
EDITH COWAN UNIVERSITY

Faculty of Computing, Health and Science

Level 1 Research Centres

Annual Report Format

As at 31 December 2009

Mine Water and Environment Research Group (MiWER)

Introduction	<p>Background:</p> <p>The MiWER level 1 research group brings together successful researchers with significant experience and publication records and those who are currently establishing themselves in the research field of environmental chemistry. MiWER's research strategy makes use of applied grants to research mine water impact and remediation to initially produce high quality applied research reports to the funding body and then high quality papers to the scientific community. MiWER has a broad field of research, driven by both broad research interests of its diverse staff and student members and the necessity of a competitive funding environment. MiWER group members research predominantly in the aquatic sciences (both marine and freshwater), across the fields of ecology, environmental chemistry and ecotoxicology. Collaboration between MiWER members and other SNS staff members including epidemiologists and botanists have enabled the group to extend research into some of these other areas through collaborations.</p> <p>Objectives:</p> <p>The main aims of this group are;</p>
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	<ol style="list-style-type: none"> 1. To facilitate collaborative research between staff members with expertise related to the environmental issues surrounding mine waters. 2. To facilitate applications for infrastructure required to support members of the group. 3. To enhance the strength of postgraduate research in the area of rehabilitation of acid sulphate soil disturbance and acid mine drainage through bioremediation (see section below listing BSc honours and postgraduate students supervised by Clint McCullough and Mark Lund. 4. To build and capitalise on the exposure and experience gained by the team from ECU's participation in the State's Centre of Excellence in Sustainable Mine Lakes. These include a national and international network and increasing scientific reputation within this research area. <p>Strategies:</p> <p>To collaborate for the purposes of applying for research funds to increase infrastructure to more effectively undertake research in this area.</p> <p>To present the work of the group to increase the profile of both individual researchers and the collective group.</p> <p>To develop research initiatives for both industry and competitive funding.</p>
Membership	<p>Members:</p> <p>Dr Clint McCullough</p> <p>A/Prof Mark Lund</p> <p>Dr Naresh Radhakrishnan</p> <p>Dr Lu Zhao</p>

	<p><i>A/Prof Mark Lund:</i></p> <p>Linkage with XStrata Coal Pty Ltd (Australia), researching pit lake remediation techniques</p> <p>Linkage with Kemerton Silica Sand Pty Ltd (Australia), researching pit lake remediation techniques</p> <p>Linkage with City of Stirling (WA) studying Acid Sulfate Soils</p> <p>Linkage with Cities of Wanneroo and Joondalup (WA) studying wetland midge problems</p> <p>Linkage with City of Perth regarding the Point Fraser constructed wetland</p> <p>Linkage with the Midge Research Group</p>
Grants held	Please see below (i.e., ongoing grants awarded in previous years and continuing)
Grants awarded	Please see below (in reporting year)
Publications:	Please see Attached list
Financial Report (where applicable)	Please see Table of grants attached
Performance Indicators	<p>Clint McCullough: 2,749 RAI points.</p> <p>Mark Lund –2, 817 RAI Points.</p> <p>Naresh Radhakrishnan: Only began position late 2008.</p>

	Lu Zhao: Only began position late 2009.
Promotion	<p>The MiWER group has expertise and activity in the areas of Aquatic Ecology and Environmental Chemistry and Ecotoxicology.</p> <p>For further information contact: Dr. Clint McCullough.</p> <p>MiWER website: http://www.chs.ecu.edu.au/MiWER/</p>

Summary of Performance 2009

Individuals within this Level 1 group have had success during 2009 with the publication and submission of articles in and to various journals. Dr. Clint McCullough and Assoc. Prof. Mark Lund also attended a key international conference and presented their work in Pretoria, South Africa. They have also been successful in achieving funding from industry sources including a new Nationally-Competitive Category 1 ACARP grant to research the effect of Aquaculture on mining pit lakes water quality and sustainability. Many industry-funded applied research projects have also been completed and reports for the funding bodies finalised. Students being supervised by group members are progressing well and are also contributing to the success of the group via conference attendance (1 conference paper presented in 2009) and peer review publication writing (1 paper accepted in 2009).

MiWER is recognised, both by national and multi-national industry and national and international researchers as the premier mine water research provider in

Australia. As recognition of the international reputation of this group, we have recently been approached by the previous conference's organising committee and are now planning the 2012 International Mine Water Congress for Perth (the previous South African conference had 350 delegates). We are developing this congress in collaboration with the large multi-national environmental and engineering firm Golder Associates whom we also have research engagements with.

The research field of mine water impact assessment and remediation continues to grow in scope of application. MiWER members have completed a scoping study with Rio Tinto where we have now been offered ongoing funding to research remediation technologies for acidic lakes of the Pilbara region. More locally, the City of Stirling continues to strongly support our research. Over the last five years we have been researching Acid Sulfate Soils at sites within and funded by the City of Stirling with significant success. We have been transferring the Acid Mine Drainage mining remediation knowledge we have developed from the related situation of Acid Sulfate Soil issues within the City's urban wetlands and are developing an ECUI grant application to take this research to a higher level of scientific understanding. MiWER research work is often found preferable by organisations such as local government to that of other professional providers such as environmental consultants as it represents unbiased, quality research that is at the international forefront of the science.

2009 Grants held and awarded.

Bold type indicates Category 1 Nationally Competitive grant.

