

STRATEGIC
WATER
MANAGEMENT

in the
**Minerals
Industry**



A framework





Aim

To promote a strategic approach to water management at mining and processing sites so that water is more efficiently managed and valued as a vital business, community and environmental asset.

This publication was produced jointly by the Ministerial Council on Mineral and Petroleum Resources (MCMPR) and the Minerals Council of Australia (MCA).

The MCMPR consists of the Federal Minister for Industry, Tourism and Resources, state and territory ministers with responsibility for minerals and energy and the New Zealand Minister for Energy. The Papua New Guinea ministers for Mining and Petroleum and Energy have observer status. MCMPR's mission is to promote the general welfare and progressive development of the Australian mining and minerals industry, and to consult on the nation's energy needs, resources and policies.

The MCA represents companies involved in mineral exploration, mining and processing of minerals. Its activities are funded entirely by its member companies which, between them, produce about 85 per cent of Australia's mineral output. The Minerals Council's strategic objective is the advocacy of public policy and operational practice for a world class industry that is safe, profitable, innovative, environmentally and socially responsible and attuned to community needs and expectations.

ISBN 0 642 72522 5

© 2006. This work is copyright to the Ministerial Council on Mineral and Petroleum Resources (MCMPR). It may be reproduced in whole or in part subject to the inclusion of an acknowledgment of the source and no commercial usage or sale. Reproduction for purposes other than those indicated above requires written permission from the MCMPR Secretariat, GPO Box 9839, Canberra ACT 2601.

Design: Big Island Graphics

Print: Union Offset Printers

Working Group

Kristina Ringwood	(Co-Chair) Rio Tinto Ltd
Michael Balfe	(Co-Chair) Department of Industry & Resources, Government of Western Australia
Carolyn Balint	Iluka Resources (Ouyen)
Christine Charles	Newmont Australia Limited
Brett Gray	Department of Industry, Tourism and Resources, Australian Government
Greg Morris	Newcrest Mining Limited
Elise Newberry	Department of Primary Industries, Government of New South Wales
Ranga Parimala	Department of Industry, Tourism and Resources, Australian Government
Craig Roberts	Department of Primary Industries, Government of New South Wales
Lucy Roberts	Xstrata PLC
Melanie Stutsel	Minerals Council of Australia

The Working Group would like to thank the following people who greatly assisted in the preparation of the framework: Paul Cristofani and Cormac Farrell (MCA), Jenny Scougall (Department of Industry, Tourism and Resources, Australian Government), John Allen (Newcrest Mining Limited), Bianca Dry (Department of Industry & Resources, Government of Western Australia) and Michael O’Flynn (Department of Natural Resources, Mines and Water, Queensland Government).

Special thanks also to those who responded during the public consultation phase on the draft framework.

Contents

Chapter 1: Valuing Water	9
Objective: Manage water as a key business asset with social, cultural, environmental and economic value	9
• Water is an asset with social, cultural, environmental and economic value	11
• Decision-making reflects the true value of water	13
Overview: National Water Initiative	12
<i>Case studies:</i>	
<i>Value of water at Comalco</i>	10
<i>Increasing water use efficiencies at Yabulu Refinery</i>	15
Chapter 2: Strategic Water Planning	
Objective: Position the business over the longer term through strategic water planning	16
• A strategic water plan enhances business by maximising opportunities and minimising risks	16
• The water resource and its context are understood	20
• Water issues are incorporated into business decision-making	20
<i>Case studies:</i>	
<i>Using treated waste water at Iluka's Hamilton mineral separation plant</i>	19
<i>Using excess mine water for irrigation at Bobadeen</i>	21

Chapter 3: Implementation

Objective: Improve operational performance through effective water management	22
• Site water management plans and balances are critical tools	22
• Responsibilities, accountabilities and resources are allocated to implement site water management plans	25
• Continuously improve water performance using indicators and benchmarking	27
<i>Case study:</i>	
<i>Water inputs and outputs at Cadia Valley</i>	26

Chapter 4: Engaging stakeholders

Objective: Build relationships with stakeholders on water issues to generate mutually beneficial outcomes	29
• Water is managed as a shared community resource	30
• Other water users' rights and interests are respected	30
• Collaboration and partnerships provide opportunities and minimise business risk	31
• Engagement is based on transparency, trust and accountability	32
<i>Case studies:</i>	
<i>Industry - government collaboration at Hlsmelt®</i>	32
<i>Sustainable water management through community engagement</i>	33

List of figures

Figure 1: How the Strategic Water Management Framework informs business planning	7
Figure 2: Cadia Valley operations water balance	26



Introduction

This Strategic Framework for Water Management in the Minerals Industry aims to:

Promote a strategic approach to water management at mining and processing sites so that water is more efficiently managed and valued as a vital business, community and environmental asset.

Reliable access to water, its management and disposal, is critical for Australian mining and processing sites. Given growing public concern about water resources, the minerals industry has an urgent need to demonstrate, and be recognised for, responsible water management. Effective performance in this regard will help the industry maintain its social licence to operate and continue to grow.

