CUMULATIVE IMPACTS

A GOOD PRACTICE GUIDE FOR THE AUSTRALIAN COAL MINING INDUSTRY

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Cover image: Bulk carriers waiting to be loaded with coal off the port of Newcastle. Newspix/James Croucher

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The Centre for Social Responsibility in Mining (CSRM) and the Centre for Water in the Minerals Industry (CWiMi) are centres within the Sustainable Minerals Institute. CSRM works with companies, communities and governments to respond to the socio-economic and political challenges brought about by resource extraction. CWiMI is engaged in research, contracting services and education related to water use in the minerals industry.

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SUMMARY

The Australian mining industry and the coal mining sector in particular operate in an increasingly challenging environment of changing community expectations, increased governance and public scrutiny. It is in this context that cumulative impacts have assumed growing importance.

Cumulative impacts are the successive, incremental and combined impacts (both positive and negative) of an activity on society, the economy and the environment. They can arise from the compounding activities of a single operation or multiple mining and processing operations, as well as the interaction of mining impacts with other past, current and future activities that may not be related to mining. Cumulative impacts are most often raised in the context of multiple mining operations in established mining provinces such as the Bowen Basin and Hunter Valley. However, cumulative impacts may also arise through the interaction of mining with other activities and industries, such as grazing and broad scale agriculture, and thus may arise in emerging and prospective mining regions such as the Surat, Gunnedah and Galilee Basins. In the case of coal, the heightened prominence of climate change, a cumulative impact writ large, adds a further layer of complexity.

The Australian coal industry is responding to these challenges by strengthening company and site-level management systems, investing resources in engagement with communities and other external stakeholders, and developing mechanisms for regularly reporting on their social and environmental performance. For the most part, the focus of companies has been on managing the performance of their own operations. Cross-company collaborations, however, are essential to effectively respond to complex issues that are the result of multiple activities and actors. Collaboration at the national level, through industry associations such as the Minerals Council of Australia and the Australian Coal Association, must also be supported by regional multi-stakeholder partnerships; particularly in established mining areas such as the Hunter Valley and Bowen Basin, where there is a concentration of mining activity, or emerging areas, such as the Gunnedah and Surat Basins where new resource developments are interacting with other significant land uses. A collective approach to the management of cumulative impacts, ideally involving not just mines but government, community and other industries as well, has the potential to produce better sustainable development outcomes.

This guide, which itself is an example of cross-company collaboration, focuses on the opportunities and challenges involved in proactively identifying and responding to cumulative impacts at the local and regional scale and details examples of collaboration to assess manage, monitor and report cumulative impacts.

01 INTRODUCTION

This good practice guide was prepared to enhance the capacity of the Australian coal mining industry to identify, assess, manage and monitor cumulative community, economic and environmental impacts. The guide was prepared by the Centre for Social Responsibility in Mining and the Centre for Water in the Minerals Industry, Sustainable Minerals Institute, The University of Queensland, with the support of the Australian Coal Association Research Program. The guide aims to provide a practical resource to assist the industry and government to assess and manage the cumulative impacts of coal mining at the local and regional scale. It highlights examples and discusses methodologies on how best to identify and respond to cumulative impacts.

While the primary audiences for the guide are the coal mining industry, government policy-makers and regulators, the document has been written to make it relevant to the mining and minerals industry more broadly. Furthermore, the guide may be of interest to local communities impacted by mining, the research community and civil society organisations.

1.1 CUMULATIVE IMPACTS AND COAL MINING

Cumulative impacts are the successive, incremental and combined impacts of one, or more, activities on society, the economy and the environment. Such impacts can be both positive and negative and can vary in both intensity as well as spatial and temporal extent. Cumulative impacts may be generated through the aggregation or interaction of impacts (see section 2 Understanding Cumulative Impacts). Examples of impacts that have the potential to be cumulative are shown in **Table 1**.

In the mining context, cumulative impacts can arise from compounding activities of a single operation or multiple mining and processing operations, as well as the aggregation and interaction of mining impacts with other past, current and future activities that may not be related to mining. The nature and scale of cumulative impacts can vary considerably depending on such factors as the type of mining activity, the proximity of the mines to each other, the extent of other contributing activities, and the characteristics of the surrounding natural, social and economic environments. The compounding effects of multiple mine closures (a kind of 'reverse' cumulative impact where impacts are generated by the cessation of activities) can be as challenging for regional communities and economies.

The central idea behind the assessment and management of cumulative impacts is that it is insufficient to only consider the impacts of a single project or action. Sustainable development requires that the full range of human generated stresses are understood in their environmental, economic and social context. The role of the assessment of cumulative impacts is to identify, examine, and respond to such impacts. The aim of cumulative impact management is to keep the total effects of all stresses at acceptable levels and to enhance opportunities through co-ordination.

This good practice guide was prepared to enhance the capacity of the Australian coal mining industry to identify, assess, manage and monitor cumulative community, economic and environmental impacts.

TABLE 1: EXAMPLES OF COAL MINING IMPACTS WITH THE POTENTIAL TO BE CUMULATIVE.

EXAMPLES OF NEGATIVE IMPACTS	EXAMPLES OF POSITIVE IMPACTS
▸ Price inflation (e.g. housing and rents) and the disproportionate impacts on residents not employed in the mining industry. ▸ Overloading of existing social services (e.g. childcare, healthcare and education). ▸ Reduced visual amenity (especially in high density mining regions). ▸ Perceived and real loss of community identity due to demographic change. ▸ Increased noise and vibration from blasting and hauling. ▸ Reduced water quality (e.g. saline discharge into rivers). ▸ Increased dust and associated air quality issues. ▸ Reduced water quantity (groundwater draw and water table impacts from multiple mines and industries). ▸ Greenhouse gas emissions, including fugitive emissions. ▸ Traffic congestion and road degradation. ▸ Vegetation clearing and loss of biodiversity.	▸ Increased employment and economic investment. ▸ Regional and community development benefits from mine community investments. ▸ Local business development from mine procurement. ▸ Greater royalties and taxes. ▸ Road and infrastructure upgrades. ▸ Investment in biodiversity offsets and rehabilitation (on and off lease). ▸ Increased awareness of health and safety. ▸ Population increases that create a critical mass for better services and infrastructure (e.g. schools, and sporting teams). ▸ Development of human capital (skills, employment and training).

1.2 WHY IS THERE A NEED FOR A GOOD PRACTICE GUIDE FOCUSING SPECIFICALLY ON THE CUMULATIVE IMPACTS OF COAL MINING?

There are some compelling reasons for producing a guidance document which focuses specifically on cumulative impacts of coal mining in Australia.

First, cumulative impacts can be what are most important to communities, environments, and economies in the vicinity of mining operations because cumulative impacts are what they experience. The overwhelming number of components and complexity of interactions of cumulative impacts can be challenging for institutions and methodologies and may reduce the effectiveness of conventional mine-by-mine approaches. It is expected that this guide will help equip both industry and government to take a collaborative and proactive approach to assessing and managing cumulative impacts.

Second, with the expansion of coal mining in a number of Australian resource provinces cumulative impacts have assumed growing importance. Cycles of economic growth and contraction have resulted in major transitions for regional communities and environments. Mining expansion into new regions can also have the effect of contributing to already impacted environmental and social systems. The guide seeks to enhance the capacity of industry and government to identify, assess, manage and monitor cumulative impacts in a range of different contexts. The guide presents targeted approaches to manage cumulative impacts relevant to the range of operational settings: 'mature', high density, coal mining regions (e.g. Hunter Valley); dispersed mining regions (e.g. Bowen Basin); emerging regions (e.g., the Surat Basin); and prospective regions (e.g. Gunnedah Basin).

Third, there is a need to facilitate dialogue and information sharing within the coal industry, and between industry and regulatory and planning authorities, on the assessment and management of cumulative impacts. Cumulative impacts are receiving increasing attention and focus during the regulatory approvals phase of projects. It is hoped that this guide will advance such communication.

Finally, there is much to gain from increased consideration of cumulative impacts. Proactive and collaborative management of cumulative impacts can benefit regional environments and communities and contribute to industry's social license to operate. Resources are often not the limiting factor to better cumulative impact management. More effective co-ordination of existing resources may go a long way toward mitigation and enhancement, and better planning and assessment may help avoid adverse impacts, and exploit opportunities for positive investments and efficiency gains through reduced duplication. There are growing expectations that the (coal) industry will enhance its capacity to respond to changing regulatory and community expectations, and that governments will play a more effective co-ordination, service delivery and assessment role in resource provinces and resource communities.

1.3 THE BUSINESS CASE: OPPORTUNITIES AND CHALLENGES

The value of 'social license to operate' is increasingly evident within the extractive resource industries. Resource developers are more aware that unmitigated negative impacts have the potential to delay or prevent expansion of mining in existing and prospective areas as a result of community concerns. Likewise, for governments looking to realise the opportunities of resource development, the conditions in regional communities and environments must be a priority. The assessment and management of cumulative impacts play an important role in assisting industry and government to contribute to sustainable development, in mediating the relationship between communities, government and industry, and in earning and maintaining their social license to operate. Industry and government both have a responsibility to protect and promote community welfare and environmental sustainability from negative impacts and to maximise opportunities.

Improved processes for assessing and managing cumulative impacts also makes good business sense by assisting industry to:

- provide greater certainty for project investments and increase the chances of project success;
- avoid and reduce social and environmental risks and conflicts faced by industry and communities;
- identify issues early, avoid and reduce costs when compared to unplanned solutions, and incorporate unavoidable costs into feasibility, project development and planning;
- plan for social and physical infrastructure;
- inform and involve internal and external stakeholders and assist to build trust and mutually beneficial futures;
- improve the quality of life of employees and improve the attraction and retention of skilled workers;
- leave a positive legacy beyond the life of the project and thus increase competitive advantage;
- comply with regulatory requirements and international principles and standards; and
- enhance corporate reputation.

Pre-competitive research and development has long been a part of industry practice. Increasingly collaboration, synergies and co-ordination are also needed in the stages after mines have established. Leading practice efforts to address cumulative impacts are focussed on:

- delivering long term benefits to regions, economies and communities;
- a systematic and strategic approach to dealing with social, environmental and economic issues;
- effective regional and land use planning;
- partnerships and co-ordination with other resource developers, industries, government and non-government organisations;
- ongoing assessment and management that accounts for the totality of impacts on a system;
- timely, meaningful and coordinated community engagement and participation;
- the co-ordination and prioritisation of environmental and social investments and initiatives;
- collective reporting on the overall industry contribution and totality of activities and impacts; and
- open and responsive dealings with communities and stakeholders.

Cumulative impact management can level the playing field in which companies operate. When environmental and social systems reach their capacity to absorb impacts, effective allocation can share the responsibility of staying within limits or thresholds across all who are contributing to a problem, rather than leaving the last development in line, to experience the consequences of stricter standards or the prospect of the activity not proceeding.

The quality of life of employees is a priority for companies competing to attract skilled workers. Pressure on social infrastructure, such as schools, childcare, health services from the demands of mining operations and deterioration of environmental conditions such as air quality and water quality can reduce the amenity of resource communities and the attraction and retention of staff.

The assessment and management of cumulative impacts is a regulatory requirement in all Australian jurisdictions (see section 3). When development proposals attract public controversy the lack of attention to analysis of cumulative impacts can be an area where further assessment is requested, which can lead to delays in approval or rejection of the proposal. Cross-industry co-ordination and partnerships are also now expected by regulators.

Increasingly industry is also obligated to undertake comprehensive assessment and management of cumulative impacts under codes and agreements with industry associations, multilateral institutions and financiers (see Table 2), and corporate policies. The International Council on Mining and Metals (ICMM) and the Minerals Council of Australia (MCA) have both specified principles that require the consideration of cumulative impacts when proposing developments. Financial institutions, such as the International Finance Corporation (IFC) and those that have adopted the Equator principles also set standards that include the assessment of cumulative impacts as a condition of lending.

There are a number of challenges, however, to the effective assessment and management of cumulative impacts. Information on the plans and activities of other current and future projects (both mining and non-mining) can be difficult to ascertain, impacts may have temporal and spatial extents beyond those which can be studied by a single project, systems and their limits and thresholds may be poorly understood, particularly in regions of transition or where little research exists, and when information is available there are often issues with the compatibility of methodologies and data sets.

TABLE 2. RELEVANT INDUSTRY CODES AND LENDING STANDARDS.

CODE	DETAIL
International Council on Mining and Metals Principal 6 (2008, 10).	'Assess the positive and negative, the direct and indirect, and the cumulative environmental impacts of new projects – from exploration through closure.'
Minerals Council of Australia Enduring Value – Australian Minerals Industry Framework for Sustainable Development. Guidance on implementing ICMM Principles 6 & 9 (2005, 17, 23).	'Predict, assess and monitor emissions to air, land and water, including noise, odour and vibration; ensure design emissions are within standards and guidelines; make project changes as necessary to ensure commissioned site can meet emission standards; provide a basis for future improvements' 'Undertake social and economic research and assessment in partnership with communities and appropriate organisations to support planning and development of operations with subsequent management review of social and economic effects through the whole cycle' 'Recognise existing community planning processes and utilise these where feasible to achieve mutually beneficial social outcomes. Develop community partnerships and work to secure community ownership of the processes and outcomes.'
International Finance Corporation Performance Standard 1, No.5 (2006, 2)	Impact assessments should consider 'areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.'

1.4 HOW THE GUIDE WAS PREPARED

The information and advice presented in this guide has been drawn from a broad range of sources, including:

- a review of cumulative impact literature, legislation, government guidance documents and environmental impact assessments for coal developments submitted in Queensland and New South Wales;
- information and advice obtained through targeted consultations with industry personnel, regulators, planners, local government personnel and other stakeholders;
- reconnaissance trips to the Gunnedah and Bowen Basins, including meetings with key local government and community stakeholders;
- a study tour to Canada to investigate approaches for the management and assessment of cumulative effects, particularly in Alberta's Oil Sands region;
- research undertaken by the authors for ACARP project C14047, 'Assessing the Cumulative Impacts of Mining on Regional Communities: An exploratory study of coal mining in the Muswellbrook area of NSW', and ACARP Project C13079, 'Monitoring the Impact of Coal Mining on Local Communities';
- a simultaneous review of approaches to the management of social impacts in Canada, South Africa and Australia undertaken by the authors for the Queensland Government;
- peer review of academic publications prepared by the authors; and
- inputs and advice by the industry monitors appointed to the project.