	Author(s) and brief title of grant	Funding body	Total value of grant (\$)	Year
1	Lund/McCullough: <i>Nuisance midge management research</i>	Cities of Joondalup and Wanneroo	60,734	2009–2010
2	McCullough/Lund: <i>Temporal variability and ecosystem function of the aquatic macroinvertebrate communities of the Kemerton Wetlands</i>	Kemerton Silica Sand Pty Ltd	58,367	2009–2011
3	McCullough/Lund: <i>Understanding Pit Lake Resources within the Collie Basin</i>	Department of Water	296,997	2009–2010
4	Lund/McCullough: <i>Limitations to Bulk Organic Bioremediation of Acid Coal Mine Lakes</i>	Australian Coal Association Research Program (ACARP)	166,336	2009–2010

2009 Publications

An important consideration when funded by industry, whether the awards are competitive or not, is that research reports and not peer-reviewed publications are the required output for these funding bodies. Technical reporting to industry is mandatory in maintaining effective engagement with industry/agencies and the application of research and forms the basis of my peer-reviewed publication in journals. The exercise of writing voluminous research reports is consistent across many of MiWER's industry-based grants and can take considerable time, and although the outputs may be of significant use of the funding body or industry concerned, these

reports are not considered in research activity measures. When added to the peer-reviewed these extra research outputs demonstrate considerable, and growing, research activity.

Peer-review publications

Kumar, N. R.; McCullough, C. D. & Lund, M. A. (2009). Water resources in Australian mine pit lakes. Proceedings of AUSIMM Water in Mining 2009, Australasian Institute of Mining and Metallurgy (AUSIMM), Perth, Australia. pp. 507-511.

Kumar, N. R.; McCullough, C. D. & Lund, M. A. (2009). Water resources in Australian mine pit lakes. *Mining Technology*. 118: 205-211.

Lund, M. A. & McCullough, C. D. *Biological remediation of low sulphate acidic pit lake waters with limestone pH neutralisation and amended nutrients* International Mine water Conference. Pretoria, South Africa. 19-23 October, International Mine Water Association, 8pp.

McCullough, C. D.; Steenbergen, J.; te Beest, C. & Lund, M. A. *More than water quality: environmental limitations to a fishery in acid pit lakes of Collie, south-west Australia*. International Mine Water Conference. Pretoria, South Africa. 19-23 October, International Mine Water Association, 507-511pp.

Neil, L. L.; McCullough, C. D.; Lund, M. A.; Tsvetnenko, Y. & Evans, L. (2009). Toxicity of acid mine pit lake water remediated with limestone and phosphorus. *Ecotoxicology and Environmental Safety* 72: 2,046-2,057. (Highlighted paper). IF=2.6, FOR=B

Book chapters

McCullough, C. D. (2009). Aquatic toxicity assessment across multiple scales. In, *Lake Pollution Research Progress*, Miranda, F. R. & Bernard, L. M. (eds.) Nova Science Publishers Inc., Hauppauge, New York, USA.

McCullough, C. D.; Hunt, D. & Evans, L. H. (2009). Sustainable development of open pit mines: creating beneficial end uses for pit lakes. In, *Mine Pit Lakes: Characteristics, Predictive Modelling, and Sustainability* Castendyk, D.; Eary, T. & Park, B. (eds.) Society for Mining Engineering (SME), Kentucky, USA, 249-268pp.

Technical Reports

van Etten, E.; McCullough, C. D. & Lund, M. A. (2009). *Evaluation of rehabilitation efforts at the Kemerton Silica Sands Pty. Ltd. project area, November 2008*. Report number 2009-02, Centre for Ecosystem Management/Mine Water Environment Research, Edith Cowan University, Perth, Australia. Unpublished commercial-in-confidence report to Kemerton Silica Sand Pty Ltd.

van Etten, E.; McCullough, C. D. & Lund, M. A. (2009). *Riparian vegetation characteristics of seasonal wetlands in Kemerton, south-western Australia* Report number 2008-17, Centre for Ecosystem Management/Mine Water Environment Research, Edith Cowan University, Perth, Australia. 60pp. Unpublished report to Kemerton Silica Sand Pty Ltd.

Zhao, L. Y. L.; McCullough, C. D. & Lund, M. A. (2009). *Mine Voids Management Strategy (I): Pit lake resources of the Collie Basin*. Department of Water Project Report MiWER/Centre for Ecosystem Management Report 2009-14, Edith Cowan University, Perth, Australia. 200pp. Unpublished report to Department of Water.

Conference Presentations

Galeotti, D. M.; McCullough, C. D. & Lund, M. A. (2009). *Can meta-population theory explain survival of an aestivating fish species in a seasonal wetland complex?* Australian Society for Limnology 2009 Congress. Alice Springs, Australia.

Kumar, N. R., McCullough, C. D. & Lund, M. A. (2009), Water resources in Australian mine pit lakes. Proceedings of the 2009 Australasian Institute of Metal and Metallurgy (AusIMM) Water in Mining conference, Perth, Australia. 15 September – 17 September 2009.

van Etten, E. J. B.; McCullough, C. D. & Lund, M. A. (2009). *How precisely do we need to match topsoil to site for successful restoration of post-mining environments? A case study from wetlands in south-western Australia*. 19th Conference of the Society for Ecological Restoration International (SERI). Perth, Western Australia, Australia. 23 August – 27 August 2009.

Popular articles

McCullough, C. D. (2009). Australia's mining boom leads to a boom in new lakes. *SILnews* 54: 8-9.

McCullough, C. D. (2009). Community supported ecological restoration. *Cohesion* 2009(3): 8.