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A case study of an alternative approach to coal mine site water management: West Cliff Colliery NSW

Antony Volcich
University of Wollongong

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**A CASE STUDY OF AN ALTERNATIVE APPROACH
TO COAL MINE SITE WATER MANAGEMENT:
WEST CLIFF COLLIERY, NSW.**

**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
MASTER OF ENVIRONMENTAL SCIENCE (RESEACH)**

**From The
University of Wollongong**

**By
ANTONY VOLCICH**

**School of Earth and Environmental Sciences
Faculty of Science
The University of Wollongong**

2007

CERTIFICATION

I, Antony John Volcich, declare that this thesis, submitted in fulfilment of the requirements for the award of the degree of Master of Environmental Science (Research), University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Antony John Volcich

ABSTRACT

The provision of water supply, its usage and discharge, are major concerns for all mines, both underground and opencut, often accounting for a significant portion of the daily running cost of mining. To reduce these costs, mines will often collect as much site runoff as possible, and recycle the water whenever economically feasible. The constant recycling of on-site waters can mean that, over time, the levels of salinity, acidity or alkalinity, or other contaminants may build up within the internal water management system to a point which may lead to problems with licensed discharge requirements.

This project investigated the water quality at West Cliff Colliery, an underground coal mine, in the Illawarra Coal Measures, in order to develop an improved system for managing water resources with minimal environmental impact. While West Cliff Colliery is totally self sufficient and independent of any town water supply, issues have arisen with the quality of water being discharged into the receiving waterways, Brennans Creek and the upper Georges River. To alleviate these issues, a new water management system (WMS) has been established to try and maintain an adequate supply of clean recycled water and to prevent uncontrolled discharges to the environment outside West Cliff's Environmental Protection Licence (EPL) requirements.

To monitor changes in the WMS, a new operation of the system involved a daily testing and monthly sampling regime of the key water quality parameters pH, EC, temperature and ORP. These parameters were measured at designated sites within the WMS using probes and meters that had been freshly calibrated each day. Monthly grab samples were also taken from the same designated sites for laboratory analysis of trace (heavy) metals. Chemical speciation modelling was also carried out in order to determine the ecotoxicity of dissolved trace metals in the discharge water.

Operating the WMS in the new manner prescribed led to a significant reduction in uncontrolled discharges to the environment, a reduction in salinity of the WMS water, a reduction in the concentrations of potentially ecotoxic elements As, Cu, Ni, and Zn. It also maintained a high level of compliance with the mines current EPL and provided a more constant environmental flow in the upper Georges River without having to resort to much more costly forms of water treatment.

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List of Symbols and Acronyms

AMD – Acid Mine Drainage

BCD – Brennans Creek Dam

CPP – Coal Preparation Plant

CWM – Coal Washery Material

DEC – Department Environment and Conservation

Density – Grams per centimetre³

EC – Electrical Conductivity

EPA – Environmental Protection Authority

EPL – Environmental Protection License

GAC – Granular Activated Charcoal

GRP – Gross Regional Product

LDP – Licensed Discharge Point

LOR – Limit of Resolution

mg/L – Milligrams per litre

ML – Megaliters

mV – Millivolts

NATA – National Association of Testing Laboratories

NOEC – No Observable Effect Concentration

O&G – Oil and Grease

ORP – Oxidation Reduction Potential

pH – Potential Hydrogen

PLC – Programmable Logic Control

PRP – Pollution Reduction Program

S.d. – Standard deviation

T – Temperature Degrees Celsius

TDS – Total dissolved solids

TSS – Total suspended solids

µg/L – Micrograms per litre

µS – Micro Siemens

WMS – Water Management System