Many of the sources used in preparing the guide are listed following each section.

1.5 SCOPE AND STRUCTURE OF THE GUIDE

This guide provides advice on the identification, assessment, management and monitoring of cumulative impacts and provides practical examples and methodologies drawn from working examples on how best to address cumulative impacts. The primary focus is on cumulative impacts in the social and environmental sphere, although the broad approach can potentially be applied to other types of impacts as well (e.g. institutional, cultural).

The guide is not intended to provide a definitive source of advice for managing and assessing social and environmental impacts, more generally. Instead it should be read as a source of good practice examples and advice on the additional challenges that cumulative impacts pose for coal mining operations. The guide is a companion to two earlier resources produced by the Centre for Social Responsibility in Mining and funded through the Australian Coal Association Research Program, '*Developing a Community Impacts Monitoring and Management Strategy: A guidance document for Australian coal mining operations*', and '*A Sourcebook of Community Impact Monitoring Measures for the Australian Coal Mining Industry*', both published in July, 2005.

The guide consists of the following sections:

Section 1

'Introduction', familiarises the reader with the topic and the purpose of the guide.

Section 2

'Understanding Cumulative Impacts', explores the concept of cumulative impacts in greater detail. The section outlines a typology of cumulative impacts, considers how impacts accumulate and interact, and discusses the implications for assessment and management.

Section 3

'Assessing Cumulative Impacts', scopes regulatory requirements at the State and Commonwealth level and outlines good practice assessment methodologies and practices.

Section 4

'Managing Cumulative Impacts', focuses on collaborative efforts to proactively deal with cumulative impacts at the site, regional and state scales. Multi-stakeholder initiatives between industry, community and government are presented to highlight the potential benefits of collaboration.

Section 5

'Monitoring and Reporting Cumulative Impacts', details approaches to collect, analyse and disseminate information on cumulative impacts.

Section 6

'Conclusion', reiterates the key messages developed within the body of the guide and outlines a conceptual approach to assist organisations to begin to better understand and manage cumulative impacts.

Appendix

'The Australian Black Coal Industry', provides contextual background on the industry and the environments, communities and economies in which the industry operates. Four resource provinces are described as well as some of the environmental, social and economic challenges specific to each region.

SECTION 1 FURTHER RESOURCES

Section 2

'Understanding Cumulative Impacts' provides an in-depth discussion of how impacts may aggregate and interact, including a typology of cumulative impacts.

For further guidance resources see:

- Brereton, D, Moran, CJ, McIlwain, G, McIntosh, J and Parkinson, K (2008). Assessing the Cumulative Impacts of Mining on Regional Communities: An exploratory study of coal mining in the Muswellbrook area of New South Wales. Centre for Social Responsibility in Mining, Centre for Water in the Minerals Industry, The University of Queensland. Australian Coal Association Research Program (C14047). 145p.
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02 UNDERSTANDING CUMULATIVE IMPACTS

Understanding the different ways by which cumulative impacts aggregate and interact is crucial for formulating appropriate strategies to avoid, mitigate, or enhance impacts. Such information should ideally be collected and up-dated across the life-cycle of mining projects, using impact assessments, research projects, and ongoing monitoring.

2.1 WHAT ARE CUMULATIVE IMPACTS?

Cumulative impacts are the successive, incremental and combined impacts of one, or more, activities on society, the economy and the environment. Cumulative impacts result from the aggregation and interaction of impacts on a receptor and may be the product of past, present or future activities.

Cumulative impacts can be both positive and negative and can vary in intensity as well as spatial and temporal extent. Cumulative impacts may interact such that they trigger or are associated with other impacts. They may aggregate linearly, exponentially or reach 'tipping points' after which major changes in environmental, social and economic systems may follow.

2.2 HOW DO CUMULATIVE IMPACTS AGGREGATE AND INTERACT?

Impacts may aggregate and interact in three main ways:

Spatial impacts are those which occur over an area. Spatial impacts may vary in both extent and intensity. A spatial extent impact may consist of the area over which vegetation has been cleared for mining, while spatial intensity impacts may occur in areas where there is overlap between spatial extent impacts from more than one source, such as an area of dust deposition where the source of the dust is several upwind mine sites.

Temporal impacts are those that vary over time. Simple temporal impacts have a specific time of commencement and a measured form over time, for example the economic activity in a nearby town tracing a similar time series to the production of a group of mines. Offset temporal impacts occur when multiple simple temporal impacts are superimposed upon one another over time. The simplest types are where the same simple temporal impact comes from one mine at time t and from a second mine at time t+1.

Linked impacts involve more complex interactions such as where one impact triggers another or where a single activity has multiple effects. Linked triggered impacts are those that occur when one impact, either by its occurrence or by reaching a threshold level, causes another impact that would not otherwise have occurred. The second impact is the triggered impact. An example of a triggered impact would be when the economic activity in a town, associated with multiple operating mines, becomes sufficiently large for a new amenity to be financially viable, e.g., a new shopping outlet. Similarly, as the population of a community grows it is able to support more activity networks such as sporting teams and may attract more government resources (e.g. for education, health and law enforcement).

Linked associative impacts occur where multiple direct or indirect impacts occur as a result of a single action. Continuing the example above, rapid economic and population growth may have the associated impact of increased traffic, and shortages of accommodation and services, such as childcare. Cumulative impacts tend to compound, such that the entity experiencing or receiving multiple impacts may be more sensitive to each individual impact than if they were experiencing them in isolation.

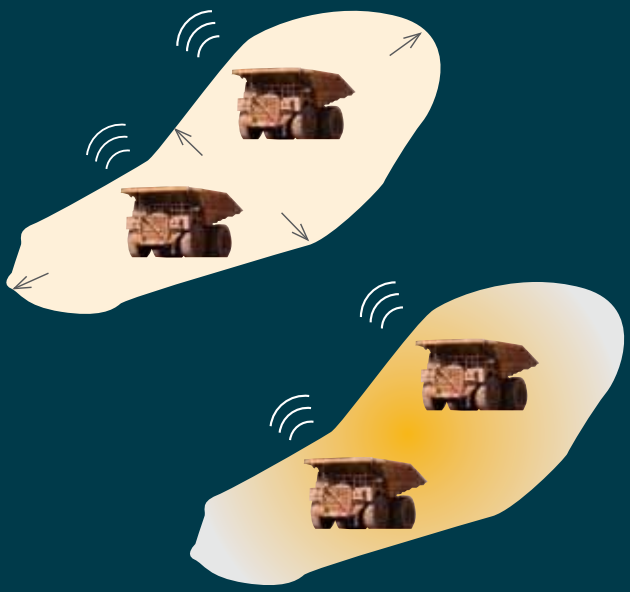


FIGURE 1: CUMULATIVE IMPACTS CAN VARY BY SPATIAL EXTENT AND SPATIAL INTENSITY, FOR EXAMPLE, THE NOISE IMPACTS OF MINE TRUCKS FROM MULTIPLE OPERATIONS OR PITS.

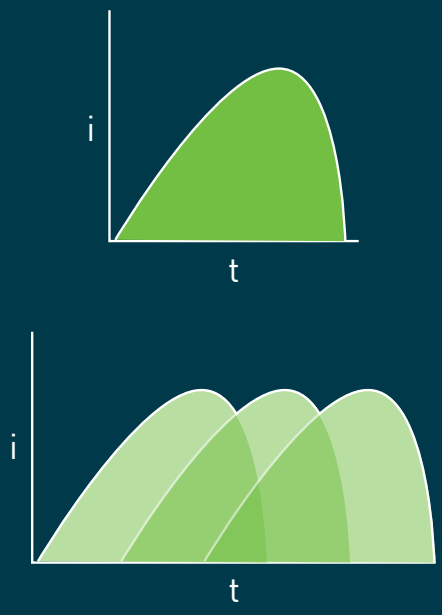


FIGURE 2: THE SPATIAL INTENSITY, SPATIAL EXTENT AND INTERACTION (TRIGGERS AND ASSOCIATIONS) OF IMPACTS (I) CAN VARY OVER TIME (T). MULTIPLE IMPACTS MAY BE OFFSET DUE TO DIFFERENT POINTS OF COMMENCEMENT AND FORM OVER TIME.

2.3 IMPACT PATHWAYS

Impacts can result directly from an action or from a pathway or chain of indirect impacts. Understanding the process of causation is an important aspect of managing impacts. Impact pathways can be traced by determining the actions (and non-actions) that lead to effects. The terms direct and indirect are used to describe a causal relationship. It is important to note that the same impact can result from different direct or indirect pathways, different activities, or different types of accumulation (aggregation and interaction).

Cumulative impacts may result from the aggregation and interaction of direct or indirect impacts. Depending on the context and the location in time and space, different receptors (such as a social group, river or geographic region) may experience the same impacts differently. A mining-related activity may generate multiple direct and indirect impacts and/or contribute toward existing stresses/opportunities within social and environmental systems generated from other (non-mining) activities.

Cumulative impacts are not necessarily a part of a causal pathway, that is, a cumulative impact may result from the aggregation or interaction of impacts from multiple unrelated sources. An example of this may be the cumulative social impact experienced from the aggregation of different amenity impacts of mining (such as noise, dust, vibration, scenic amenity).

The presence of one impact may also change how another may be experienced, independent of how that impact was generated.

Understanding these relationships is important to effectively manage, avoid, mitigate and enhance impacts. The cause and effect relationships, and the ways that impacts aggregate and interact can be understood through impact assessment methodologies (see section 3) and research and monitoring (see section 5). Through such understandings management can be tailored to achieve specific outcomes (see section 4).

2.4 SOURCE AND SINK IMPACTS

An additional distinction that is evident in cumulative, as well as direct and indirect impacts is that between source and sink impacts. A sink impact results from the addition of material to a receiving environment (the outputs of an activity; e.g. coal dust, greenhouse gas, or social investments). A source impact results from the extraction of natural, social, human or economic resources (the inputs of an activity; e.g. the water draw from a river or pressures on health services).

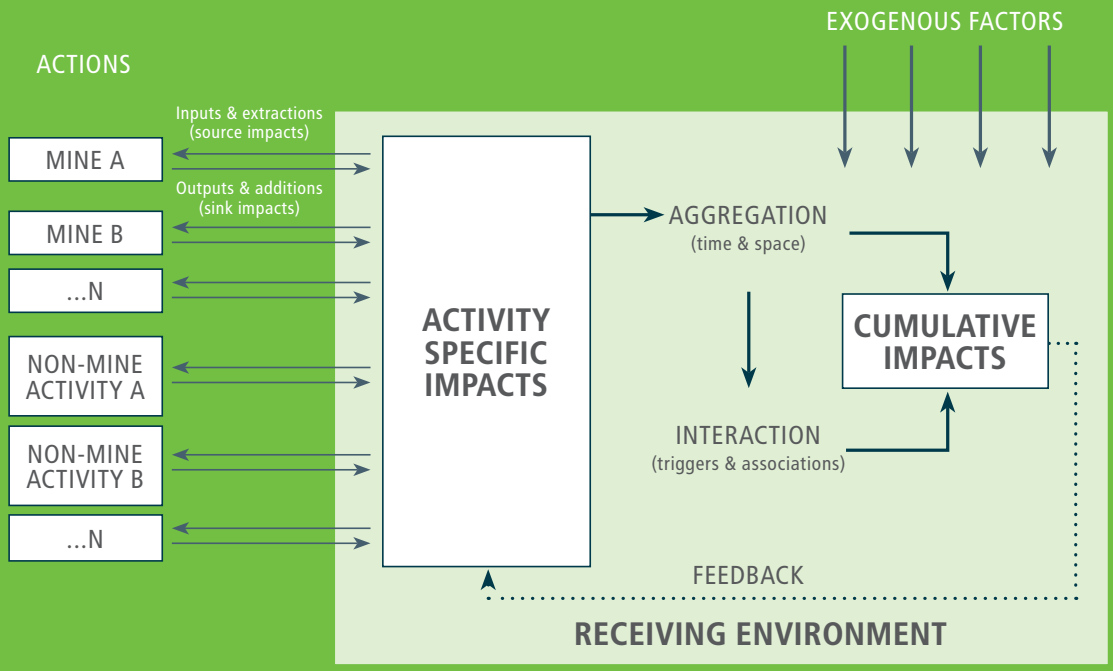
For both source and sink impacts it is important to have a good understanding of the nature of the impact and the responsiveness of the environment. Arguably the interaction between sink impacts and their environment are better understood in the mining context than source impacts. This is probably because the attention paid to discharges, such as air and water, has led to research to define thresholds above which impacts are considered significant. With the exception of impacts on air quality (most notably greenhouse gases) the spatial extent of most sink impacts, arising from mining, are local (vibration, noise, dust, and amenity) and more clearly bounded (e.g. watersheds, airsheds and bioregions). On the other hand, source impacts, such as changes to surface and groundwater, biodiversity, social services, human resources (e.g. skills and employment), and social infrastructure (e.g. housing and health services) can be difficult to understand in both baseline and impacted states and may extend across ill-defined spatial extents.

2.5 A SYSTEMS APPROACH

The sustainability of environmental and social systems requires that the totality of impacts on a receiving environment are understood. Impacts can be generated as a direct result of mining or non-mining activities, indirect and direct pathways, the aggregation and interaction of direct and indirect impacts into cumulative impacts, and the feedback of cumulative impacts to produce further indirect and cumulative impacts.

FIGURE 3 illustrates a conceptual model of cumulative impacts in mining. The scope of the receiving environment will vary in spatial and temporal extent (e.g. a catchment, airshed, local government area, household, or bioregion) but once defined all of the contributing activities and impacts should be understood. This includes past, current and reasonably foreseeable future impacts. The definition of the receiving environment will vary for different impacts. This is best done collaboratively with the participation of government, communities and other industries. Receiving environments may be influenced by external forces that are not activity generated impacts. These 'exogenous factors' may include variations in climate, global economic conditions or social and cultural trends.

