models were formulated and calibrated in order to help optimise a dewatering plan for a mineral sand deposit in Northern Victoria. The models were also used to assess the likely impacts of dewatering and associated water disposal on the Murray River.
- ***Mine water management consultant for Murray Basin Titanium Ltd for the Prungle Mineral Sand Mine.*** Responsibilities included the development of numerical groundwater models to assist in designing a groundwater supply scheme to provide water for a dredge mining operation in Northern Victoria. Investigations also included the assessment of groundwater extraction and disposal on local and regional surface water and groundwater resources.
- ***Murray Darling Basin Sustainable Yields Project. CSIRO.*** Groundwater modelling team leader for a major project covering groundwater resources in Queensland, New South Wales, Victoria and South Australia. SKM was contracted by CSIRO in 2007 to undertake the groundwater resource assessment for the entire Murray Darling Basin. The project involved the numerical modelling of all major fresh water aquifers in the basin. Twelve finite difference numerical models were run for the study. Results were used to quantify the available groundwater resources of the basin and to assess the impacts of future climate change and impacts of groundwater development on river flows.
- ***Northern Sewer Project, Groundwater Models.*** Groundwater flow models were developed for the NSP1 and NSP2 sewer tunnels in north Melbourne. The models were used to assess inflows into the tunnels and to determine the likely impacts of groundwater drawdown on the aquifer and on

the associated loss of base flow to local streams and rivers. Models were constructed to assess both the construction and operational phases.

- ***Lindsay River Groundwater Modelling. DNRE Victoria.*** Development of a three dimensional finite element groundwater model of the aquifers within the Lindsay River Anabranch of the Murray River. The model was developed in the FEFLOW modelling code and is being used to design a salt interception scheme.
- ***Numerical Water Trade Models. Mallee CMA Victoria.*** Project manager and leader of modelling team to develop, calibrate and run predictive scenario models for the Nangiloc Colignan and Wemen irrigation areas in northern Victoria. Models were aimed at quantifying the impact on salinity in the River Murray associated with the trading of irrigation water.
- ***South East Queensland Effluent Reuse Study – Darling Downs.*** Brisbane City Council. The impacts associated with future use of treated effluent for irrigation in the Darling Downs was investigated through the development and calibration of large scale three dimensional groundwater flow and solute transport models. Impacts under investigation included changes in groundwater head, changes in the groundwater interaction with rivers and streams and the water quality changes in the aquifer.
- ***Lake Toolibin Groundwater Modelling. CALM WA.*** A three dimensional finite difference groundwater model was formulated to assess the dewatering performance of a network of pumping bores designed to reduce groundwater heads beneath Lake Toolibin. The project is aimed at minimising salinisation of the lake by reducing groundwater discharge through the lake bed.
- ***Barwon Downs Groundwater Modelling. Barwon Water, VIC.*** This project involved the development and calibration of a large three dimensional finite difference groundwater flow model to assess the safe long term yield from the Barwon Downs borefield. Models were calibrated over a thirty year period of observation and were run in predictive mode for 100 years.

KINGSTON MORRISON LIMITED, AUCKLAND

1997 to May 2000

In July 1999, Kingston Morrison Ltd joined the Sinclair Knight Merz Group.

- **Senior Geothermal Reservoir Engineer.** Responsible for all aspects of geothermal reservoir assessment and well testing. Also responsible for all hydrogeological investigations and groundwater modelling.

SUMIKO CONSULTANTS COMPANY LIMITED, TOKYO, JAPAN

1991 to 1997:

Geothermal Reservoir Engineering Manager. Responsible for the enhancement of geothermal reservoir engineering and mineral resource evaluation capabilities in Sumiko Consultants through the acquisition of reservoir and well bore simulation codes and the application of geostatistical methods and software.

GEOHERMAL ENERGY NEW ZEALAND LIMITED (GENZL), AUCKLAND

1981 to 1991:

Reservoir Engineer. Responsible for all geothermal reservoir engineering studies including extended assignments in Indonesia, Kenya and Japan.

HAWKES BAY REGIONAL WATER BOARD

1979 to 1981:

Groundwater Engineer. Duties included the investigation of hydraulic and chemical characteristics of aquifers in the Hawkes Bay region and the preparation of resource management plans.