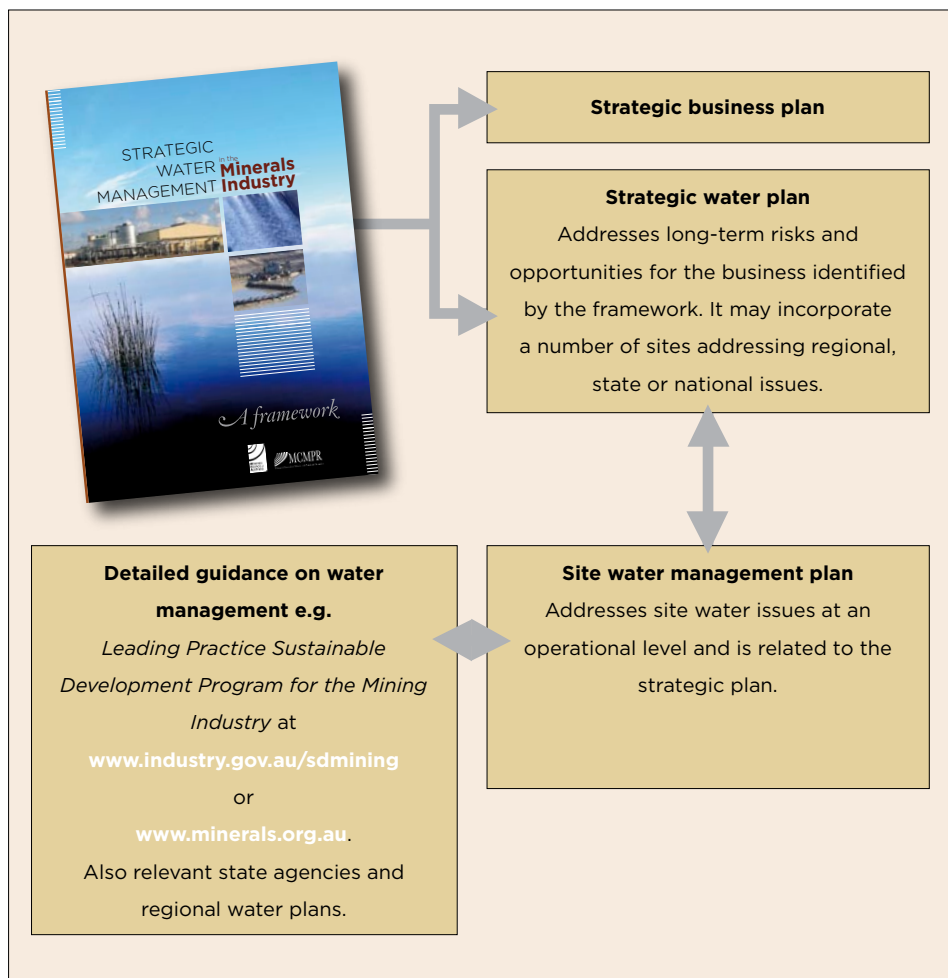
This framework sets out the strategic issues that minerals operations need to consider for responsible water management at a site and corporate level in order to manage risks and identify opportunities for continuous improvement. It provides high level guidance on issues that should be addressed in developing a water strategy for a business, as shown in Figure 1. These issues are addressed in four chapters: Valuing Water; Strategic Water Planning; Implementation; and Engaging Stakeholders. Case studies show leading examples of how applying the framework can result in social benefits, environmental improvement and enhanced business value.

The water debate is rapidly evolving and its drivers are dynamic, many falling outside industry control. The mineral industry's commitment to continuous improvement in water management and efficiency demands a strategic approach that takes into account:

- increasing competition for limited resources
- protection of water quality
- rising prices
- changing community expectations
- impacts of climate change
- evolving policy context.



Figure 1:

How the Strategic Framework for Water Management informs business planning



These issues present an urgent challenge to industry to find innovative solutions to protect businesses from rising costs and uncertain impacts on production. There is increased pressure for significant water users to manage water more sustainably and to recognise water as an asset on loan from the community.

Governments are responding to community concern by introducing wide ranging policy reforms, shown by the signing of the National Water Initiative. In response



to these developments, the minerals industry needs to be proactive by strategically planning for, and managing, water resources to deliver the following benefits:

- continued access to water for production and growth
- reduced operating costs from efficient resource use
- improved environmental outcomes and reduced environmental risk
- enhanced reputation through better stakeholder relationships that consider community expectations
- more efficient working relationships with regulatory authorities.

This high level framework does not aim to replicate publications that provide detailed guidance for water management. More detailed instructions for developing water management plans are presented in the Leading Practice Sustainable Development Program for the Mining Industry at www.industry.gov.au/sdmining or www.minerals.org.au. Other information is available from relevant state water agencies.

Audience

The framework is targeted at the following key audiences:

- corporate managers and planners responsible for providing strategic direction on water as input to business plans
- mine managers, water managers and environmental officers responsible for managing water programs and engaging with local communities.

Other audiences include a diverse range of minerals industry stakeholders, such as governments, the community, academics and non-government organisations who are interested in understanding the drivers for water-related decision-making at mine sites. The framework can be used as a communications tool to engage these stakeholders, and to demonstrate business intent and objectives in a transparent way.

Chapter 1: Valuing Water

Objective:

Manage water as a key business asset with social, cultural, environmental and economic value.

Principles:

- water is an asset with social, environmental and economic value
- decision-making reflects the true value of water.

Mineral operations need to manage water as a key asset with business value. Managing water solely as an operational issue leaves a business exposed to risks caused by not appreciating the social, environmental and economic values of water. For the purposes of this framework reference to 'social values' includes 'cultural values'. Adopting a strategic approach which takes account of the true value of water will provide business opportunities and risk protection.

As a significant water user and producer of waste water, the minerals industry has a role in the stewardship of water resources. Industry has responsibility for the wise management of water so that all users' current and future water needs are not adversely affected by its activities. This is a critical aspect for the industry to maintain its *social licence to operate*.

Water therefore needs to be regarded as a vital business resource requiring appropriate planning and accountabilities. The minerals industry must be actively involved in policy debates that could change present entitlements, limit access to new water supplies, or increase the cost of water supply and water discharge.

A stewardship approach will help deliver high standards in water management and a commitment to continual improvement. Stewardship requires a long-term perspective and considers production, community concerns, technology, research, and public policy issues.

