A CONSOLIDATED APPROACH TO IMPLEMENTING BEST PRACTICE GUIDELINES, WATER USE LICENCE CONDITIONS AND INTEGRATED WATER AND WASTE MANAGEMENT PLANS IN THE MINING ENVIRONMENT – OPPORTUNITIES AND CHALLENGES

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ABSTRACT

South Africa is a water scarce country and experiences many water related challenges with respect to mining. A number of guideline documents have become available that provide an opportunity to marry together legislation and best practice into useable tools of implementation.

The preparation of an Integrated Water and Waste Management Plan (IWWMP) is a standard condition in Water Use Licences (WUL) for risk-based activities (21e, 21f, 21g, 21h and 21j water uses). The IWWMP therefore aims to provide a plan for the implementation of the WUL. In addition to legal compliance, implementation of best practice is also required to ensure mines operate in accordance with the principle of integrated water resource management. The Department of Water Affairs has captured current best practices for the mining environment in the Best Practice Guidelines series. In addition mining companies may have developed their own environmental standards and practices to achieve integrated mine water management. The existence of these and other inputs into the development of an IWWMP provides both opportunities and challenges which are discussed in this paper.

In maximizing the opportunities and meeting the challenges, the IWWMP becomes a living document serving as the tool for simultaneously achieving compliance against the WUL, implementing best practices, meeting company standards and achieving maximum environmental cost benefits for the mine.

1. INTRODUCTION

National Context

South Africa is a water scarce country and experiences many water related challenges with respect to mining. Water management at mines is primarily controlled by the National Water Act, Act 36 of 1998 (NWA) and, to a lesser extent, the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and the National Environmental Management Act, Act 107 of 1998 (NEMA).

Chapter 4 of the NWA addresses the use of water. This includes defining the permissible use of water, how quantities will be allocated and the licensing of water use. Section 21 of Chapter 4 of the NWA specifies which water users require a water use licence. In terms of Government Notice 519 of 6 May 2009 waste related water uses (21e–engaging in a controlled activity, 21f-discharging waste or water containing waste, 21g-disposing of waste in a manner which may detrimentally impact on a water resource, 21h-disposing of water which contains waste from or which has been heated in any industrial or power generation process and 21j-removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of the activity or for the safety of people) require registration by 30 August 2009. This registration is in preparation for implementation of the waste discharge charge system.

The key water management tools and regulations under the respective acts pertinent to mining and their influence on mine water regulation are presented in Table 1. The implication of this legislation is that a mining operation currently requires three different environmental authorisations prior to commencement of operations. The National Environmental Management: Waste Act 59 of 2008, superseded Section 20 permits in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989) as of 1 July 2009 and brings in a fourth environmental authorisation for mines in terms of a waste management licence.

Table 1**.** Key mine water management aspects of national legislation

Act and key management tool	Regulation	Specific to		Key aspects
		Mining	Water	
NWA: Water Use Licence	Regulation 704 (Government Gazette 20118, 4 June 1999)	No	Yes	Condition 4 restricts the location of any mine infrastructure within the 1:100 year flood line or 100 m of a watercourse (mine residue deposits, water storage facilities, plant, boreholes etc.)
				Condition 5 restricts the use of mine residue or other substances which may cause pollution of a watercourse
				Condition 6 requires separation of clean and dirty water
				Condition 7 requires prevention of pollution and water use efficiency
MPRDA: Environmental Management Plan	Regulation 527 (Government Gazette No. 7949 April 2004)	Yes	Yes	Condition 68 states that the provisions of the NWA shall apply to the water management and pollution control at all proposed prospecting or mining operations
				Condition 69 controls disposal of waste material, particularly the establishment of sand dumps and slimes (tailings) dams on the banks of surface water resources
				Condition 70 requires prevention of soil pollution and erosion control which if not controlled may adversely impact on surface water resources
				Condition 71 requires the siting of toilet facilities in such a manner that no water or other pollution is caused
				Condition 73 controls the management of residue stockpiles and deposits including waste characterisation and classification, site selection and design
NEMA: Environmental Impact assessment	Regulations 286 and 287 (Government Gazette No. 28753, April 2006)	No	No	List of activities that require either a basic assessment or environmental impact assessment
National Environmental Management: Waste Act:	None as yet	No	No	The issuing of a waste management licence for a waste disposal facility is subject to the inclusion in the licence of any conditions contained in a Record of Decision issued by the Minister of Water and Environmental Affairs regarding any measures that

Act and key management tool	Regulation	Specific to		Key aspects
		Mining	Water	
Waste Management Licence				the Minister considers necessary to protect a water resource as defined in the National Water Act, 1998 (Act No. 36 of 1998). (Application to the various mine residues is yet to be defined)

Each authorisation has conditions attached to it to which the mining operation is legally obliged to comply. These conditions do not exempt the operation from any other legal requirement not specifically included in the authorisation's conditions, for example, all Regulation 704 conditions apply unless an exemption is granted in the Water Use Licence (WUL). In addition, any commitments made in the application for authorisation are also legally binding. The result is a 'basket' of water management commitments and obligations as presented in Figure 1. Into this basket add in company and international standards and the 'basket' is ready to collapse.