FIGURE 3: A CONCEPTUAL FRAMEWORK OF THE CUMULATIVE IMPACTS OF MINING.



SECTION 2 FURTHER RESOURCES

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03 ASSESSING CUMULATIVE IMPACTS

Cumulative impacts should be identified and assessed across the lifecycle of mining and resource processing operations. This includes all of the activities from exploration, though to post-closure and from extraction and processing through to recycling and waste management. Cumulative impacts can be effectively identified and assessed at the scale of a single activity, project, region, policy or program. Depending on the scale and significance of the action cumulative impacts can be identified and assessed as part of environmental impact assessments (EIA), social impact assessments (SIA) and regional or strategic assessments – or may be the subject of studies specifically devoted to identifying and responding to cumulative impacts (sometimes called cumulative effects assessments).

This section provides guidance on how to account for cumulative impacts during the impact assessment process.

Cumulative impacts can be effectively identified and assessed at the scale of a single activity, project, region, policy or program.

3.1 THE TYPES AND PHASES OF IMPACT ASSESSMENT AND MANAGEMENT

Impact assessment is a process for understanding and responding to the environmental, social, cultural and economic issues associated with development. It should be approached as an iterative process, rather than a one-off activity, and be focused on how to identify, avoid, and mitigate negative outcomes and enhance positive outcomes. Impact Assessments can be predictive (what is expected to happen) or evaluative (what happened and why). They can be focussed on assessing impacts at the scale of a project, plan or a region. Impact management generally refers to systems and strategies that are implemented during the different phases of a development (including exploration) to monitor, report, evaluate, review and proactively respond to change.

Not all impacts are predictable. Because communities and environments are dynamic, an element of uncertainty will always be present. Similarly, not all impacts can be avoided, or mitigated. But impact assessment can provide insights, focus attention, and identify key issues from stakeholders to predict and anticipate change. Impact management can also assist industry and governments to proactively address the intended and unintended consequences of mining developments. The form and level of assessment and analysis will be determined by the significance and scale of the action and the sensitivity of the community and environment.

Impact assessment and management consist of a number of distinct, yet iterative, phases (**Figure 4**).

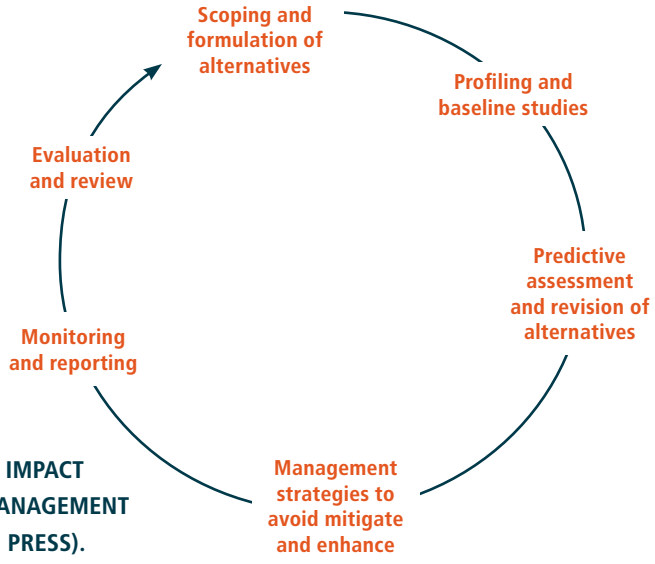

FIGURE 4. PHASES OF IMPACT ASSESSMENT AND MANAGEMENT (SOURCE: FRANKS, IN PRESS).

The following sections discuss cumulative impacts with reference to project-level assessments (section 3.2) and strategic assessments (section 3.3). Section 3.4 provides guidance on how cumulative impacts can be addressed within the different phases of impact assessment. Section 4 will address the management of cumulative impacts and Section 5 discusses the monitoring and reporting of cumulative impacts.

3.2 PROJECT-LEVEL IMPACT ASSESSMENT

Impact assessments are most commonly undertaken as part of regulatory approval processes during project development. Such assessments are mandated by governments and are focussed on predicting impacts related to a specific project.

Voluntary project-level impact assessments may also be undertaken by resource developers independently of what is required by government. Such assessments are usually initiated in response to a major change in the project or community; for example, in preparation for closure or for a major expansion, or to assist with the planning of a resettlement.

REGULATORY REQUIREMENTS FOR THE ASSESSMENT OF CUMULATIVE IMPACTS

Impact assessments are required to be undertaken in both Queensland and New South Wales as part of regulatory approval processes. The assessments in both states follow the same essential process:

1) the production of an initial advice statement (Queensland) or application for approval (New South Wales) by the proponent that broadly outlines the scope of the proposal;
2) the development by the relevant agency of a Terms of Reference (Queensland) or report detailing the environmental assessment requirements (New South Wales) to be covered in the assessment (in Queensland the ToR includes provision for public comment, while in NSW the requirements must take into account the views of other government agencies);
3) the production of the Environmental Impact Statement (EIS) by the proponent (which includes social impacts);
4) a period of public review and comment, and if required by the relevant authority, a supplementary EIS to address issues raised by public submissions; and
5) a decision whether to approve the proposal and an environmental assessment report that provides an overview of the process and indicates whether the EIS has complied with the Act.

In both New South Wales and Queensland the environmental impact assessment procedures require proponents to address cumulative impacts. Table 3 lists the current requirements under relevant Australian, Queensland and New South Wales legislation and policy. In practice these requirements are specified in the terms of reference or assessment requirements of the impact assessment.

Cumulative impacts are commonly raised by stakeholders in public submissions to impact assessments and during community consultation. In cases where assessments have not adequately addressed such impacts further assessment may be requested, which can lead to delays in approval or even rejection of the proposal.

Insufficient treatment of cumulative impacts can also be a target for litigation (Kennett, 1999). For example, at Newmont's Carlin Trend gold deposits in Nevada a court ruled that the environmental impact statements (submitted in 1997) did not adequately consider the potential for cumulative impacts arising from the proposal to expand the mines, thus sparking an 11 year delay (Pettit and Grotbo, 2008).

TABLE 3. REQUIREMENTS TO ADDRESS CUMULATIVE IMPACTS IN RELEVANT AUSTRALIAN, QUEENSLAND AND NEW SOUTH WALES LEGISLATION AND POLICY.

LEGISLATION/TERMS OF REFERENCE	INDICATIVE EXTRACT
COMMONWEALTH	
Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (March 2010)	No specific mention of cumulative impacts though the act requires consideration of reasonably foreseeable indirect impacts by third parties. Impact is defined to include direct, indirect and reasonably foreseeable consequences of actions. Federal court rulings have interpreted the act to include cumulative impacts. The 'Hawke' review of the EPBC act has signalled that cumulative impacts will be a focus of reform.
QUEENSLAND	
Qld Environmental Protection Act 1994	The Act makes no distinction between cumulative or other impacts, but expects an EIS to assess all such impacts. The draft ToR must be 'in the approved form.' In practice this means that project ToR must be based on the generic ToR developed by the Department of Environment and Natural Resource Management.
Qld Department of Environment and Resource Management Generic ToR (2010)	The generic ToR does not require a separate section for cumulative impacts, but rather requires them to be assessed in issue-related sections, such as those for ecology, social impacts, or noise. Indicative extracts from the generic ToR are: "Describe any cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned development or sources of contamination." "The cumulative impacts of the project must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts". "Where impacts from the project will not be felt in isolation to other sources of impact, it is recommended that the proponent develop consultative arrangements with other industries in the proposal's area to undertake cooperative moniToRing and/or management of environmental parameters. Describe such arrangements in the EIS."
Qld State Development and Public Works Organisation Act 1971.	The Act makes no distinction between cumulative or other impacts. Act requires compliance to the ToR finalised by the CoordinaToR General.
Qld CoordinaToR General. Generic ToR (2010)	'The EIS should summarise and describe cumulative impacts 'in combination with those of existing or proposed project(s) publicly known or advised by [the Department of Infrastructure and Planning] to be in the region, to the greatest extent practicable. Cumulative impacts should be assessed with respect to both geographic location and environmental values. The methodology used to determine the cumulative impacts of the project should be presented, detailing the range of variables considered, including where applicable, relevant baseline or other criteria upon which the cumulative aspects of the project have been assessed. 'The EIS should provide a comparative analysis of how the project conforms to the objectives for 'sustainable development'....'This analysis should consider the cumulative impacts (both beneficial and adverse) of the project from a life-of-project perspective, taking into consideration the scale, intensity, duration and frequency of the impacts to demonstrate a balance between environmental integrity, social development and economic development.' 'The SIA will include an evaluation of the potential cumulative social impacts resulting from the project including an estimation of the overall size, significance and likelihood of those impacts. Cumulative impacts in this context is defined as the additional impacts on population, workforce, accommodation, housing, and use of community infrastructure and services, from the project, and other proposals for development projects in the area which are publicly known or communicated by [the Department of Infrastructure and Planning], if they overlap the proposed project in the same time frame as its construction period'.
NEW SOUTH WALES	
NSW Environmental Planning and Assessment Act 1979.	The Act makes no distinction between cumulative or other impacts (except in environmental assessment of fishing activities).
NSW Department of Urban Affairs and Planning (2000). Coal Mines and Associated Infrastructure. EIS Guideline.	▸ '(a) identify other existing or proposed activities in the area with similar environmental impacts or which are likely to impact on the same elements of the environment (e.g. clearance of the same type of habitat)' ▸ '(b) assess the extent to which the environment affected by the proposal is already stressed' ▸ '(c) identify any likely long-term and short-term cumulative impacts, such as air quality, noise or traffic disturbance, visual impacts, surface water and groundwater issues, public health; or loss of heritage items, vegetation or fauna habitat' ▸ '(d) consider the receiving environment's ability to achieve and maintain environmental objectives', and ▸ '(e) consider options for integrating operations with adjoining mines to obtain operational synergies, reduce costs, prevent environmental impacts or lessen land degradation (e.g. spoil transfer, wastewater exchange for reuse, integrated rehabilitated landforms, joint rail or road haulage works, joint coal handling or treatment facilities, integrated and shared moniToRing networks and programs).'

Even in cases where legislation does not explicitly mention cumulative impacts courts may rule to mandate their inclusion, such as recent cases involving the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Given these circumstances proponents are well advised to consider and account for cumulative impacts within project-level assessments as a matter of course.

Queensland

In Queensland, mining projects are commonly assessed under the *Environmental Protection Act 1994*. In such cases the process is managed by the Department of Environment and Resource Management (DERM). Impact statements are accompanied by Environmental Management Plans (EMPs) and Social Impact Management Plans, which outline ongoing monitoring and treatment of impacts and, in the case of EMPs, establish the conditions for an Environmental Authority (permit).

Projects considered 'significant' by the Queensland Government are required to be assessed under the *State Development and Public Works Organisation Act 1971*. In these cases the assessment process is managed by the Coordinator General, a division of the Department of Infrastructure and Planning. In practice there is significant overlap between what is required under both systems.

Cumulative impacts are not specifically mentioned in either the *Environmental Protection Act 1994* or the *State Development and Public Works Organisation Act 1971*. These acts both specify that an EIS must be written in the form requested by the agency and, as such, guidance on the type of impacts that need to be assessed is given in the ToR developed by the agencies (see Table 3).

Under the Queensland Environmental Protection Act 1994 the development of a Draft ToR is the responsibility of the proponent, with a period of public comment and then finalisation by DERM. While no definition of cumulative impacts is provided by the Queensland Government the Department of Environment and Resource Management's generic ToR does provide some guidance by stating that cumulative impacts "must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts" (DERM, 2010). Evidence of collaborative management is also required.

Cumulative impacts also play a role in the consideration of the level of impact assessment required. The Queensland Government considers the potential influence cumulative impacts may have on the overall impacts of a proposal when deciding whether, under the *Environmental Protection Act 1994*, the proposal is:

- a standard application that does not require an EIS;
- a non-standard application that does not require an EIS; or
- a non-standard application that does require an EIS.

New South Wales

In New South Wales, impact assessment is regulated under the *Environmental Planning and Assessment Act 1979*. The act is supported by the *State Environmental Policy (Major Projects)* that was introduced in 2005 and defines the classification criteria for different levels of assessment. Mining projects generally fall into the 'Designated' and 'State Significant Development' categories (for more information see NSW DUAP, 2000, 2).

The New South Wales Department of Urban Affairs and Planning has published a guideline for the preparation of EIS for coal mines and associated infrastructure (2000). The guidelines describe cumulative impacts as the result of "a number of activities with similar impacts interacting with the environment in a region…they may also be caused by the synergistic and antagonistic effects of different individual impacts …[and] due to the temporal or spatial characteristics of the activities and impacts" (NSW DUAP, 2000, 37).

Cumulative impacts are required to be considered when prioritising issues, in site selection, the assessment of potential impacts, and management (NSW DUAP 2000, 13, 15, 23). Proponents must consider the resilience and capacity of the receiving environment to cope with impacts, the relationship to other mines and infrastructure, and must refer to existing regional, cumulative and strategic studies (such as the Upper Hunter Valley Cumulative Impacts Study), catchment or cumulative water quality management strategies and compliance arrangements (NSW DUAP 2000, 3, 17, 23, 26, 37).

For analysis of air quality, the guidelines describe a suggested methodology of cumulative assessment (NSW DUAP 2000, 28) and compel the proponent to take into account the cumulative effects of other developments that have been approved but are yet to commence (NSW DUAP 2000, 29). Measures to avoid and mitigate river impacts through discharge schemes, trading or supply to and from adjacent mines and industries, and reuse opportunities are also to be considered (NSW DUAP 2000, 27).

Commonwealth

At a federal level the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) includes an impact assessment function that is triggered in cases where the Minister believes there to be likely impacts on matters of national environmental significance from a proposal. Both Queensland and New South Wales have bilateral agreements with the Commonwealth to manage the assessments as a part of the State assessment process. While the EPBC Act does not specifically mention cumulative impacts a number of Federal Court rulings have interpreted the act in such a way that the Minister must consider cumulative impacts when considering the significance of an action[1].