Value of water at Comalco

Rio Tinto's Comalco aluminium business is situated in the Queensland regional centre of Gladstone. As a result of the historically severe drought in 2002, water in the local dam dropped to critical low levels prompting a call for Comalco and the other industries in Gladstone to reduce their water consumption by 25 per cent.

Comalco examined trading options and opportunities to use waste water from one activity as a raw material for another. The business achieved its reduction target through operational changes such as reconfiguration of flows in the cooling tower.

At the time, it was expected that a 50 per cent restriction would be imposed by June 2003. Comalco committed AUD2 million to seawater cooling technology, investigated thermal desalination, and the ability to apply reverse osmosis. It was estimated that if the business reduced production to meet water restrictions, rather than using technology and innovations, it would cost more than AUD135 million in lost revenue. Fortunately, in February 2003, heavy rains replenished the regional water supply, providing a three year supply of water.

Comalco continues to voluntarily operate under the 25 per cent restriction applied during the drought. Comalco's contract with the local water board does not currently provide any financial incentive for reducing water use; however, the contract is being reviewed.

This experience emphasised the value of water to Comalco and the need for a strategic approach to secure supply. The business is continuing to investigate other possible water sources including the potential use of grey water from industrial sites and municipal sewage plants.



Digestion units at Comalco Alumina Refinery (shown as tubes) where a focus on water efficient design means that the tubes contain process water and heat rather than losing both through dissipation from open tanks.

Water is an asset with social, environmental and economic value

Industry cannot take water for granted. Water's true value is often only appreciated when its quality has been impacted, when insufficient water is available, or if the operation is unable to discharge excess or waste water.

Some parts of the minerals industry, and the broader community, have viewed water as an inexpensive commodity, rather than an asset with significant value. It is important to recognise the role water plays in the environment and in the economic development of regions and communities.

Water of almost any quality has value. In many cases, the minerals industry has the capacity to replace fresh water with poorer quality water – such as saline and waste water – for mining and mineral processing and to recycle large quantities of water. Not only do these initiatives benefit communities and local ecosystems, but they provide operations with the means of addressing scarce water supply.

Industry's approach to water management is increasingly being scrutinised by external parties. For example, financial analysts are rating companies according to their exposure to, and management of, water risk as a direct threat to production. Adopting this framework will assist business position itself to positively respond to such analysis.


The National Water Initiative (NWI), described below, provides a blueprint for Australian water reform. It is vital that stakeholders work together to support this important reform and contribute to the development of approaches that will help to value water in a sustainable way. The Strategic Framework for Water Management in the Minerals Industry is consistent with, and complements, the NWI principles.

National Water Initiative

The National Water Initiative (NWI) is a comprehensive framework for water reform agreed to by the state and federal governments. Governments are committed to meeting key targets by 2010. These require significant legislative, policy and water planning changes to improve the productivity and efficiency of water use, while maintaining healthy river and groundwater systems.

The initiative builds on the 1994 Council of Australian Governments (COAG) framework for water reform agreed to by federal, state and territory governments. A major focus of this reform effort has been on agricultural uses (which account for 67 per cent of Australia's total water use) and on urban water use. The minerals industry is also a significant user of water and the obligations and benefits that flow from the NWI will have a profound impact on water access and management with resultant risk, operational and financial consequences. As the NWI reforms progress, areas of special importance to the minerals sector include:

- meeting challenges associated with restoring any over-allocated water systems to sustainable levels
- responding to government expectations that water will be used productively and efficiently – regardless of quality – resulting in greater emphasis on practices such as recycling, reuse, benchmarking and comprehensive site water planning and management
- proactively working with all stakeholders, including Indigenous groups, to better understand the local environment and issues, and identify opportunities for improved resource sharing at all project phases (such as mine treatment and usage of a town's grey water, or water sharing between projects)
- ensuring that mining/mineral processing continues to be a high value water user, consistent with reforms such as trading to facilitate water moving to its highest value use
- directly influencing policy and planning changes proposed by state regulatory agencies
- stressing the importance that any regulatory decision-making impacting upon water access – such as in response to environmental factors – is made transparently, in consultation with affected parties and based on sound science.



NWI clause 34 recognises the special circumstances experienced by the resources sector, such as its temporary operational nature (when compared with agriculture), large use of non-potable/hyper saline water and higher representation in the more remote regions of the country. Accordingly, the initiative acknowledges that different approaches may be required to assess resource sector proposals, including triple bottom line considerations.

Australian business should understand what is required under the NWI reforms. Resultant statutory and policy changes will manifest themselves in all jurisdictions, from state to catchment level. Industry must therefore actively engage in the consultation process that precedes these needed policy reforms. The high level guidance provided by this Strategic Framework for Water Management in the Minerals Industry, with its focus on valuing water, strategic water planning, implementation and stakeholder engagement, seeks to inform and guide wise water resource decision-making, consistent with NWI principles.

Decision-making reflects the true value of water

By considering the true value of water in their decision-making, businesses will be better placed to minimise waste and ensure water quality and security of supply for their production requirements. The need to protect the viability of natural water sources, such as rivers, means that more water is likely to be allocated by regulatory authorities to the environment. In addition, the price of water will increase to reflect the total cost of water supply.

The total economic or true value of water includes all direct market and non-market values. Market values include:

- cost of exploration and extraction of groundwater
- social, cultural, environmental and economic feasibility study costs
- waste stream disposal costs
- pump and licensing costs, plus labour for moving pipes
- cost of water supply
- reticulation costs such as pumping, storage and power consumption

- water treatment costs
- cost of maintaining water infrastructure and monitoring equipment
- cost of personnel involved in monitoring, managing and reporting water use
- mitigation and remediation costs in the event of spillage
- construction and rehabilitation costs of engineering works, such as river and clean/dirty water diversions
- cost of personnel associated with establishing and maintaining relationships with water stakeholders
- costs associated with fines for any breaches of regulations.