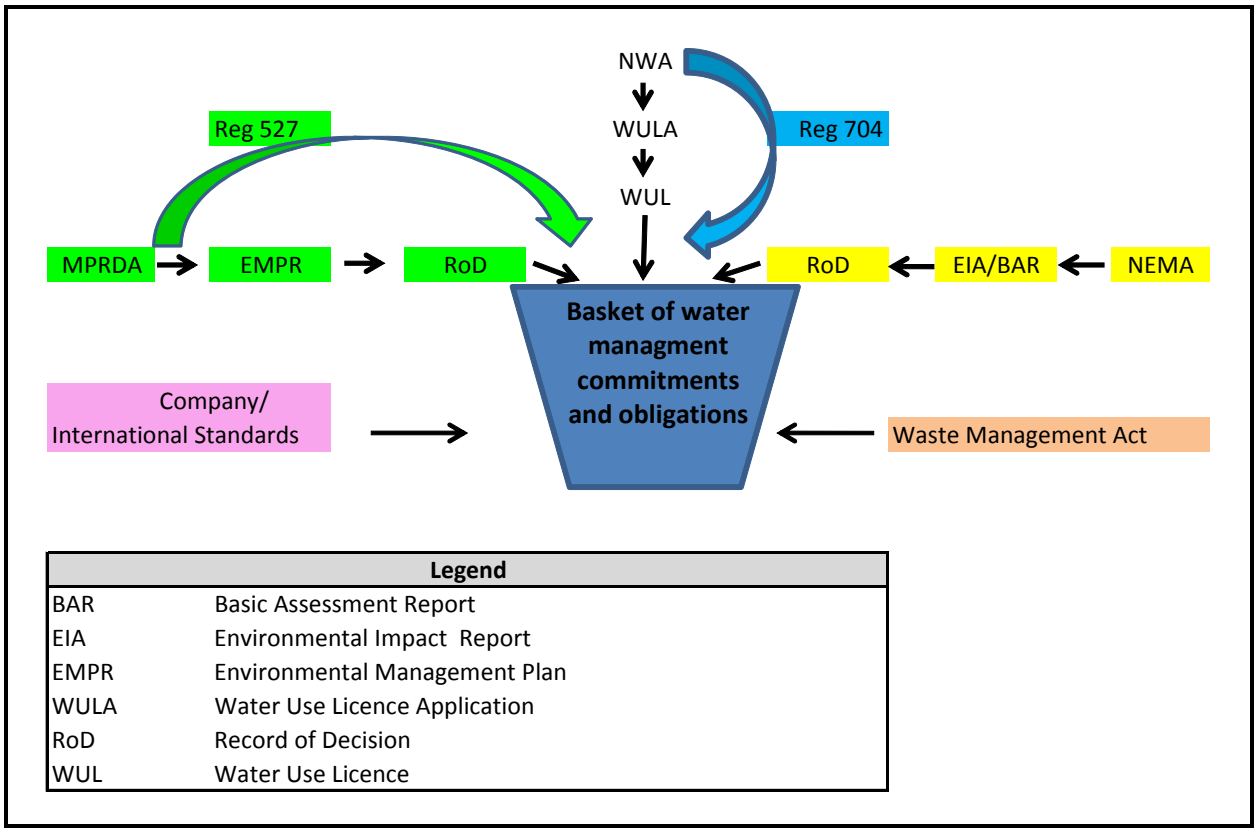

Figure 1. Inputs into the 'basket' of water management commitments and obligations

Local Context

Some metropolitan and industrial growth centres have developed around mineral deposits and are situated far from major water resources (DWAF, 2000), which has contributed to inequitable distribution of water amongst users and is exacerbated by the lack of policy to promote conservation (WISA, 2002). In some instances these issues have been addressed through development of partnerships between the mines and local government, for example:

- Treatment of acid mine drainage to provide potable water to the Emahlaleni Local Municipality as a joint initiative between Anglo Coal South Africa and BHP Billiton Energy Coal South (Mey, Naude and Bloy, 2008).
- Supply of final treated municipal sewage effluent to local mines to minimise potable water consumption by the mine and discharge by the local municipality.