The independent review of the EPBC act (the 'Hawke' review) has signalled that cumulative impacts will be a focus of reform.

[1] See for e.g. Brown v Forestry Tasmania, Wielangta Forest decision [2006] FCA F1729; and Queensland Conservation Council Inc v Minister for the Environment and Heritage, Nathan Dam case, [2003] FCA 1463).

3.3 STRATEGIC AND REGIONAL ASSESSMENTS

Strategic assessments are assessments done at the scale of a policy, plan or program, while regional assessments may be at the scale of a minerals or resource province, catchment, or political jurisdiction. Strategic and regional assessments may be undertaken during, or prior to, the establishment of a new type of industry, extraction method, or exploitable resource. The advantage of such approaches are that they:

- facilitate the early identification and resolution of potential issues when there is the flexibility to make changes;
- provide an opportunity for longitudinal and comparative research;
- may more effectively identify existing and potential cumulative impacts;
- may explicitly link assessment to regional planning and reporting; and
- can establish baseline and regional datasets that assist the development of region-wide monitoring efforts.

A strategic assessment can be the most appropriate form of assessment for regions involving multiple stakeholders or complex, large-scale actions[2].

[2] Regional Forestry Agreements are examples of strategic assessments that guide potential resource development in Australia.

Strategic assessments are often promoted as a method to more effectively account for cumulative impacts because they are:

- broader in spatial and sometimes temporal extent;
- they may make explicit regional standards, thresholds, and links to land use planning; and
- they often establish regional databases, protocols, management systems and tools for implementation (e.g. the definition of thresholds and methods for allocation within limits).

In some jurisdictions, government-led strategic and regional assessments may establish the conditions for future development and reduce or remove the requirements for project-specific impact assessments prior to regulatory approval, if the proposals meet the conditions outlined in the assessment. Such an approach has obvious benefits for business as it can:

- lead to better delivery of social infrastructure and services, as well as better environmental outcomes;
- provide certainty for development proposals;
- reduce the potential for consultation fatigue;
- reduce the regulatory burden and shorten the approvals process;
- avoid the duplication of project level assessments; and
- inform developers about the environmental and social context in which they operate.

STRATEGIC ASSESSMENTS UNDER THE AUSTRALIAN EPBC ACT

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) includes an impact assessment function that is triggered in cases where the Minister believes there to be likely impacts on matters of national environmental significance from a proposal. The EPBC Act 1999 also provides the facility to undertake strategic assessment, in collaboration with state jurisdictions. The Commonwealth Department of Environment, Water, Heritage and the Arts have established a function to undertake strategic assessments.

A strategic assessment process has been initiated for urban planning in New South Wales and Victoria, a common-user liquefied natural gas (LNG) hub precinct in the Browse Basin of Western Australia, and a fire management policy in New South Wales. The rationale behind the proposal for a single LNG precinct, for example, was that it had the potential to minimise the cumulative impacts of multiple developments and deliver synergies for industry.

Strategic assessments undertaken within the jurisdiction of the EPBC Act consider the range of impacts that are likely to arise from the policy, plan or program and the proposed management arrangements, safeguards and mitigation measures. They have the potential to set out the conditions by which development can proceed and thus reduce the necessity for project level approvals, if the proposals meet the conditions outlined by the assessment.

http://www.environment.gov.au/epbc/assessments/strategic.html

UPPER HUNTER CUMULATIVE IMPACT STUDY, NEW SOUTH WALES

In the mid 1990s, the NSW Commission of Inquiry for the Bayswater No. 3 and Bengalla coal mines recommended that the NSW Government undertake a study of the cumulative impacts of coal mining on the Upper Hunter Valley Region. This recommendation was prompted through the concerns of community and local government. The study, the 'Upper Hunter Cumulative Impact Study and Action Strategy' (UHCIS) was released in June 1997 (NSW DUAP, 1997). The aims of the study were to:

- establish the effects of cumulative impacts of various existing and major proposed land uses and activities;
- establish a regional framework for the assessment of the environmental impacts of individual development proposals and activities;
- provide the basis for coordinated environmental monitoring and enhanced environmental management practices;
- assist future strategic land use and development planning at both the local and regional levels.

The scope of the UHCIS incorporated the Local Government Areas (LGAs) of Singleton, Muswellbrook, Scone, Murrundi and Merriwa. The study consisted of three phases:

1) A qualitative review of all potential cumulative relationships between various land uses and activities and the environment, using a set of environmental indicators.
2) Analysis of the more significant potential impacts using quantitative techniques. The most relevant environmental impacts of a cumulative regional nature were examined, including air quality, water quality, catchment conditions and economic and social conditions.
3) Strategic assessment of the findings of phases 1 and 2.

In accordance with the data available at the time, the study found that there were no major cumulative impacts that warranted additional regulatory intervention or major restrictions on development. The UHCIS highlighted the need for more consideration to be given potential cumulative impacts in future decision making, planning and environmental management.

Key proposals were to:

1) Strengthen the planning process – use the outcomes of the study in future EIS and planning activities.
2) Strengthen environmental monitoring and databases – examine the relevance and consistency of data for assessing cumulative impacts.
3) Strengthen environmental management practices – develop and implement best practice guidelines and reconsider existing practices.
4) Improve co-ordination, liaison and participation – implement initiatives for improved information sharing and consultation.

An action strategy of 39 items was developed. A number of these action strategy items had particular relevance to the coal industry. These included a recommendation that cumulative impact considerations be addressed in EIS preparation, and that a landscape master plan be developed to coordinate between existing and future mines, to lessen the visual impact of construction and mining developments, and to ensure appropriate mining rehabilitation. The study proposed a review of monitoring systems for the Upper Hunter and the development of a consistent and coordinated environmental monitoring approach to enable the detection of long-term trends and cumulative impacts. A series of ongoing review reports was also proposed to monitor performance of conditions of consent for coal mining projects with regard to environmental monitoring and independent auditing. Other action items included the development of site-specific blasting guidelines, operational guidelines and a clarification of issues pertaining to community concerns about nuisance dust. Finally, the study advocated the continued development of best practice guidelines for stabilisation and rehabilitation of areas exposed by mining (NSW DUAP, 1997).

Following the UHCIS, a strategic assessment was developed to analyse the coal mining potential of the Upper Hunter Valley (NSW Department of Planning, 2005). The assessment took into consideration coal resources, mine development potential, surface and groundwater, social and amenity issues, natural and cultural heritage, land and agriculture. In late 2006, the NSW Government also initiated a strategic review of the impacts of underground mining in the Southern Coalfield, specifically subsidence. The findings of the review stressed the need for better assessment of cumulative and regional impacts and improved attention to cumulative impacts within project level EIAs. The study also recommended that regulatory agencies and industry consider collaborative efforts with other 'knowledge holders' to develop improved regional and cumulative environmental data sets for the Southern Coalfield (NSW DPI, 2008).

REGIONAL MINE CLOSURE STRATEGIES, SOUTH AFRICA

The Regional Mine Closure Strategies are whole of government strategic assessments of mine closure introduced by the South African Government in 2008. The strategies were introduced to address the cumulative impacts of mine closure, that is, the unintended consequences of the closure of a single mine on the communities and other industries in the region, particularly where other mines rely on shared infrastructure and industrial synergies. The regional strategies identify dependencies, scope the regional context, develop a strategic framework to promote alignment between individual mine closure plans, and outline conditions and actions for operations.

The South African Government has identified a number of priority resource intensive regions for application of the strategies, though mines may be excised from the strategy if they do not pose any risks to other mines as a result of closure. In such cases only the specific mine closure plan applies. The regional closure strategies are used by the authorities to assess the suitability of individual mine closure plans, which are required by law.

The regional closure strategies cover environmental and socio-economic issues. In the socio-economic area the strategies are founded on a social and economic profile and propose short-, medium- and long-term actions to minimise mining dependency and promote alternative economies, for example, to establish a regional industry forum to coordinate initiatives, establish employment and training programs and counselling services for retrenched employees, and engage with stakeholders over proposals for post-mining land use.

The strategy is a product of the 'Sustainable Development through Mining' program, led by the Department of Minerals and Energy (DME), the Council for Scientific and Industrial Research (CSIR), Mintek and the Council for Geoscience (CGS). The program was established following the World Summit on Sustainable Development in Johannesburg, 2002.

3.4 ACCOUNTING FOR CUMULATIVE IMPACTS IN THE PHASES OF IMPACT ASSESSMENT

The following section provides guidance on how cumulative impacts can be addressed within the phases of impact assessment already outlined in Figure 4, that is, during the scoping and formulation of alternatives, profiling and baseline studies, and predictive assessment and revision of alternatives phases.

Scoping and the formulation of alternatives

The scoping phase sets the parameters for the later phases of assessment and management by:

- determining the scale, timing and focus of the assessment;
- ascertaining who is likely to be impacted; and
- identifying the actions that are likely to result in impacts.

Scoping begins with a definition of the purpose of the assessment and identification of background material that may influence the assessment.

Cumulative impacts are an important consideration during this phase. While an issue or opportunity may appear minor or insignificant when considered in isolation, in concert with other overlapping activities, it may have greater significance.

During the development of a new project, planners are usually faced with a number of alternative options. Impact assessments provide an opportunity to investigate these alternatives in greater detail to assist decision makers to choose the most appropriate option. Alternative options are formulated for later analysis and an initial appraisal of the impacts of these alternatives is undertaken. Impacts can be prioritised, in consultation with stakeholders, to narrow down the analysis and investigation of the later phases to address key issues of relevance.

It is critical to consider cumulative impacts in the development of alternatives, since it is only by re-evaluating and modifying alternatives in the light of the projected impacts that adverse consequences can be effectively avoided or minimised, and opportunities enhanced.

Scoping will also include the identification of the spatial and temporal boundaries of the assessment. A balance will need to be found between the need to account for the actions that are contributing toward, and accumulating as impacts and time, resource, and data constraints. The boundaries of the assessment may vary for different media (air, water, land etc.).

The adaptive capacity of environmental and social systems to absorb impacts should be considered during scoping. Further, the likelihood of other potential future and simultaneous proposals should be scoped and considered. Forecasting is a means to provide information on such future activities.

Forecasting

A major impediment identified by proponents and government to addressing cumulative impacts within project-level impact assessments, and effective planning more generally, is the availability of information on the future of developments. There is an absence of reliable data in the public domain about planned and possible future developments and the closure timing for existing developments. This is largely due to considerable uncertainty about the future context and issues of commercial sensitivity. Forecasting is a means to provide information on future activities and their likelihood. Forecasting may include the collation of information on:

- known projects (announced, approved, or in construction);
- other existing and proposed land uses;
- potential future operations;
- production trends, resource reserves and pricing forecasts;
- consumption and demand trends; and
- upstream and downstream technology roadmaps (Giurco et al., 2009).

OIL SANDS DEVELOPERS GROUP, ALBERTA, CANADA

The Oil Sands Developers Group (OSDG) is an industry representative organisation established to respond to the regional and cumulative impacts of extensive development of Alberta's oil sands resource. The organisation was originally founded as the Regional Infrastructure Working Group in 1997, but later changed its name to the Athabasca Regional Issues Working Group Association in 2003, and then to the OSDG in 2008. The organisation fulfils the traditional roles of an industry representative organisation, that is to share and disseminate information and advocate a collective position, however, the organisation also undertakes a rather unique role of commissioning industry forecasting surveys to assist government and industry planning of social and physical infrastructure development and to anticipate and respond to social, economic and environmental impacts (Athabasca Regional Issues Working Group, 2007a, 2007b).

The OSDG began its activities with an assessment of the issues of concern at a regional scale. Committees were established to respond to priority issues. Currently the organisation hosts committees in the following areas: Aboriginal affairs, co-generation/ transmission, communications, health care, housing, regional environmental & regulatory affairs and transportation. One of the early hurdles that faced the group was the administrative burden of managing multiple committees. A full-time coordinator was hired to support the committees and assist in the timely completion of work.

The committees play an important role in overseeing the industry surveys and forecasting. The process emerged out of a fairly informal group of companies with a vested interest in the aggregated data. Now it is a requirement of membership to provide data during surveying. Data collection is limited to the member companies for the most part and data is collected/analysed in house and with the assistance of consultants. Data is publically reported in an anonymous and aggregated form. The committees review the survey templates on a yearly basis, while OSDG staff send-out, collect, and analyse the data and prepare the reports. Confidentiality is maintained by controlling who has access to the raw data. Only one organisation currently requires a formal confidentiality agreement with the organisation. Trust has been established through the consistent confidential treatment of data. Surveys include information on corporate donations, contributions to Aboriginal peoples, Aboriginal workforce, Aboriginal contracts, employment, revenues to government, camp residents, current and future anticipated capital expenditure and production.

Photo Courtesy of HATFIELD CONSULTANTS

The Planning Information and Forecasting Unit in Queensland provides data that can be used to inform planning and assessments. Industry can also play an important role in the collection of data. Forecasting innovations in Canada have overcome issues of commercial sensitivity and confidentiality to provide anonymous and aggregated data on future activities (See text box, 'Oil Sands Developers Group'). Such information can also assist industry to negotiate with government on future infrastructure needs and priorities.

Profiling and baseline studies

Profiling is a process to collect relevant primary and secondary data about a community, environment or economy. Baselines are an appraisal of the pre-impacted state of a system.

Profiles and baseline studies provide a benchmark against which potential impacts can be anticipated and change measured. They provide detail on the cumulative pressures of existing activities in the region (mining and non-mining) and can be used to inform impact prediction and identify priority areas for mitigation and management.

Baselines and profiles are traditionally undertaken as part of development approval processes, but are now recognised as having much broader application. Leading companies now routinely require their operations to undertake such studies and update them at regular intervals, including when there is any significant change to the scale or shape of a project. Some companies also provide quite specific guidance to operations on what should be covered in these studies.

One major issue of concern regarding cumulative impacts is the effect of a 'shifting baseline'. The development of a baseline as a snapshot of a system at a particular point in time will in fact represent an already impacted system that includes the cumulative impacts of past activities. To overcome this issue it is important to consider historical trends and historical information about the 'pre-impacted' state of systems. Comparison of the proposed activities should then be made to this historic state in addition to the snapshot of the system at the time of the baseline study.