Non-market values include the social, environmental and economic benefits of protecting water ecosystems. Because these values are more subjective, they are difficult to quantify financially. Non-market values incorporate perceptions of water by external parties. They include:

- cultural and spiritual associations with water or the land on which water infrastructure is planned
- the value of ecosystem services reliant on the same water supply
- competing social demands on the same resource, such as domestic water supply or recreational use
- competing industry demand for the same resource
- social, cultural, environmental or economic impacts on downstream water users if water quality or quantity is affected by mining operations
- impact on reputation for perceived poor water management performance
- cost to the operation if water excess or waste water cannot be discharged
- economic value to allow production and processing to take place
- loss of income, jobs or market share if there are production cut-backs as a result of water excess or shortage.

The true value of water is collectively determined by the various users of the resource in the catchment area and beyond. While minerals operations in remote areas may not see much direct economic competition for this common resource, water is valued differently by its various users. Indigenous communities, for example, may value water beyond its economic or market value.

Increasing water use efficiencies at Yabulu Refinery

BHP Billiton subsidiary Queensland Nickel (QNI) operates a nickel refinery at Yabulu, in north Queensland. QNI's Yabulu Refinery refines more than 3.5 million wet tonnes of imported nickel laterite ores each year, producing high-quality nickel and cobalt products for sale into world markets.

Water is essential to operations and finding more efficient ways to reuse and recycle water to reduce 'new' water use is part of the operating philosophy. A strategy to improve efficiencies, known as the Yabulu Optimisation Initiative, provides the operation with a sustainable future through increased recoveries and throughput while decreasing unit costs.

QNI has identified numerous projects that offer potential environmental and economic benefits. Some of those projects, specifically aimed at energy and water reuse, were effectively commissioned in 2003.

The Green Water Re-Use Project recovers water, nickel and heat energy from a basic nickel carbonate slurry. The reuse of water from this project has saved about one million litres of new water per day, together with increased nickel recoveries.

The Cobalt Plant Water Re-Use Project recovers heat and water, saving more than 350,000 litres of new water every day together with energy savings.

These projects, and a third project involving Boiler Feed Water, have reduced the quantity of new water used in the production process by 20.3 kilolitres per tonne. The efficiencies have created natural resource savings and increased product sales worth more than AUD3.8 million annually. These successes confirm environmentally beneficial projects can also return a sound economic benefit.



Water monitoring at Yabulu Refinery



Chapter 2: Strategic Water Planning

Objective:

Position the business over the longer term through strategic water planning.

Principles:


- a strategic water plan enhances business value by maximising opportunities and minimising risks
- the water resource and its context is understood
- water issues are incorporated into business decision-making.

A strategic water plan will provide greater assurance that business growth objectives – which rely on water access, use and disposal – can be achieved. *Chapter 3: Implementation* provides an overview of how a strategic water plan is implemented at the site level through the site water plan.

A strategic water plan enhances business value by maximising opportunities and minimising risks

A strategic water plan is a key tool in managing long-term business risks and opportunities concerning water. It takes into account social, environmental, economic and operational aspects of water management. This approach enables a business to grow while anticipating changing community expectations and regulations. The plan should be informed by:

- corporate vision and operational business needs
- government policy
- state, regional and local water resource plans
- community expectations
- environmental conditions
- economic drivers.



The plan should also identify opportunities for the business such as collaboration and partnerships with the community, government, other industry, and research and development (R&D) organisations.

The strategic water plan is linked to the business plan and aligned with the key business objectives. The plan should address the major business challenges concerning water, such as major expansions, community concerns about water quality and quantity, environmental impact monitoring, and future government water policy. By its nature, the strategic plan should go beyond compliance and generate extra social, environmental and economic value.



The business case for a water strategy is that it:

- ensures continued access to water for production and growth
- reduces operating costs over the longer term from efficient resource use
- improves environmental outcomes and reduces environmental risk
- values water, including the social, environmental and economic aspects
- enhances business reputation through better stakeholder relationships that take into account community expectations
- provides more efficient working relationships with regulatory authorities.

The strategic water plan can support community engagement programs and help develop greater stakeholder awareness of operational water management. It will also provide business with the opportunity for positive recognition of its performance on water issues.

The primary elements of a water strategy can include:

- Managing water sustainably at operations
 - understand the water resource and its context
 - ensure high standards are used
 - provide direction on water reduction and water quality targets
 - identify water efficient technology and practices
 - identify long-term water risk and opportunities
 - promote a water efficient culture

- 
- 
- Understanding the value of water
 - factor water risk into relevant business decisions (for example, equipment upgrades, projects, operations, expansions, closure and R&D)
 - engage to understand community expectations of water when making business decisions
 - Supporting good governance and development
 - work with government to develop policy which is aligned with sustainable development objectives
 - support innovative R&D
 - Partnering with community groups, water utilities, non-government organisations, academia, other industry and governments at all levels in water-related projects to share expertise and demonstrate commitment to leadership and responsible water performance.

Sustainable water management can result in a significant gain for the minerals industry, individual companies and stakeholders. Water infrastructure on mine sites is often viewed as having community value during operations and subsequent to mine closure. Strategic planning will provide opportunities for early engagement with water agencies, neighbours, and the community to identify water-sharing projects and post-closure water management options.

Using treated waste water at Iluka's Hamilton mineral separation plant

Iluka Resources Limited is an international mining and mineral processing company that specialises in mineral sands. Iluka has recently commenced production of heavy mineral concentrate from its Douglas Mine near Balmoral in western Victoria.

To process the heavy mineral concentrate from Douglas and the Northern Murray Basin, Iluka is constructing a mineral separation plant (MSP) near Hamilton in Victoria. Heavy mineral concentrate will be processed at the MSP into rutile and zircon products before being transported to Portland for export.