- Mine run sewage plants that also cater to part of the local municipality area, with reuse of the final treated effluent in the mine to minimise potable water consumption in the mine processing circuits.

2. GUIDELINE DEVELOPMENT

Over the last decade, the Department of Water Affairs and Forestry (DWAF), now known as Department of Water Affairs (DWA), has recognised the challenges facing both the water user and the authorities (national, provincial and local) in managing the country's water resources in an integrated manner. This recognition has resulted in a number of guideline documents that provide the mining industry with an opportunity to marry together legislation and best practice into useable tools of implementation as well as the fostering of partnerships between mines and local government.

This paper focuses on the Integrated Water and Waste Management Plan (IWWMP) Guideline (DWAF, 2008) and the Best Practice Guidelines (BPG) series (DWAF, 2006, 2007, 2008).

Overview of IWWMP Guideline and BPGS

The preparation of an IWWMP is a standard condition in WUL's for risk-based activities (21e, 21f, 21h, 21g and 21j water uses). The IWWMP therefore aims to provide a plan for the implementation of the WUL and ongoing compliance with its Conditions. In addition to legal compliance, implementation of best practice is also required to ensure mines operate in accordance with the principle of integrated water resource management. The DWEA has captured current best practices for the mining environment in the Best Practice Guidelines (BPG) series. The core BPGs focus on the DWA water management hierarchy (DWAF, 2008), namely:

Pollution Prevention

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Minimisation of Impacts
Water Reuse and Reclamation
Water Treatment

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Discharge or disposal of waste and/or waste water
Site specific risk based approach
Polluter pays principle

The BPG's are, therefore, key to integrated water resource management and are described in Table 2 below.

Table 2: Overview of the Hierarchy Series of BPGs

Guideline 1	Title	Overview
BPG H1	Integrated Mine Water Management	This BPG is aimed at defining the overall role of the Best Practice Guidelines for Water Resource Protection in the South African Mining Industry in supporting integrated water management at mining sites and provides guidance on how and when to make use of the different BPGs and how to implement integrated water management at mine sites.
BPG H2	Pollution Prevention and Minimisation of Impacts	The core of integrated water management at mining sites is the mine water management hierarchy which essentially states that mines must, in the first instance seek to optimally implement pollution prevention measures. The common thread throughout all pollution prevention options is to prevent or minimize pollution through the application of appropriate assessment techniques, the application of appropriate design and the ongoing and effective management and re-evaluation of the installed pollution prevention measures. BPG H2 provides a Framework for a Pollution Prevention and Minimisation of Impacts Plan
BPG H3	Water Reuse and Reclamation	The focus is on development of appropriate water reclamation strategies based on optimal minimisation and prevention strategies at source. The BPG provides a Framework for a Reuse and Reclamation Plan
BPG H4	Water Treatment	The BPG describes the technical methodology that should be applied by a mine to identify the constituents of concern that may require mine water to be treated to enable sustainable reuse or discharge. It also considers the identification of suitable types of water treatment technology for the removal of constituents of concern and safe disposal of residues (brine and sludge management) thereafter.

3. INTEGRATION OF THE GUIDELINES WITH OTHER REQUIREMENTS

In addition to the DWA guidelines mining companies may have developed their own environmental standards and practices to achieve integrated mine water management. The existence of three major inputs into the development of an IWWMP provides both opportunities and challenges. Figure 2 illustrates the integration of the BPG, WUL and company standards and practices into the IWWMP.

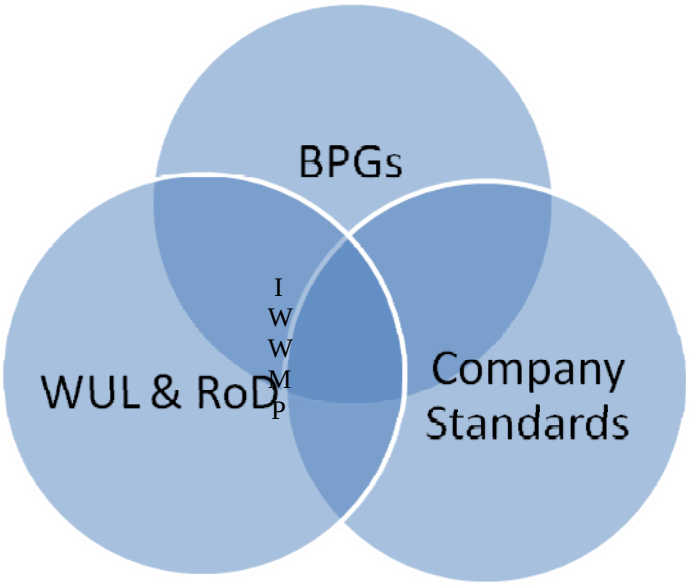

Figure 2. The basis for an Integrated Water and Waste Management Plan

The IWWMP is an outline of a comprehensive plan, devised in collaboration with the relevant mine personnel, to optimize water uses and minimize water-related impacts to achieve and maintain:

- Corporate and regulatory compliance
- Environmental benefits and continued stewardship
- Close/cordial/constructive community, neighbour and regulator relationships
- Significant reductions in operating and remediation costs
- Major reductions in closure liabilities
- Enhancements in the technical capacity and personal satisfaction of mine personnel
- Enviable company reputation and shareholder approval

The benefits of the IWWMP as well as the integration of all the water 'basket' (Figure 1) components together with the tools of the BPG's is depicted in the general model of operations management by Pycraft, Singh, Phihlela, Slack, Chambers, Harland, Harrison and Johnston (2000) in Figure 3.

4. OPPORTUNITIES

The IWWMP is an opportunity for the mine to specify its water-management objectives and targets, to develop its water management tools and its measures of progress and success (involving the designated mine team, using the BPG's as a resource, and work-shopping with consultants).

The IWWMP provides a structure that defines the regulatory framework and promotes:

- The setting of clear objectives and targets, aimed at achieving the benefits depicted in Figure 3;
- The development of tools such as a water monitoring program, interactive water balances, assessment techniques, trouble shooting measures, reporting structures;
- The formulation of strategies to achieve the objectives;
- The detailing of plans specifying targets, activities, resources, responsibilities, programs, feedback through monitoring, and modifications for the maintenance of success.

5. CHALLENGES

The challenge with regard to the IWWMP is to get mine management involvement in order to:

- drive the process
- take ownership and custody of the IWWMP
- have pride in their achievements.

Mine involvement may be driven by a number of factors as described in the case study below.

6. CASE STUDY

An existing mine located in Mpumalanga is situated in an area with a low evaporation potential with net positive summer rainfall. In addition the terrain is mountainous reducing the area available for storage of excess water hence discharge of this water is inevitable. An IWWMP was compiled for the mine's WULA, which incorporated the conditions in the licence framework document issued by DWA based on a previous WULA, the relevant BPGs, applicable commitments in the Environmental Management Programme Report as well as additional commitments made by the mine. This case study focuses on how the need for a WUL was used to get buy-in from all parties in the development of an IWWMP aligned to the BPGs. The IWWMP was submitted to DWA at the beginning of July 2009 and hence the case study does not deal with the implementation phase of the IWWMP.

At the outset of the project, the development of the IWWMP was viewed simply as an update of information supplied previously to DWA as part of the WULA. As the development of the IWWMP progressed a number of factors resulted in buy-in and active participation from the mine:

- the mine was made aware of the level of detail required in an IWWMP, the legal standing of the IWWMP (implementation of the IWWMP is a standard condition of a water use licence for mining) and the need to align the commitments in the IWWMP with the BPGs
- a scientifically valid motivation and management plan for the discharge would be required
- implication to the mine of not receiving a WUL or receiving a WUL that excluded provisions for discharge (potential mine closure with subsequent negative socioeconomic impacts)
- it became clear that not all the information was available with the mine or its holding company but rested with other consultants and contractors
- this information was not always appropriate or adequate for the IWWMP and additional work had to be done, for example the modelling of the discharge had to be further refined to address DWA's concerns regarding the need for an abstraction when there could be discharge water available.

The active participation of the mine and holding company took the form of work sessions and meetings held at the mine with the various consultants, contractors and relevant mine personnel participating as required. The key BPG in the development of the IWWMP was H3: Water Reuse and Reclamation as the mine will not be able to operate without receiving an authorisation for discharge. Application of the guideline principles was applied in the prioritisation of water reuse and reduction at source to minimise the discharge. This resulted in a framework for a reuse and reclamation plan which will be further developed as the mine plan progresses and the IWWMP is implemented. The draft IWWMP was thoroughly reviewed by the mine, holding company and key contractors resulting in ownership of the document. It is anticipated that this ownership will lead to implementation of the IWWMP, accompanied by monitoring and auditing of the implementation to further develop and optimise the IWWMP.