Predictive assessment and the revision of alternatives

Impact prediction is an opportunity to analyse the issues scoped in more detail. In this phase likely impacts are identified and predicted, and their scale and significance evaluated, using technical and participatory methods.

To account for cumulative impacts analysis should consider associated facilities, policies or programs, such as, roads, power transmission lines, and government programs, and the existing and forecasted activities determined during scoping. Predictions should describe how the proposed activity will contribute to the existing situation, and the capacity of environmental and social systems to absorb the impacts given foreseeable future activities.

Predictive assessment methods are highly specific to the impact under analysis. For example, analysis of the impact of water extraction may consider multiple areas of potential abstraction, overlapping cones of drawdown, dewatering discharge locations, distribution of ecosystems within the project area, and catchment scale groundwater levels.

There are, however, a number of general approaches that can assist to take into account cumulative impacts.

Scenarios

Scenario analysis is a tool to anticipate change under different plausible future situations. Given uncertainty about the future, scenario analysis can provide the opportunity to consider the proposal in the context of a number of plausible futures. Scenario analysis assists to understand causal relationships in more detail though comparison of the proposal under different situations and through the testing of assumptions.

Modelling

Modelling attempts to simulate systems and understand the impacts of variables by quantifying cause and effect relationships. While modelling can require a large investment in time, resources and data it can be an effective means to quantify cumulative impacts, provided that the geographical, time and systems boundaries that define the model are carefully calibrated. Models can be run for different scenarios.

Impact pathway analysis

This approach seeks to map the relationships between the direct and indirect impacts of actions and their interaction. By mapping how impacts generate, interact and aggregate, the 'pathway' of impacts can be predicted. This approach is sometimes also known as change mapping.

Collaborative research

Research can be undertaken in collaboration with other stakeholders to develop and test methods and understand systems in more detail, for example the temporal and spatial extent of impacts, interaction between impacts, and the pathways of effects. Leading organisations are commissioning research into the generation and accumulation of impacts before and after formal impact assessment processes. Collaboration increases the opportunities to understand the totality of impacts and activities contributing to an issue.

FRAMEWORK FOR THE CUMULATIVE EFFECTS OF MINING ON GROUNDWATER, NATIONAL WATER COMMISSION

The Sustainable Minerals Institute at The University of Queensland and Sinclair Knight Merz are developing a framework for the assessment of the cumulative effects of mining operations on groundwater systems. The study is part of the Australian Government's National Water Commission and aims to assist jurisdictions to ensure that their land-use planning and EIA requirements are compliant with the National Water Initiative. The study is applying the tools developed under the project in the assessment of the cumulative impact of mining on water resources in up to four regions.

The study will develop:

- guidelines for environmental impact assessments (EIAs) that outline both general areas and specific items related to water resources, in particular groundwater, that should be considered during the assessment of mining proposals;
- risk-management based tools to assist planners and developers to predict and minimise the cumulative impact of future mining activities on other water users;
- guidelines and tools to enable the integrated management and accounting of water resources across multiple mine sites to minimise the impact on water resources. These will be based on an adaptive management framework to enable improved outcomes as knowledge increases.

ISAAC RIVER CUMULATIVE IMPACTS ASSESSMENT, QUEENSLAND

In 2002 BHP Billiton Mitsubishi Alliance (BMA) and Anglo American began a collaboration and engaged Alluvium Consulting to conduct a voluntary impact assessment on the cumulative impacts of longwall coal mining on a 100km stretch of the Isaac River in Central Queensland. The Queensland Department of Environment and Resource Management was also a major stakeholder in the process.

Many existing and proposed mine developments are situated along the Isaac River. Cumulative impacts of mining and land use change, together with the likely consequences of drought, have resulted in significant impacts to the health of the river system. The assessment sought to identify the precise impacts of mining developments, primarily concerning river diversions and stream bed subsidence, and provide recommendations for mine planning and operations which will enhance the health outcomes of the river system in the future (Lucas et al., 2009).

The collaboration is unique and acknowledges that understanding local geomorphic processes and cumulative impacts, as well as options for managing these, are essential for ongoing mining development in the region. To adequately understand such processes within a dynamic river system requires an assessment that exceeds the scale of individual mine leases thus requiring a co-operative approach (Lucas et al., 2009).

The Isaac River Cumulative Impact Assessment (Hardie and Lucas, 2002) goes beyond the regulatory requirements for either company. The results of the study have led to proactive management at both Broadmeadow and Moranbah North mines and have increased the broad base knowledge of hydrology, geomorphology and ecology of the region thus enhancing state government regulation for guiding future development in the region (Lucas et al., 2009).

SECTION 3 FURTHER RESOURCES

- New South Wales Department of Planning (2007). Guidelines for establishing and operating community consultative committees for mining projects. June. 8p.
- New South Wales Department of Planning (2008). Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield. Strategic Review. New South Wales Government. Sydney. July.
- New South Wales Department of Urban Affairs and Planning (1997). Upper Hunter Cumulative Impact Study and Action Strategy. New South Wales.
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04 MANAGING CUMULATIVE IMPACTS

Issues that arise as a result of multiple activities, policies and behaviours are best approached collectively.

The type and characteristics of cumulative impacts and the relationship between impacts are important when considering which management strategy will be most effective. Collaborative management efforts vary in complexity with each demanding a different degree of maturity of the collaborative relationship (see Figure 5). Approaches such as networking or the informal exchange of information are relatively straightforward and are, increasingly, a common feature of the industry. More involved approaches, such as the co-ordination of activities or programs or industrial synergies, can deliver good outcomes, but are much more challenging to implement and usually require more mature collaborative relationships.

Management also varies in the target of the approach. Cumulative impact management may seek to avoid, mitigate, or enhance the impacts of:

- past and existing development;
- the project under development or consideration;
- potential future projects (Duniker and Greig, 2006).

In the case of regulators, management might also consider whether and how proposed and future projects should proceed.

This section details practical strategies, drawn from working examples, to better manage cumulative impacts at the operational and regional scales, including information exchange, networking and forums (section 4.1); the co-ordination of community engagement mechanisms (section 4.2); the facilitation of industrial synergies (section 4.3); partnerships and multi-stakeholder working groups (section 4.4); strategic and regional planning initiatives (section 4.5) and the pooling of resources to fund initiatives (section 4.6).

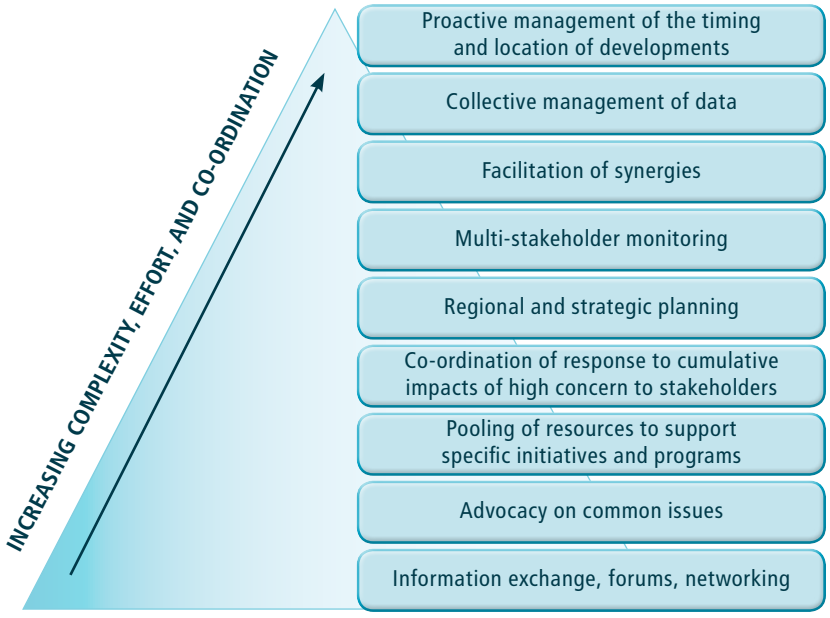


FIGURE 5: THE CUMULATIVE IMPACT MANAGEMENT HIERARCHY

4.1 INFORMATION EXCHANGE, NETWORKING AND FORUMS

Informal and formal networks can provide important opportunities to exchange experiences at the operational and strategic level to better manage the impacts of multiple activities. Informal networks are relatively common within the industry both within and between companies. Such professional networking is an opportunity to exchange ideas and advice and communicate approaches (both successes and failures). More formal networking arrangements, such as forums of mine managers and professional staff, provide an ongoing opportunity to discuss common issues and coordinate activities.

THE AWARD WINNING UNIVERSITY OF QUEENSLAND AND RIO TINTO COAL AUSTRALIA 'KOALA VENTURE' PARTNERSHIP IS RESEARCHING THE USE OF REHABILITATED LAND FOR KOALA HABITAT.

CENTRAL QUEENSLAND MINING REHABILITATION GROUP

The Central Queensland Mining Rehabilitation Group (CQMRG) is a collaborative forum through which members can share their experiences and information about environmental management of mine sites. CQMRG was formed in 1991.

Most members are industry affiliated and major sponsors include: URS, Sinclair Knight Merz, Xstrata Coal, forget-me-not children's home, Ecowise Environmental, McCullum Environmental, Rio Tinto Coal Australia, Anglo Coal, Central Queensland University and PS.

Triannual workshops and newsletters accessible to members as well as other interested parties foster a process of collaborative social learning through which practitioners can build on lessons learnt and shared by others or, alternatively, seek feedback and advice in a neutral setting.

http://www.cqmrg.org.au

UPPER HUNTER RIVER REHABILITATION INITIATIVE

A rehabilitation initiative in the Upper Hunter Valley has taken an alternative approach to collaborate on a program of river rehabilitation. The Upper Hunter River Rehabilitation Initiative was a five year program, completed in 2007, which trialled river rehabilitation methods in the 10km reach of the Hunter River south of Muswellbrook. The research was funded by the Australian Research Council, the NSW Department of Natural Resources, NSW Department of Primary Industries, the Hunter-Central Rivers Catchment Management Authority, NSW Department of Lands, Newcastle Ports Corporation, Mt Arthur Coal, Bengalla Mining Company (Coal & Allied) and Macquarie Generation (Hunter-Central Rivers CMA, 2008).

4.2 COORDINATED COMMUNITY ENGAGEMENT

Many mining operations have developed community consultation arrangements, including formal committees. Community engagement is currently conducted mainly at the individual mine level (in some cases as a legislative requirement) leading to multiple community consultative committees in regions of intense resource development. Anecdotal evidence suggests that this can have the effect of becoming repetitive and demanding on community representatives. In some circumstances joint multi-mine engagement mechanisms are better able to address issues at a broader level and facilitate a more collaborative approach to managing cumulative impacts across multiple projects (operated by one or more companies). The most appropriate engagement mechanism will, however, depend on the local context.

The tasks of a joint consultative committee would be to inform stakeholders of actions taken by the industry to manage multi-mine impacts; provide a forum for feedback and discussion of issues and solutions; and identify and plan collaborative initiatives to contribute to the development of the region. Representation from groups such as youth and aged organisations, local business, tourism, health, welfare, policing and education in addition to environment, government and community groups, would help to ensure a broad range of issues are covered. A collaborative approach may also result in efficiency gains, reducing the time and resources spent on multiple consultative committees. There will remain a need to address operation specific issues and account for the overlapping phases of mining development.

In the absence of a collective approach, informal co-ordination across mining operations on the timing of community consultation initiatives can better facilitate community input and help reduce any consultation burden. Another alternative approach is to encourage informal networking between two or more mine-specific community consultative committees.

4.3 FACILITATION OF SYNERGIES

Industrial synergies refer to exchanges between different businesses or sectors to achieve a more productive use of resources (van Berkel et al., 2006). This may include the capture, recovery and reuse of previously discarded by-products from one development, by traditionally separate industries operating in close proximity (van Beers et al., 2007) or cooperative activities such as trading and supply between projects and joint facilities. The same principles apply to social issues and synergies can be found between developments to better coordinate the use of facilities, for example, the accommodation of workers or staff, or the alignment of business development and employment opportunities. Synergies require the sharing of operational information, establishing operational and contractual arrangements, and the evaluation of the benefits of the activities.

4.4 PARTNERSHIPS AND MULTI-STAKEHOLDER WORKING GROUPS

Partnerships and multi-stakeholder working groups are an opportunity to facilitate cooperation around a particular goal and solidify ongoing collaboration to tackle complex problems. At a broader level, working groups can share strategic information, develop and coordinate solutions, undertake research into best practice and assessment methodologies and facilitate cross-sector communication. At a resource province level, local working groups can provide ongoing engagement and feedback to resource companies, identify and deliver preferred strategies, programs and projects that are consistent with regional planning.

CROSS-SECTOR PARTNERSHIPS

There are numerous examples of partnerships between individual companies and community or government organisations, right through to higher-level, multi-stakeholder partnership agreements at the industry to government level.

The Gladstone Schools Engineering Skills Centre (GSESC) is a training program co-located within the NRG Gladstone Power Station. The centre prepares secondary school students for engineering trades. The program is funded by the Rio Tinto Aluminium Community Fund, the NRG Gladstone Power Station, the Australian National Training Authority (ANTA) and local schools in conjunction with Education Queensland (CSRM, 2007). The Mining Industry Skills Centre is another collaborative initiative between the mining industry and the Queensland Government to encourage skills development.

In the area of Indigenous employment and Indigenous enterprise development, there are several agreements between the mining industry, and state and commonwealth governments. A memorandum of understanding (MOU; signed in 2006) between the Minerals Council of Australia and the Commonwealth Government aims to improve Indigenous outcomes from mining at various locations around Australia, and a MOU signed between the Queensland Resources Council, the Queensland State Government and the Commonwealth is targeting Indigenous employment and enterprise development in North West Queensland.

At the corporate level, BHP Billiton Iron Ore entered into a partnership in 2005, solidified by a MOU, with the Western Australian Department of Education and Training to improve educational services in the Pilbara communities of Port Hedland and Newman. This partnership was followed by a health MOU with the Western Australian Department of Health to improve the quality of services in the Pilbara.