The site of the MSP was selected due to its proximity to essential infrastructure, including road, rail, gas, electricity and, particularly, water. The MSP is located adjacent to Wannon Water's waste water treatment facility. The MSP will use secondary treated waste water from the facility for its mineral separation process. All water used on the site will be treated to Class A, allowing for human contact.

The construction of the water treatment plant was the result of a partnership arrangement between Iluka, Wannon Water and the Victorian Government. The reuse of waste water by the MSP has the potential to save up to 500 megalitres of potable water from Hamilton's water supply.

An Environmental Management Forum has been established to provide regular feedback to the community and regulatory agencies on the MSP's operations. The results of environmental monitoring programs, covering surface water, groundwater, air quality, noise and terrestrial systems, will be publicly available on a quarterly basis.



Iluka's mineral separation plant under construction



The water resource and its context is understood

Water resources are vested in, and managed by, the states.

Understanding the needs and aspirations of all water stakeholders is necessary to adequately identify and prioritise risks and opportunities (see Chapter 4: Engaging Stakeholders).

When establishing and maintaining a strategic water plan, minerals operations need to understand the existing and future water requirements of other stakeholders, including community, ecological, political, cultural and other industry issues. A strategic plan will take into account perspectives outside the catchment, including regional, state and national issues.

It is vital to understand future demographic trends, community expectations and Indigenous concerns, potential climate change impacts, other industrial competition for water, and political issues associated with water management.

As water becomes a more valuable asset and moves to higher valued uses, it is important that equity concerns regarding water access and water use are carefully considered.

Water issues are incorporated into business decision-making

The minerals industry's approach to water management is increasingly being scrutinised by external parties. To protect the business, each operation needs to incorporate water risk into key business decisions. This ensures that opportunities are identified and risks associated with water are addressed before they impact on operations.

A strategic water plan can contribute to due diligence processes associated with acquisition and divestment by more clearly identifying risks associated with water management and potential impacts on social, economic and environmental assets.

Using excess mine water for irrigation at Bobadeen

The Bobadeen Irrigation Scheme is an innovative means of disposing of surplus mine water generated by Xstrata Coal's Ulan coal mine, in the western coalfields of New South Wales. The scheme is the result of a two-year consultation program with the community and government agencies, and an extensive evaluation of water management/disposal options. Ulan commissioned the scheme at a project cost of AUD7 million.

Saline mine water is pumped six kilometres from Ulan Mine to a 502 megalitre storage dam. Water is pumped from the dam to five points where it is used to irrigate 242 hectares of vigorously growing perennial pastures. Beef cattle are grazed on the pasture to encourage regrowth and maximise water use through optimum plant growth.

The irrigation scheme, which straddles the Great Dividing Range, presented some unique environmental challenges. The scheme needed to meet salinity targets for the Hunter and Central West catchment areas. In consultation with the Federal Government, Ulan developed a pilot 'salinity offset program' to offset the residual salinity load arising from the irrigation scheme. This ensures there is no net increase in salinity load in the Macquarie and Hunter catchment areas.



Ulan Coal Mine, New South Wales, has an innovative scheme in place using saline water to irrigate 242 hectares of pasture near the mine.



Chapter 3: Implementation

Objective:

Improve operational performance through effective water management.

Principles:

- site water management plans and balances are critical tools
- responsibilities, accountabilities and resources are allocated to implement site water management plans
- continuously improve water performance using indicators and benchmarking.


A site water management plan comprehensively addresses particular operational issues, as distinct from a higher level strategic water plan discussed in the previous chapter.

Because water management is required for effective functioning and sustainability of all mineral operations, planning for site water issues should commence prior to any work on the ground. This planning would reflect the directions outlined in the company strategic water plan. In this way, potential social, environmental, economic and operational constraints on water management can be avoided or minimised; opportunities for post-mining land uses maximised; and innovative strategies can be implemented.

Linkages to documents providing detailed guidance for water management are contained in the Introduction section of this document. State water agencies are also important contacts.

Site water management plans and balances are critical tools

Consistent with the principles outlined in Chapter 4: Engaging Stakeholders, site water management plans should be developed in collaboration with relevant stakeholders such as water supply agencies and local communities.



A site water management plan should describe the historical performance and current status of water management, identify key issues and risks associated with future water usage, identify community issues, and present actions and targets to drive further improvements in water management at each operation.



A site water management plan should:

- identify legislative and other regulatory requirements relating to water management
- identify impacts on other users, upstream and downstream of the operation, including impact on ecosystems
- identify and assess water resources and their context, including ground and surface water
- identify operational water supply, recycling, and disposal needs using water and solute balances
- identify accountabilities and responsibilities
- identify opportunities for recycling and conservation, and using different qualities of water in place of high quality water
- manage treatment of waste water (regulated and unregulated discharges)
- develop monitoring and measurement regimes
- establish contingency plans using a risk-based approach.

Water costs money. To save money, an operation needs to learn how to use less, recycle more and to keep water as clean as possible for reuse and ultimate disposal. A site will gradually develop a water conservation culture by implementing and reinforcing effective water management practices. Training, reinforced by clear, unequivocal management support and adequate resources, will encourage employees to adopt efficient water use behaviour and lock in savings for the long-term.

In order to adequately understand the water resource and its context, baseline data relating to water resources, current and predicted water demand, and the surrounding environment (in particular, water dependent ecosystems) should be incorporated into the development of site water balances and water management plans.

There are numerous interactions with the water cycle, from exploration to mine closure. Minerals operations occur in different physical environments ranging from tropics to



deserts, so water management (supply, use, disposal, water losses) must reflect site-specific factors. Water quantity and quality requirements vary significantly across the industry and will be affected by the locality, the mining and processing methods, and the commodity being mined.