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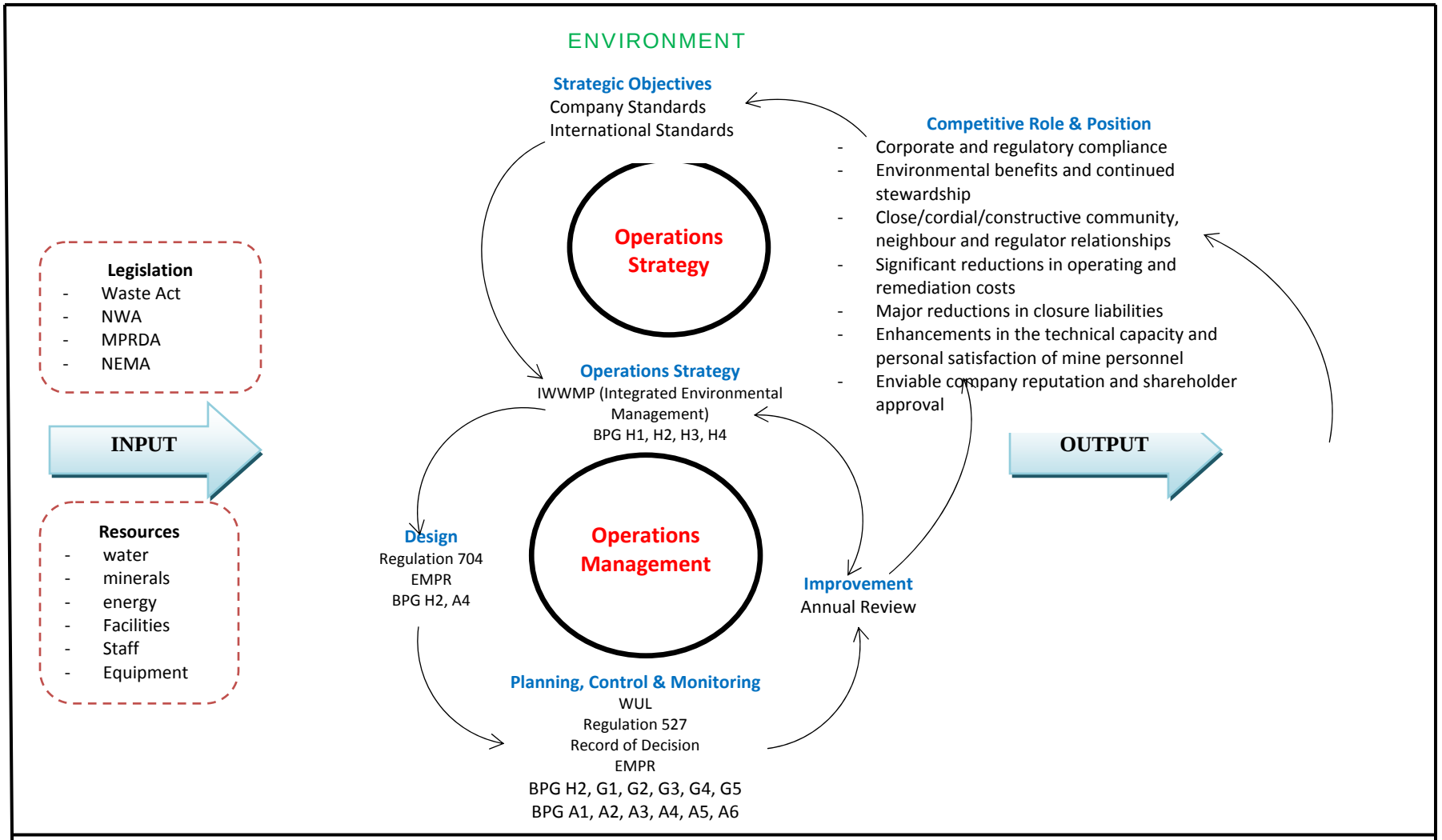

Figure 3. A general model of operations management illustrating the integration of the water management "basket" into mining operations and the advantages gained

7. WAY FORWARD

Suggestions for tackling the challenges and maximizing the opportunities reside in our ability to:

- comprehensively understand all the inputs into the water 'basket,'
- communicate openly through integration workshops with relevant mine personnel,
- develop a consolidated strategy,
- include appropriate EMP, WUL, Social and Labour Plan commitments and BPG's into contractor contracts.

Great effort and thought is required to generate the IWWMP the value of which lies not in the written pages but the implementation thereof.

8. CONCLUSIONS

In maximizing the opportunities and meeting the challenges, the IWWMP becomes a living document serving as the tool for simultaneously achieving compliance against the WUL, implementing best practices, meeting company standards and achieving maximum environmental cost benefits for the mine.

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