The Pilbara Industry's Community Council (PICC) is an industry-led, multi-stakeholder body in Western Australia. PICC consists of BHP Billiton Iron Ore, Chevron Australia, Fortescue Metals Group, North West Shelf venture, Rio Tinto Iron Ore, Woodside, the Commonwealth, Western Australian and local Governments, Pilbara communities, and the Chamber of Minerals and Energy Western Australia (CME, 2008). PICC has two current areas of work. These are an Indigenous employment program and an alternate stream on improving towns (CME, 2008). Multi-stakeholder working groups, such as PICC, offer opportunities to share strategic information, develop and coordinate solutions, undertake research into best practice and facilitate cross-sector communication.

INDUSTRIAL SYNERGIES - KWINANA, WESTERN AUSTRALIA

The Kwinana Industrial Area (KIA) is located 30km south of Perth, Western Australia. The KIA was established in the 1950s and houses resource processing and heavy industries, such as alumina, nickel and oil refineries, chemical factories, power plants and cement and fertiliser manufacturers. The facility is also located adjacent to a sensitive marine ecosystem. Since the 1980s Kwinana operations have sought to identify and establish by-product and utility synergies. Over forty seven such synergies have been developed to date, with the participation of more than 30 companies. New synergy opportunities have been identified by establishing a database of inputs and outputs, reviews of company literature, one-on-one discussions and focussed opportunity identification workshops. The KIA is a working example of industrial symbiosis and the potential for industrial synergies to reduce cumulative impacts.

For more information see the Centre for Sustainable Resource Processing: http://www.csrp.com.au/database/au/kwin/

4.5 STRATEGIC AND REGIONAL PLANNING

Government-led planning at the strategic and regional scales provides important constraints and guidance for resource development projects. Governments are well placed to provide leadership in the co-ordination and assessment of development, and in service delivery. Industry too has a role to support these processes, contribute to the development of regions, and respond to the impacts of their activities.

Land-use and social planning at the regional scale has the potential to guide resource development decision making, and strategic planning can assist to prioritise actions and coordinate the delivery of investments across scales (see section 4.6). In both cases planning should represent a collaborative process, clearly articulate preferred futures, and have effective links to the EIA and approvals processes.

Local government, regional development organisations, community organisations and the small business community are experienced partners that have a strong stake in outcomes. The following cases demonstrate the benefits of partnership approach to planning and delivery.

CUMULATIVE EFFECTS MANAGEMENT FRAMEWORK, ALBERTA, CANADA

In Alberta, a region renowned for its richness in oil and gas development, a new Provincial cumulative effects framework has been created to ensure a results-based and area-specific approach. This has been driven, in part, by the increasing scale and complexity of cumulative impacts, along with an evident need to implement a more systematic resource based and spatially appropriate approach.

In Canada, cumulative effects assessment is a requirement nationally and in some provincial jurisdictions. The requirement for the assessment of cumulative effects was formally introduced, nationally, into the EIA process in 1995 with the promulgation of the Canadian Environmental Assessment Act.

In October 2007, the Alberta Government announced a broad new approach to address cumulative effects. The cumulative effects management approach will:

- consider the total impact of development in a region, over time, in decision-making;
- determine the capacity of the land and the environment to support the effects of all activities; and
- identify thresholds for the air, land, water and biodiversity.

The cumulative effects management approach aims to focus planning and decision-making on the impacts of activities, rather than the activities themselves. It seeks to ensure that all the impacts of all activities, over time, are considered and included, by strengthening the consideration of cumulative impacts at the project level and by undertaking government-led regional assessments. Regional assessments consider all of the potential impacts of all projects within a region, both existing and new; to create a more comprehensive view of development and land-use activity.

The cumulative effects assessment (CEA) is a regulatory requirement of the EIA and needs to document predicted changes to the environment that might be reasonably anticipated from a proposed activity in combination with other activities. The CEA is to include a discussion of historical developments and activities that have created the current baseline conditions. Explicit in the discussion (which is provided by the proponent) is a prediction of the incremental consequences of development, identification of interactions of stresses, and a prediction of cumulative consequences of combined effects. The proponent must detail the effects in respect to time and space and defend any assumptions made in the report. The CEA report must also demonstrate that it is not a static one-off review and that baseline conditions, project parameters, natural conditions, etc. will change over time.

Furthermore, regulators expect the proponent to:

- consult with adjacent industrial operations and incorporate data into their CEA report;
- present and provide an exploratory analysis of potential outcomes based on information obtained; and
- describe how the proponent proposes to monitor uncertainties and plans to address unfavourable outcomes if they arise.

Photo Courtesy of HATFIELD CONSULTANTS

SUSTAINABLE RESOURCE COMMUNITIES POLICY, QUEENSLAND

In September 2008, the Queensland Government introduced the Sustainable Resource Communities policy to improve the assessment and ongoing management of social impacts, provide for greater co-ordination and collaboration between stakeholders, and address resource governance issues at multiple scales. Cumulative impacts were a key rationale for the development of the policy.

The policy is designed to both maximise the opportunities presented by developments in Queensland resource regions and mitigate and avoid adverse impacts in areas such as social infrastructure, employment, housing, community services, amenity, quality of life, health and education. The policy is initially focussed on three resource communities, the Bowen Basin, the Surat Basin, and the North West Minerals Province, where resource development has significantly, or in the case of the Surat, has the potential to significantly affect community infrastructure and services, and the social structure of communities.

The policy responds to the cumulative and regional impacts that may be experienced by Queensland communities, economies and environments as a result of multiple, concurrent and overlapping proposals for resource development. The policy strengthens the Queensland Government's co-ordination role, introduces a social impact assessment (SIA) function, improves state-wide and regional co-ordination through the formation of a partnership group and local leadership groups, emphasises greater links to regional planning, and introduces social impact management plans (SIMPs) to outline the forecast changes to communities, the agreed strategies for mitigation of impacts, and the responsibility of various parties in relation to management. Finally, the policy seeks to facilitate research into leading practice.

The Queensland Partnership Group and Local Leadership Groups

The role of the partnership group, which consists of representatives of state and local government, the Local Government Association of Queensland, and the Queensland Resources Council, is to share strategic information, develop and coordinate solutions, undertake research into best practice and assessment methodologies and facilitate cross-sector communication. At a resource province level, local leadership groups will act as a 'sounding board' for resource companies and will focus on regional planning, and developing projects that address the cumulative effects of resource developments. They will provide ongoing engagement, identify preferred strategies and programs to manage impacts, and will link to regional planning.

Social Impact Management Plans

The Social Impact Management Plans (SIMPs) will facilitate ongoing management of impacts identified through the SIA process. The plans will "outline the forecast changes to communities in terms of local and cumulative effects, the agreed strategies for mitigating the effects and the responsibility of various parties in relation to the strategies" and will be implemented as a condition of project approval (QDTRDI, 2008, 3). Regional planning will also command greater attention under the policy. Draft statutory regional plans have been recently developed for a number of regions and further plans will be prioritised to provide guidance to resource developments.

OIL SANDS SUSTAINABLE DEVELOPMENT SECRETARIAT, ALBERTA, CANADA

Increasingly over the past decade, the Province of Alberta, and the town of Fort McMurray in particular, has experienced many of the same social and economic resource development issues as the Bowen Basin.

The scale of mining development in the Athabasca region is significant. As of mid 2008, 7 additional oil sands operations were under construction and 15 had either received or been submitted for regulatory approval. In 2007 Fort McMurray, the regional population centre, housed over 27,000 workers in camps and temporary accommodation (hotels and motels) in addition to a permanent population of 66,000 people (OSDG, 2008). The permanent population has risen from just 37,000 in 1999, a rate of around 9% per annum. The potential for environmental change is also large. Oil sands underlie 140,200km^2 of boreal forest, with 20% accessible to open cut mining, and the remainder potentially accessed through in-situ methods. Industry estimates indicate that around 420km^2 of boreal forest is currently disturbed for oil sands mining (OSDG, 2008).

Rapid growth in oil sands development has led to high housing costs, stretched social and health services, a high proportion of workers in temporary accommodation, skills shortages and very high workforce turnover in non-mining service sectors. More than $86 billion was invested in Alberta's oil sands since 2000 (Government of Alberta, 2009). The Province of Alberta has responded to these issues with an array of approaches including, an impact assessment system based on cumulative impacts (Cumulative Effects Management Framework; discussed above), a multi-stakeholder approach to regional monitoring (the Cumulative Environmental Management Association; discussed below), a new regional planning framework (Land-use Framework) and a whole of government approach to coordinate the delivery of infrastructure and services (the Oil Sands Sustainable Development Secretariat).

The Oil Sands Sustainable Development Secretariat was formed in 2007 by the Government of Alberta to tackle the social, infrastructure and economic 'rapid growth' issues of oil sands development. The Secretariat is similar in approach to the Queensland Coal Infrastructure Taskforce. The Secretariat sits within the Treasury Board of the Alberta Government, has seven permanent staff, and takes a whole of government approach to align the activities of multiple ministries and assist local municipalities. The Secretariat is developing a social and infrastructure assessment model to determine the level of investment required, short-term action plans, and coordinate long-term strategic planning.

In February 2009 the Secretariat released, Responsible Actions: A plan for Alberta's Oil Sands. The 20 year plan will be implemented regionally through the Land-use Framework regional plans, and at a provincial scale through government ministries, coordinated by the Oil Sands Sustainable Development Secretariat. Strategy 2 of the plan is to 'promote healthy communities and a quality of life that attracts and retains individuals, families and businesses'. The goals of the strategy are to identify social and infrastructure needs, and address these needs though programs and initiatives; take into account the 'shadow population' as a result of remote working arrangements (such as drive-in-drive-out and fly-in-fly-out); develop community approaches for planning and capacity building; explore funding models that take into account cyclical growth and regionalisation of municipal service delivery in high growth areas (Government of Alberta, 2009, 22). The plan also sets out a process for data sharing with industry, the Sustainable Resource and Environmental Management Information-Sharing Initiative, to promote consistency.

The plan is based on research and consultations undertaken as part of Investing in our Future: Responding to the Rapid Growth of Oil Sands Development (Government of Alberta, 2007, 2006). This research found significant gaps in housing, services and infrastructure and provided detailed recommendations that provide comparative insight to Australian resource communities, including on topics such as the balance between industry and government investment, forecasting methodologies, the regulatory approvals process, the release of land and affordable housing programs, and even the on the need for the establishment of a new town north of Fort McMurray to service the industry.

COAL INFRASTRUCTURE TASKFORCE, QUEENSLAND

In October 2004, the Coal Infrastructure Co-ordination Group was formed by the Queensland Government, later changing its name to the Queensland Government Coal Infrastructure Taskforce. The mandate of the Coal Infrastructure Taskforce is to coordinate whole-of government planning for the provision of coal infrastructure (transport, water, energy, housing and social infrastructure) in Queensland. The body, which is part of the Queensland Department of Infrastructure and Planning, reports to the Cabinet Budget Review Committee thus providing the Taskforce with a direct line to state government decision-making and resources. The Taskforce is an attempt to expedite the infrastructure investments to cope with the sharp expansion of the coal industry since 2003 and to proactively address the cumulative impacts on physical and social infrastructure, especially in Bowen Basin mining communities.

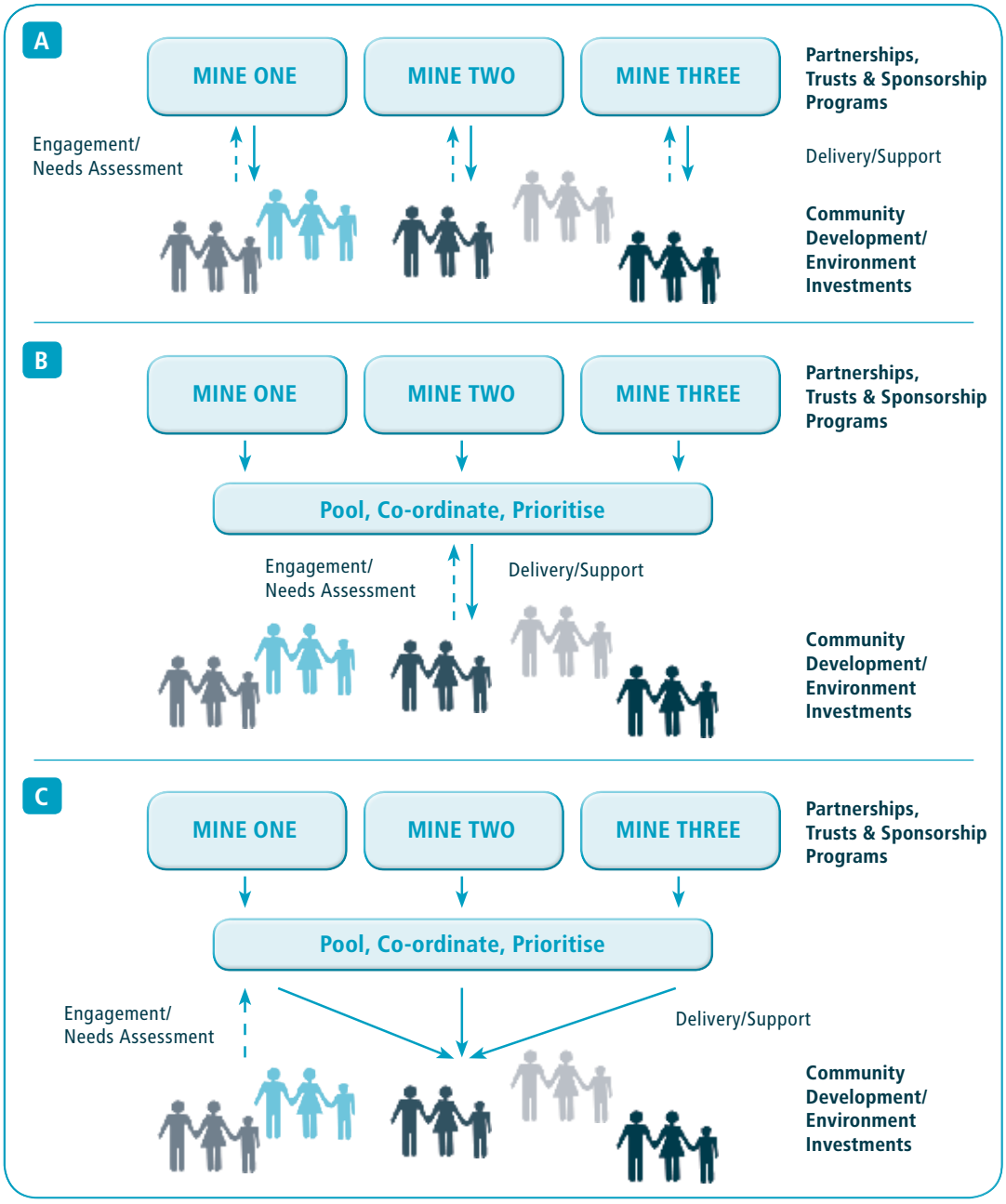
In 2005 the Queensland Government, with the support of the Queensland Resources Council (QRC), prepared the Coal Infrastructure Program of Actions to coordinate development to meet Queensland's current and future coal infrastructure needs. The program of actions is heavily focused on transport infrastructure, but areas such as water and power supply, workforce skills and social and housing infrastructure are also included. The Taskforce has commissioned a Queensland Coal Industry Strategic Plan to determine future infrastructure needs of the state.