Issues associated with surface and groundwater resources must be considered in planning and developing operations. In some areas there may be a critical surplus of water so dewatering will be a major activity, with potential impact on neighbours, downstream users and the environment. In other areas a shortage of water, or poor water quality, will drive water efficiencies. Alternate water supplies and reviewing water allocation arrangements with other local users, such as towns and other industries, will also need to be considered.

Ongoing water measuring and monitoring needs to be undertaken for the life of the operation and for a period following closure. Monitoring should include:

- water inputs into the system (such as rainfall, supply water, groundwater extraction, surface water pumping, recycled water)
- outputs from the system including regulated and unregulated discharges (such as rainfall run-off, seepage, evaporation, groundwater)
- water storage (including reconciliation of input and outputs to ensure integrity of storages)
- water balance for solutes, such as salt, quality and contaminant
- local surface and groundwater quality and quantity (surface and groundwater both on and off site) to assess impacts from the operation on an ongoing basis.

A key aspect of water planning is final mine closure. Acceptable post-mining water objectives should be developed in consultation with relevant stakeholders. Adequate resources must be allocated to deliver the objectives of the closure plan. A post-mining water balance model needs to be developed and a risk assessment should be undertaken to identify:

- potential short and long-term financial, social, and environmental impacts
- management of water-related infrastructure for post-closure opportunities, such as recreation, town water supply, irrigation and wetlands.



Responsibilities, accountabilities and resources are allocated to implement site water management plans

There is increasing evidence that sites which demonstrate excellent water performance have allocated clear accountability for water management. Incorporating water management responsibilities and accountabilities into the planning process will ensure that identified tasks and controls are implemented. Water management is not just the responsibility of site engineering and environmental staff. Operating personnel need to be clear about their water management responsibilities and accountabilities.

Employees also need sufficient resources to implement the water management plan, including adequate training, skills, appropriate tools, funding and technological assistance. This could include access to qualified and experienced personnel in the area of hydrology, accurate monitoring and recording equipment, and infrastructure such as pumps, pipes and dams.

Processes should be implemented for ongoing communication.

Water inputs and outputs at Cadia Valley



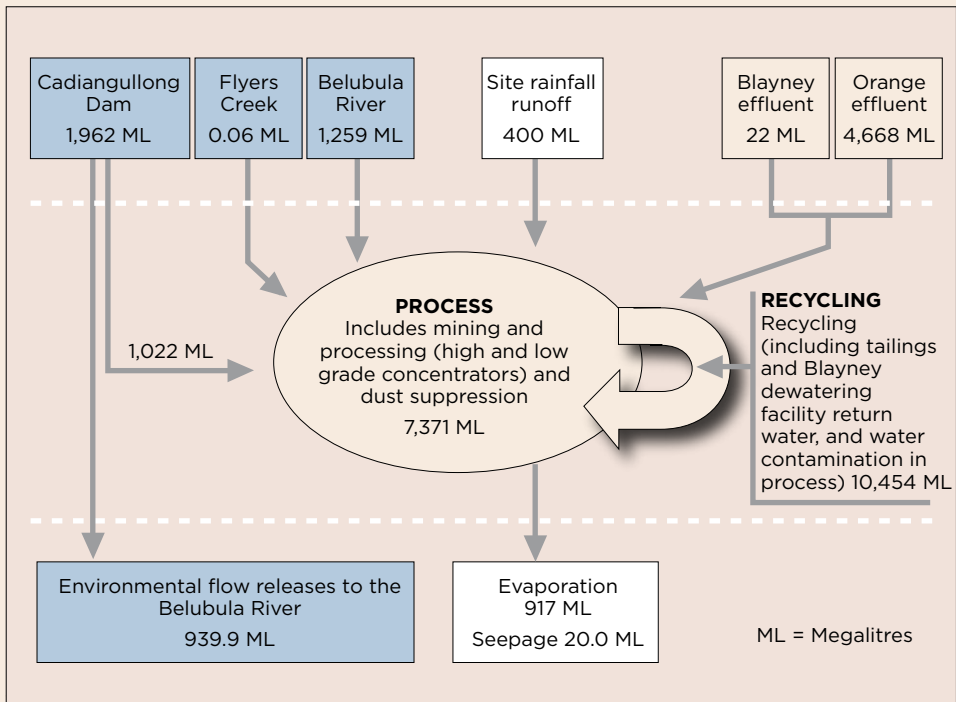
The dam is designed to overflow once full and contributes to maintaining high flow events in Cadiangullong Creek. During periods of low flow, water is released from the dam to satisfy environmental requirements.

Newcrest's Cadia Valley Operations are located 25 kilometres south of Orange in the New South Wales Central Tablelands. The operation consists of the Cadia Hill open pit and Ridgeway underground mines. Combined they produce 23 million tonnes per annum of ore, which is treated through a shared ore treatment facility producing 690,000 ounces of gold and 72,000 tonnes of copper a year.

On average, 80 per cent of water used at the operation is internally recycled. Water makeup is sourced, in order of priority, from site runoff, treated effluent town water from Orange and Blayney, licensed water from the Belubula River, and the purpose-built Cadiangullong Dam.

Some water from Cadiangullong Dam is released into Cadiangullong Creek for environmental purposes and for downstream water users. Cadia's water use and management is shown in Figure 2.

Figure 2: Cadia Valley Operations water balance



Continuously improve water performance using indicators and benchmarking

To reflect the dynamic nature of operations, water resources and changing external expectations, and to help achieve their business objectives, sites should audit or review water management plans regularly. Audits and reviews include ongoing identification of opportunities to improve performance or limit operational risk. Plans should include triggers for review such as different phases of activity, a time period, specific climatic conditions, or external requirements. Changes in the following aspects may trigger a review:

- water efficiency and reuse (including water sharing)
- water quality
- climate change predictions
- waste water management practices
- health of water dependent ecosystems
- review of water supply contracts
- community aspects
- company policy positioning.