4.6 POOLING OF RESOURCES TO SUPPORT INITIATIVES AND PROGRAMS

Most mining operations have sponsorship and donations programs to financially support community activities such as schools, clubs, societies, community events and natural resource management. In the presence of multiple mining operations or in partnership with other industries or organisations an opportunity exists to focus and coordinate these investments to target community and environment needs and generate the best value for each spend through pooling resources. Some governments and mining companies are utilising strategic planning exercises to coordinate community development with community priorities and identified needs at a site and regional level (see text boxes, Gladstone Region Social Infrastructure Strategic Plan & Clermont Preferred Futures).

Initiatives that involve multiple mining companies can present greater challenges because the reputational benefits of branding investments may limit the enthusiasm to pursue joint programs with competitors. However, the benefits of co-ordination are most obvious at the stage of selecting which projects to pursue, so that priority areas are targeted and synergies maximised. Collaboration to determine community and environment needs and priorities could occur independently of the delivery phases where organisations may choose to exclusively brand activities. For larger investments co-branding can have the effect of demonstrating a cohesive industry.

▼ **FIGURE 6: DELIVERY MODELS FOR THE CO-ORDINATION OF MINING INDUSTRY INVESTMENTS**



6A: Diagram illustrating the uncoordinated delivery of community and environmental investments by mining companies through partnerships, trusts and sponsorship programs. To simplify the diagram investments by government and non-government organisations, other industries and their associations are omitted.

6B: Diagram illustrating the co-ordination of investments through a single point of prioritisation (e.g. a needs assessment) and a single point of delivery (e.g. a partnership or industry organisation). In this model investments are commonly collectively branded and government may play a role in the co-ordination and prioritisation of investments.

6C: Diagram illustrating the co-ordination of investments through a single point of prioritisation and multiple points of coordinated delivery by different organisations. This method allows for organisations to exclusively brand activities and overcome issues regarding responsibility and liability, while still maximising synergies.

GLADSTONE REGION SOCIAL INFRASTRUCTURE STRATEGIC PLAN, QUEENSLAND

The Queensland Department of Infrastructure and Planning (DIP) identified the Gladstone Region as likely to experience significant industrial development over the short, medium and long-term. In an innovative attempt to manage the economic growth and the cumulative impacts associated with such development, DIP, together with Gladstone Regional Council (GRC) and the Gladstone Economic and Industry Development Board (GEIDB), commissioned the Gladstone Region Social Infrastructure Strategic Plan (SISP). The objective of the SISP is to 'inform and guide future planning activities and investment decisions for strategic social infrastructure in the region'.

The SISP is a positive example of the pooling of resources from multiple stakeholders to identify and fund priority social initiatives based on solid research and planning. Spanning 18 months, the research and planning process consisted of the development of a regional community profile and an audit of existing social infrastructure, the development of a planning model to foresight the impact of population growth and regional expansion on the need for additional infrastructure, and an assessment of the gaps and requirements of the region, based on the previous steps, including the identification of priority infrastructure. Significant community input in the form of community workshops and feedback provisions were also accommodated.

At the current time provisions are being made to fund the region's identified social infrastructure needs. Final stages of approval are being sought over the establishment of a proposed Foundation. Developments in the region classified as Significant Projects, and therefore requiring an Environmental Impact Statement (EIS) under Queensland legislation, will be encouraged to make voluntary contributions to this proposed Foundation as an outcome of the EIS process. Voluntary contributions are perceived as advantageous by companies as they contribute to their sustainability outcomes whilst simultaneously providing possible tax advantages.

CLERMONT PREFERRED FUTURES, QUEENSLAND

Clermont is a small rural community of approximately 2500 people located 200km inland from Mackay, in the Bowen Basin, Queensland. The town was established prior to coal mining in the region. At Clermont Rio Tinto has responded to community and local government requests for infrastructure development by working with the Belyando Shire Council (now part of the Isaac Regional Council) on a community strategic planning initiative called the Clermont Preferred Futures. The requests for infrastructure followed the decision by Rio Tinto to open a second mine (Clermont Coal mine) near the existing Blair Athol mine, which is due to close in 2015, and the potential additional impacts that would arise from these transitions. Clermont has become dependent on the economic activity of the mine and the community visioning process provided an opportunity to target future investments to enable a positive post-mining legacy.

Sponsored by Rio Tinto, led by the Belyando Shire Council (now part of the Isaac Regional Council) and facilitated by the Institute for Sustainable Regional Development at Central Queensland University the community plan is a strategic framework to guide development in the community over the coming two decades and ensure investments meet community goals. The initiative was established in February 2007. The exercise was informed by a socio-economic baseline of the town. It consisted of stakeholder mapping, analysing the socio-economic characteristics of the region and the coverage of existing data, identifying previous work and existing plans and strategies, and developing partnerships. A vision was developed from targeted community consultation and input from a diverse steering committee. An action plan was formulated and an officer appointed to coordinate implementation. The position is joint funded between the local government and Rio Tinto.

The plan is now used to guide community development and investment activities. Facilitating community visioning is one way to shape investments to enhance positive and mitigate potential negative cumulative impacts. The planning exercise is an example of a single company initiative to manage the impacts of multiple operations within its portfolio.

Sources: Faint (2008) & ISRD (2008)

SECTION 4 FURTHER RESOURCES

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05 MONITORING & REPORTING CUMULATIVE IMPACTS

Monitoring and reporting consists of the collection, analysis and dissemination of information on impacts over time. Monitoring and reporting can assist to:

- predict impacts and refine assessments;
- track the progress of, and refine, impact management approaches;
- report to communities and other stakeholders on how they are being impacted; and
- facilitate an informed dialogue with stakeholders.

This section details monitoring and reporting strategies to specifically account for cumulative impacts.

5.1 MONITORING CUMULATIVE IMPACTS

Cumulative impacts, by their nature, are defined from the reference point of the entity receiving or experiencing the impact (e.g. a town, species, or river). That is, it is the receiving entity (or 'receptor') that is experiencing the accumulation of impacts and this determines the scope of the activities and issues to monitor.

Of course not all receptors can be monitored. The first step in monitoring for cumulative impacts is to decide on the priority receptors of concern, be it a particular species, groundwater spring or socio-economic group within an economy[3].

Once the priority receptors of concern have been determined all of the actions or influences impacting on the receptor should be scoped. This step will define the boundaries of the system to be monitored. Depending on the receptor, the impacts and activities, the scale of the system and its boundaries will vary. For example a system may be defined as a local, regional or global airshed, a river catchment or sub-catchment, a wetland, groundwater system, economy, employment sector, bioregion, or a species habitat.

The next step involves tracking the activities, the direct and indirect pathways of impacts, and their aggregation and interaction. That is, the relationships between the actions that lead to impacts (both direct and indirect impacts), and how those impacts aggregate and interact should be known and sampling designed to monitor such impacts. It is important to be aware that there may be multiple pathways by which impacts are generated, resulting from different activities. Consistent monitoring and sampling methodologies may provide opportunities for the aggregation of data from multiple sources.

System level indicators and targets should then be determined to guide management approaches. System thresholds, and/or social limits will need to be defined to develop meaningful indicators and targets. Thresholds are scientifically derived points after which a major change in system state may follow. Limits are stakeholder derived preferences about the state of a particular system. Targets are desired future outcomes.

The determination of thresholds and limits should be undertaken over meaningful time scales and are best determined collaboratively. Thresholds and limits are difficult to determine and can be poorly understood, particularly in regions of transition or where little baseline information exists. In the absence of information on thresholds or limits, or under the assumption of a linear system, it is important to proceed cautiously.

The aim of this step is to develop targets with reference to a proper understanding of the system, its thesholds and limits.

The final step is to coordinate system wide management responses with other stakeholders contributing to, or with an interest in the issue.

[3] These priority entities are sometimes called Valued Ecosystem Components (Beanlands and Duniker, 1983), though of course the concept is equally applicable to social, economic, and cultural systems.

Multi-stakeholder and regional monitoring

Cumulative impacts often extend well beyond the geographic location of an operation and may contribute to systems already impacted by other operations, industries and activities. Monitoring the activities of a single operation can therefore prove insufficient. Due to sampling and methodology limitations, the aggregation of data from individual operations also often fails to present a full picture.

Regional and multi-stakeholder monitoring can help to address the cumulative impacts of multiple actions. Regional collaborative monitoring approaches have been adopted in a number of jurisdictions to address important issues of high stakeholder concern. Both government and industry can play a role in the co-ordination, management and funding of such initiatives.

UPPER HUNTER AIR QUALITY MONITORING NETWORK, NEW SOUTH WALES

In October of 2009, the New South Wales Government announced an initiative that will develop an independent air quality monitoring network for the Upper Hunter Valley. The network will be developed in response to health and amenity concerns of dust pollution from coal mining and emissions from coal fired electricity generation. The network is the result of an government-industry initiative, led by the NSW Department of Environment, Climate Change and Water (DECCW) and NSW Department of Planning, and consisting of NSW Health, Singleton Council, Muswellbrook Council, Upper Hunter Council, NSW Minerals Council, and the coal mining and electricity generation companies (Coal & Allied, Xstrata Coal, Ashton Coal, Integra Coal, Anglo Coal, Muswellbrook Coal, Hunter Valley Energy Coal, Rix's Creek, Wambo Coal, Macquarie Generation and Redbank Project).

The network will expand an existing state government air quality monitoring network with an additional 14 particulate matter air quality monitoring stations in the Upper Hunter Valley, including in the towns of Singleton and Muswellbrook. Funding for the network will be provided through industry contributions with ongoing management and administration the responsibility of the NSW government. Data will be accessible online through the DECCW's Regional Air Quality Index website. The partnership has been formalised through a Memorandum of Understanding (NSW Government, 2009).

SOURCE: AAMHATCH. HUNTER VALLEY AERIAL IMAGERY FROM A LARGE FORMAT DIGITAL MAPPING CAMERA. SEPTEMBER 2008. ORTHORECTIFIED.

HUNTER RIVER SALINITY TRADING SCHEME, NEW SOUTH WALES

The Hunter River Salinity Trading Scheme (HRSTS) is an example of a regional approach to monitor, mitigate and report on cumulative impacts in New South Wales. The geological composition of the upper Hunter Valley is naturally high in salt, and the potential for mining to increase the salinity of Hunter catchment has been a cause for concern in the local community. The disturbance of ground containing salt increases the potential for that salt to become dissolved in groundwater, and later enter the catchment system. Due to the pressures on the Hunter catchment from mining, agriculture and electricity generation, a comprehensive monitoring and regulation framework, the Salinity Trading Scheme was trialled in 1994, and implemented in 2003. Market based instruments, particularly trading schemes and offsets, have become a popular method to manage impacts as they can be an efficient way of allocating entitlements or offsetting consumed capital.

Under the trading scheme, salty water can only be discharged when the salt concentration in the river is low. Under low river flow conditions, no discharges are permitted; under high flow conditions limited discharges are allowed as determined by a system of tradable salt credits. Under flood conditions, unlimited discharge is permitted (up to a threshold salt level; NSW EPA, 2003). Stakeholders hold a license for a certain number of credits which permits them to discharge salt into a river block in proportion to the number of credits they hold (1 credit allows the holder to contribute 0.1% of the total allowable discharge). There are a total of 1000 credits in the trading scheme; these may be traded among stakeholders in the marketplace (NSW EPA, 2003). The ownership of credits, their price, and the volume and concentration of discharges are publicly reported to the community.

The New South Wales Department of Environment, Climate Change and Water has reported that since the introduction of the scheme the target salinity level of 900 EC has not been exceeded as a result of discharges.

MULTI-STAKEHOLDER MONITORING, WOOD BUFFALO, ALBERTA, CANADA

The Regional Aquatics Monitoring Program and the Wood Buffalo Environmental Association in Alberta, Canada, are examples of collective approaches to monitoring and reporting. Both of these organisations monitor the regional impacts of the oil sands industry on water- and air-sheds in the region of Wood Buffalo. The Wood Buffalo Environmental Association operates 14 active and 14 passive air monitoring stations with real time air quality data available via the internet. Both organisations have a membership that includes resource companies, environmental, Indigenous and community organisations and government agencies. The data generated from the regional monitoring programs is shared with stakeholders and the public. Both organisations periodically present aggregated data as community updates.

Photo Courtesy of HATFIELD CONSULTANTS

Regional Aquatics Monitoring Program:
http://www.ramp-alberta.org/

Wood Buffalo Environmental Association:
http://www.wbea.org/

CUMULATIVE ENVIRONMENTAL MANAGEMENT ASSOCIATION, ALBERTA, CANADA

The Cumulative Environmental Management Association (CEMA) is a non-government, multi-stakeholder, organisation established in June 2000 to assist the Government of Alberta to manage the environmental and socio-environmental impacts of oil sands development. The organisation currently is governed by 44 members representing the multiple levels of government, industry, environmental organisations and Indigenous groups and is based in Fort McMurray, Alberta, Canada. The mandate of the organisation is to develop guidance and management frameworks based on sound research and collaboration to address the cumulative impacts of oil sands development in the Wood Buffalo region of Alberta.