Performance indicators are an excellent tool for evaluating the success of water management strategies and plans. Such indicators must be quantifiable and relevant to the business. Performance could be rated against:

- water management objectives and targets, such as minimal use of potable water and maximum reuse of process/mine water
- criteria derived from statutory requirements, such as licence limits and reporting protocols
- water quality guidelines specific to the site, such as the Australian and New Zealand Guidelines for Fresh and Marine Waters
- performance indicators from the Global Reporting Initiative (refer to Definitions)
- industry leading practice
- community/stakeholder expectations.



Performance against indicators should be reported internally and externally. Internal reporting is used by the business to manage risk and may include reporting of monitoring data, non-conformance incidents, specific water-related issues and complaints. External reporting provides a transparent process to communicate site or business water performance to key stakeholders and may include:

- statutory reports such as annual environmental management reports (or equivalent) and licence returns/reporting
- other public reports such as annual environmental, sustainability, corporate social responsibility reports, and community newsletters or regional newspapers.

Regular review of progress against performance indicators is critical for determining the effectiveness of water management systems and production performance. It is also the most effective tool for facilitating continual improvement in water management.

Chapter 4: Engaging Stakeholders

Objective:

Build relationships with stakeholders on water issues to generate mutually beneficial outcomes.

Principles:

- water is managed as a shared community resource
- other users' water rights and interests are respected
- collaboration and partnerships provide opportunities and minimise business risk
- engagement is based on transparency, trust, and accountability.

Engagement with various stakeholders by the minerals industry is essential as water is a shared community resource with differing rights, interests and values.

Effective management of water provides an opportunity to collaborate and establish partnerships that diminish business risks and maximise economic returns. An open and transparent approach to such partnerships further enhances trust among stakeholders, often providing business with a platform for dialogue on other issues.

The way water is sourced, used, planned and managed at mine sites varies significantly across Australia, giving rise to a range of complex and multidisciplinary issues. This means that stakeholders will hold diverse expectations for mine operators and their companies to consult and engage in order to maximise the opportunities discussed in this framework.

For more detailed information on stakeholder engagement, refer to Ministerial Council on Mineral and Petroleum Resources 2005, *Principles for Engagement with Communities and Stakeholders*.



Water is managed as a shared community resource

Water is a shared resource and using it has inherent responsibilities. In remote locations minerals operations may be the major or only significant user of water; whereas in other areas of the country, water resources may need to be shared with other industries and communities. Water management practices by minerals companies can be a sensitive social, cultural and environmental issue, particularly in times of drought and water restrictions. Minerals companies should ensure that stakeholders are fully engaged during planning, operation and closure of their operations.

Other users' water rights and interests are respected

Engaging with stakeholders will allow industry to successfully understand and respect people's rights and interests in water. Stakeholder views must be taken into account when companies are proposing business ventures which require significant quantities of water, or when developing new water infrastructure.

To maintain its social licence to operate, the minerals industry must consult effectively with communities on decisions that may affect them. Consultation is necessary for the development of shared objectives and creation of social, cultural, environmental and economic benefits for the company, its shareholders, employees and local communities, as well as the nation (as owner of the resource). This is especially so for water where, within a catchment area and beyond, the resource might be shared by a very broad range of stakeholders with diverse needs and expectations.

Collaboration and partnerships provide opportunities and minimise business risk

Partnering with the broad community at the local, regional and national level will enable the minerals industry to enhance opportunities and reduce business risk. Minerals operations could benefit from developing relationships with the following organisations:

- local businesses
- community associations
- neighbouring land users
- academic institutions
- non-government organisations
- government.

Industry can rarely achieve the best water management outcomes on its own. Most solutions to water supply, management and disposal issues require a range of stakeholder input. Such relationship building will occasionally require resourcing, facilitation, mediation or dispute settling procedures.

Due to the increasing value they place on water, communities have become key stakeholders in water planning and management, quality maintenance, disposal, and in identifying future water options for post-mining land use.

Developing open and honest partnerships provides businesses with the opportunity to share knowledge, expertise and equipment, and to better understand other perspectives on water management. Fostering positive, productive partnerships on water issues will often result in those parties becoming business advocates.

Ongoing research and improvements in technology are critical elements for improving water efficiency and management. Staying abreast of the latest research and technology will provide significant operating advantages and production improvements. Actively identifying opportunities to conduct or sponsor research and implementing the results will further enhance business performance and a reputation for leadership.

Industry-government collaboration at Hismelt®



The Kwinana Water Reclamation Plant treats secondary treated waste water into high quality industrial grade water.

Long-term water availability and use is a strategic issue for many businesses. In times of drought the potential business risks and operating costs associated with current and future water use issues are highlighted.

Rio Tinto's Hismelt®, a revolutionary new iron smelting technology, has addressed this issue at its Kwinana operation in Western Australia where it uses treated waste water from a nearby effluent plant.

Hismelt®'s partnership with the Western Australian Water Corporation provided the critical base-load demand needed by the corporation to enable the effluent treatment project to be built. The use of waste water, which would otherwise be discharged to the ocean, reduces demand on other water resources. The treated water is of sufficiently high quality to reduce water treatment requirement on the Hismelt® site. As well as lowering the amount of effluent discharged to the local marine environment, the arrangement has also improved security of water supply for Hismelt®.

Engagement is based on transparency, trust and accountability

Engagement goes beyond compliance with legislation. It is a process where the different perspectives, aspirations and concerns of all stakeholders are shared, acknowledged and accommodated, as appropriate. Effective engagement is based on open, transparent communication, collaboration, inclusiveness and integrity.

When looking to implement effective engagement strategies, it is important that minerals operations establish clear processes for communicating agreed information. Open dialogue and recognition of accountability in stakeholder relationships are important opportunities for minerals companies to foster mutual respect and trust. In turn, it is an opportunity to build a company's brand integrity.

Sustainable water management through community engagement

Western Australia's Collie Coal Basin has seen water being managed sustainably as both a company and community asset. The state's major coal mining operations take place in the Collie River catchment area, where there is an abundance of high quality groundwater. This means that dewatering is required to allow mining to occur below the watertable.

The Collie Water Advisory Group was established in the mid-1990s, through a partnership of coal companies, the local community, the state's energy provider (formerly Western Power, now Verve Energy) and the Western Australian Government. The group's proactive approach has produced a range of initiatives to improve water management in the basin and facilitate recovery of the groundwater system. Excess mine water is now allocated for use in cooling towers at two Verve power stations, a Centre for Excellence in Sustainable Mine Lakes is operating, and a groundwater model has been developed to facilitate greater understanding of the water resource.

Coal mining companies are also participating in a federal-state salinity action plan to improve overall water quality in the Collie River Basin. Extracted water not used for mining or cooling is used to recharge the aquifer to minimise ecological impact. Major social and economic benefits have also been derived by using coal mine voids for recreation and aquaculture.

These initiatives demonstrate the social, environmental, economic and business values of water, and the diverse range of opportunities that can arise when water issues are strategically planned for and managed.



Lake Kepwari, Collie, Western Australia. Compare the change from an abandoned coal mining void in 1999 to a 102 hectare recreational lake in 2000.

Definitions

Global Reporting Initiative: The Global Reporting Initiative (GRI) is a multi-stakeholder process and independent institution whose mission is to develop and disseminate globally applicable sustainability reporting guidelines. For information on water performance indicators consult Section 5 of Part C of the GRI 2002 *Sustainability Reporting Guidelines*.

Risk assessment: The process used to assess risks using a structured methodology. The process involves comparing the level of risk with predetermined standards, target risk levels or other criteria.

Stakeholder: At the 2002 World Summit on Sustainable Development, stakeholders were defined as ‘those that have an interest in a particular decision either as individuals or representatives of a group. This includes people who influence a decision or can influence it, as well as those affected by it’. Stakeholders might include local community members, non-government organisations, government (local, state or national), neighbours, suppliers, customers, media, shareholders and/or employees.

Social licence to operate: The social licence is the recognition and acceptance of a company’s contribution to the community in which it operates, moving beyond meeting basic legal requirements towards developing and maintaining the constructive relationships with stakeholders necessary for business to be sustainable. The concept includes relationships based on honesty and mutual respect.

Sustainable water management: Enough water, of sufficient quality, at the right time, and at the right place to meet the ongoing needs of this and future generations and of the ecosystem as a whole.

True value: The total economic or ‘true’ value of water includes all direct market values and non-market values. The true value accounts for the perceived value of water by external parties and the actual value for the continued operation of the business.

Water and solute balance: A diagram and/or table showing a mining operation’s water inflows and outflows of a specified type (such as average flow rates or volumes) and the quality of water inflows and outflows (such as salt concentration).

Water stewardship: Stewardship is a particular approach to natural resource management based on the idea of the developer or user being a temporary custodian of community assets. Stewardship implies that the proponent will take account of, and responsibility for, the foreseeable effects of the development, and will seek to enhance the benefits from the development for future generations.

References

Commonwealth Department of Environment and Heritage: *Best Practice Environmental Management – Water Management*, Canberra, 1999.

Economic Consulting Services: *Water and the Western Australian Minerals and Energy Industry: Certainty of Supply for Future Growth*, report to Chamber of Minerals and Energy of Western Australia and the Commonwealth and Western Australian Governments, Perth, 2004.

Environmental Resources Management: *Water Scarcity: An Emerging Risk for Business*, New York, March 2005.

Global Reporting Initiative: *Water protocol*, <http://www.globalreporting.org/guidelines/protocols/WaterProtocol030501.pdf>, Amsterdam, 2003.

Minerals Council of Australia: *Enduring Value – the Australian Minerals Industry Framework for Sustainable Development*, Canberra, 2004.

Minerals Council of Australia: *Minesite Water Management Handbook*, Canberra, 1997.

Ministerial Council on Mineral and Petroleum Resources: *Principles for Engagement with Communities and Stakeholders*, Canberra, 2005.

National Water Commission: *Institutional Arrangements in the Australian Water Sector*, information paper prepared by ACIL Tasman for the National Water Commission, Melbourne, December 2005.

The Australasian Institute of Mining and Metallurgy: *Proceedings of Water in Mining 2003*, Publication Series No 6, Brisbane, 2003.

World Business Council for Sustainable Development: *Collaborative actions for sustainable water management*, Geneva, April 2005.

World Business Council for Sustainable Development: *Industry, Fresh Water and Sustainable Development*, Geneva, 1998.

World Business Council for Sustainable Development: *Partnerships in Practice*, Geneva, 2000.

World Business Council for Sustainable Development: *Water - Facts and trends*, Geneva, 2005.

World Business Council for Sustainable Development: *Water for the Poor*, Geneva, 2000.

Useful web sites

Australian Water Association

www.awa.asn.au

Global Reporting Initiative - GRI

www.globalreporting.org/index.asp

Leading Practice Sustainable Development Program for the Mining Industry

www.industry.gov.au/sdmining

Minerals Council of Australia

www.minerals.org.au/

Ministerial Council on Mineral and Petroleum Resources

www.industry.gov.au/mcmpr

World Business Council for Sustainable Development (WBCSD)

www.wbcsd.org