CEMA was established following an Alberta Government initiative, the Regional Sustainable Development Strategy. The strategy identified priority issues of concern through consultation, and developed a conceptual framework for cumulative impact management, and timelines for implementation. CEMA consists of a series of multi-stakeholder committees that research and define the capacity of systems and thresholds for key regional environmental issues of concern and provide an ongoing forum for dialogue between key stakeholders. The agreed thresholds and guidance are implemented by member organisations in management plans and inform the development of project-level assessments. The relative independence of the organization from government and industry provides a space for the inclusion of the views of diverse stakeholders, however, the organisation relies on the adoption of the recommendations into corporate and government policy.

CEMA is predominantly funded by the oil sands industry and has a budget in the vicinity of $8 million per annum. The budgets are developed from business plans recommended by working groups. Funding is available to environmental and Indigenous representatives to facilitate participation. An industry representative body, the Oil Sands Developers Group, manages the apportionment of industry funding provided by its members to support CEMA.

The organisation has been challenged by the difficulty of developing consensus amongst diverse parties on difficult issues and effective administrative and governance systems to help facilitate such agreement. The technical nature of the work has also been identified as a barrier to participation, especially by Indigenous representatives. The Alberta Government has recently announced that some of the functions of the organisation will now be advanced from within the relevant agency, in an effort to hasten progress.

MORANBAH CUMULATIVE REFERENCE GROUP, QUEENSLAND

The Isaac Regional Council, in collaboration with key state government, coal industry, union and community representatives has established a multi-stakeholder reference group to develop and implement strategies for dealing with the cumulative impacts of mining on local amenity in the town of Moranbah. Moranbah is located in Queensland's Bowen Basin and is surrounded by underground and open cut coal mining operations. The group was established based on collective agreement that more could be done to improve the management of cumulative environmental and socio-economic impacts on the town; in particular, dust generation from multiple mining, petroleum, agriculture, land development and industrial minerals activities around the town.

With growth in mining activities around Moranbah, and the prospect of the generation of more dust, the group believes there is much to be gained from a proactive approach now, rather than a reactive approach later. Dust issues have not previously been sufficiently addressed, with the issue currently being dealt with by the regulation of individual mines based on a national standard not tailored to local conditions or perspectives. This system has led to a range of uncoordinated approaches being adopted to manage dust at individual mining operations, including real time monitoring, workforce monitoring, boundary monitoring, and near-to-site sensitive receptor monitoring. Compliance monitoring is currently largely complaint driven. The reference group is pursuing a collective voluntary approach, to supplement the existing regulatory system.

5.2 REPORTING CUMULATIVE IMPACTS

Reporting has become a significant activity for the mining industry to communicate performance at the operational and corporate levels. Reporting consists of the documentation and communication of information on numerous activities and outcomes.

In locations where a mine is one of multiple activities impacting a system, for example in the presence of multiple mines or industries, it can sometimes be difficult to capture a full picture of the totality of the impacts. While impacts are experienced by communities, economies and environments cumulatively, reporting and communication almost exclusively presents information only on individual companies or operations. Such information can be incomplete, repetitive and overwhelming for stakeholders to digest and read.

Standardised reporting requirements, such as, the Global Reporting Initiative (GRI) are one way that reporting from multiple sources can be aggregated to provide a more complete understanding of cumulative impacts. However, while the aggregation of standardised data can produce meaningful results for some impacts, such as greenhouse gas production or the extent of disturbed land, for many others data can become meaningless outside of its local context. For example, the impact of saline mine water discharge on a river is dependent on the existing salinity of the river, the timing of discharges, the number, location and nature of discharges from other sources (point and non-point), and the tolerance of the river ecosystems to salt.

Reporting in these circumstances is best approached collectively or at a regional scale. Collective reporting to the community or to government may be more effective at communicating the priority economic, social and environmental impacts and the overall contribution of the industry.

Collective reporting can provide an overview of industry investments, activities, aggregate impacts and the state of the environment. Collective reporting may consist of information on direct and indirect employment, the provision of training opportunities, local business spend, contribution toward government and financial and in-kind support for community programs. Complaints patterns and trends may be presented alongside the responses of individual mines and collective efforts to mitigate activities. More broadly, efforts to avoid, mitigate, or enhance impacts can be presented, including details such as management of visual impacts, land disturbance, water usage and water quality, and dust and air quality. Research specifically commissioned to measure impacts may also be presented. Regional organisations, industry bodies, and governments are best placed to coordinate such efforts.

SECTION 5 FURTHER RESOURCES

- Compliance Advisor Ombudsman (2008). Participatory Water Monitoring: A Guide for Preventing and Managing Conflict. Prepared by the Office of the Compliance Advisor/Ombudsman for the International Finance Corporation (IFC) and the Multilateral Investment Guarantee Agency (MIGA), Washington.
- Designer Carrots - Commonwealth Market Based Instruments Capacity Building Program. http://www.marketbasedinstruments.gov.au
- NSW Environment Protection Authority (2003). Hunter River salinity trading scheme: Working together to protect river quality and sustain economic development. New South Wales Government. Sydney.
- Global Reporting Initiative (GRI) (2009). Sustainability Reporting Guidelines and Mining and Metals Sector Supplement. Draft Sector Supplement for Public Comment. January 28 – April 29, 2009. Version 6. 70p.
- Global Reporting Initiative (GRI) (2007). Sustainability Reporting Guidelines. Amsterdam.
- CSRM (2005a). A Sourcebook of Community Impact Monitoring Measures for the Australian Coal Mining Industry. 27p.
- CSRM (2005b). Developing a Community Impacts Monitoring and Management Strategy: A guidance document for Australian coal mining operations. 24p.

06 CONCLUSION

This good practice guide has outlined strategies to equip the Australian coal mining industry to more effectively respond to the cumulative impacts of mining activities.

Cumulative impacts are assuming greater importance in Australia and elsewhere. The expansion of coal mining in a number of Australian resource provinces has had the effect of contributing to already impacted environmental and social systems. Cumulative impacts can also be what are most important to communities, environments, and economies in the vicinity of mining operations because it is the accumulation of impacts that they experience. As such, cumulative impacts are receiving more focussed attention from regulators and planners within government agencies.

Cumulative impacts are distinguished from other impacts because:

- they cannot be properly understood or managed simply by focussing on the activities of individual mines;
- assessment of cumulative impacts, and the development of strategies to deal with them, requires an understanding of the system, or receiving environment, in which they occur (e.g. a town, airshed, or watershed); and
- in many cases they can only be addressed through collaborative action.

There are growing expectations that the (coal) industry will enhance its capacity to respond to changing regulatory and community expectations, and that governments will play a more effective co-ordination, service delivery and assessment role in resource provinces and resource communities.

Cumulative impacts present differing challenges, roles and responsibilities for industry, government regulators, and community stakeholders. Table 4 illustrates the way that the management of cumulative impacts can differ from site-specific impacts for four common issues.

Proactive and collaborative management of cumulative impacts can benefit regional environments and communities. Resources are often not the limiting factor. More effective co-ordination of existing resources can assist mitigation and enhancement efforts through reduced duplication and efficiency gains, and better planning and assessment may help avoid adverse impacts.

In this final section we outline a generic process that can be followed to guide the assessment and management of cumulative impacts.

TABLE 4: DIFFERING APPROACHES TO THE MANAGEMENT OF CUMULATIVE VS. SITE-SPECIFIC IMPACTS.

ISSUE	MANAGING FOR SITE-SPECIFIC IMPACTS	MANAGING FOR CUMULATIVE IMPACTS
Dust management	▸ Regulators set dust limits for individual sites, based on data provided by proponents, modelling (wind direction, ambient dust, etc) and submissions from potentially impacted parties. ▸ Mines: • establish point source and perimeter dust monitoring; • implement measures to ensure compliance with licence conditions (e.g. watering, timing of blasting, location of plant). ▸ Mines and regulators receive and respond to complaints. ▸ Regulators monitor for exceedances and take corrective and enforcement action where deemed necessary.	▸ Industry and regulators collaborate to: • investigate dust sources • analyse trends and patterns • establish a regional dust monitoring system • fund research on health and amenity impacts. ▸ Mechanisms created (or existing forums utilised) to engage with regional and local stakeholders to address community concerns about dust and its impacts. ▸ Companies operating in the airshed agree to voluntarily implement measures to control and reduce dust, notwithstanding that individual mines may already be in compliance with licence conditions. ▸ Local mines seek to enlist support from other industries that may be contributing to dust levels (e.g. quarries, power stations). This may include advice and assistance with dust control measures.
Visual impact	▸ Regulators set conditions for design of bunds, location of plant, screening vegetation etc, based on information provided by proponents, established practices and issues raised in public submissions. ▸ Individual mines designed in accordance with these conditions. ▸ Conditions apply prospectively, not retrospectively. ▸ Individual mines may voluntarily take additional actions to address local concerns (e.g. planting of additional screening vegetation).	▸ Regulators develop a synoptic landscape plan, in consultation with regional and local stakeholders and industry. The plan includes consideration of visual impacts, both now and post-mining. ▸ Regulators negotiate with existing and proposed developments to adopt mine designs and rehabilitation plans that are consistent with the landscape plan. ▸ Mines within a 'viewshed' collaborate on measures to reduce visual impacts (e.g. agreement to shape spoil heaps according to contours, consistent use of vegetation for rehabilitation)
Water quality impacts on local catchments	▸ Regulators set limits on amount and quality of water that can be discharged off-site, based on established standards and demands/expectations of other water users and stakeholders ▸ Mines design and manage operations to meet licence conditions. ▸ Individual mines may take additional action to prevent/minimise off-site water discharges, depending on corporate policy drivers and local circumstances.	▸ Jointly funded research undertaken into the capacity of the catchment to absorb discharges under different conditions. ▸ Engagement between regulators, local mines and regional stakeholders (including water users) to establish a process, standards and criteria for regulating the timing and scale and of discharges across the catchment. ▸ Mines in the catchment agree to manage discharges in accordance with this regime. ▸ Regional level, multi-stakeholder, collaborative mechanism established to oversee and monitor the operation of the scheme.
Pressure on social infrastructure (e.g. affordable housing, services)	▸ Proponents of major developments are required to estimate project impacts on social infrastructure as part of the SIA and propose mitigation strategies. ▸ State and local governments negotiate with developers to make one-off infrastructure contributions and other special payments. ▸ Individual mines and companies, through their social investment programs, make voluntary contributions to address perceived community needs.	▸ Government –preferably in collaboration with key regional stakeholders and industry – undertakes a strategic assessment to identify growth scenarios for a region and current and likely future social infrastructure requirements. ▸ SIAs, mitigation strategies, and management plans for new developments draw on and are aligned to this analysis. ▸ Mining operations in the region agree to contribute to a common 'social infrastructure' support fund and/or to align social investments to respond to key needs identified in the strategic assessment. ▸ Regional level, multi-stakeholder, collaborative mechanism established to monitor how well social infrastructure requirements are being met and to initiate corrective action if required. ▸ Consideration given to timing the sequencing of developments to lessen short term pressures on social infrastructure.

6.1 AN EIGHT STEP APPROACH TO UNDERSTANDING AND DEALING WITH CUMULATIVE IMPACTS

1. ***Determine the key areas of concern to stakeholders***. Cumulative impacts by definition are determined from the reference point of the receiver, that is they are the totality of impacts being experienced by an entity. The determination of priority impacts may require engagement with stakeholders, for example, through workshops or structured consultations, or they may be evident from previous monitoring efforts.

2. ***Define the system(s) to be understood***. The type of receiving environment (e.g. a town, river or airshed) will determine the scale of the system to be studied and the spatial and temporal boundaries of the assessment. The development of a baseline as a snapshot of a system at a particular point in time will in fact represent an already impacted system that includes the cumulative impacts of past activities. To overcome this issue care should be taken to consider historical trends and historical information about the 'pre-impacted' state of systems. Consideration should be given to the capacity of environmental and social systems to absorb impacts.

3. ***Determine how the impacts are accumulating***. Are impacts aggregating in time and space? Are they interacting? Are they generated as part of a causal pathway, or are they the result of the aggregation or interaction of impacts from multiple unrelated sources?

FIGURE 7: A GENERIC APPROACH TO RESPOND TO CUMULATIVE IMPACTS

4. ***Determine what actions are contributing to the generation of the impacts and by whom***. Research and data may need to be collected on the system and impacts in collaboration with other (potential) contributors. Methods such as forecasting, modelling and scenario analysis can help to project and understand how actions lead to impacts. Subject to data, time and resource constraints, the analysis should also consider associated facilities, policies or programs, such as, roads, power transmission lines, and government programs, and current, past and forecasted activities.

5. ***Review the strategies available to avoid and mitigate adverse cumulative impacts and enhance positive impacts*** (depending on the circumstances). Strategies may be focussed on past and existing development; projects under development or consideration; or potential future projects. In the case of regulators, management might also consider whether and how proposed and future projects should proceed. Management strategies may range from the exchange of information within and between organisations, through to joint programs and initiatives.

6. ***Consider, whether – and with whom collaboration is required to coordinate system wide management responses***. Collaborations may include other entities that are contributing to the impact but also those with expertise, knowledge and a stake in solutions; for example other companies, government agencies, organisations, and the research community. It is important to approach collaborations incrementally, to begin with tangible goals, and to expand the scope of the work as the relationship grows. Participants will need to be diligent to avoid the risks of agenda drift and a loss of focus.

   The establishment of a collaboration generally includes the following tasks:

   - discussion of the potential for a collective approach;
   - determination of the level of support for establishing the initiative;
   - identification of what needs to be done to set up the initiative and make it effective;
   - agreement on the role, scope and focus (for example through a terms of reference, or memorandum of understanding);
   - clarification of the governance arrangements, protocols for communication and data sharing, representation, and how to involve unrepresented groups;
   - determination of the work program and resourcing.

7. ***Monitor priority receptors of concern, determine system level indicators and targets, and agree on these with other stakeholders***. Monitoring may be best approached in partnership with other stakeholders and should be commensurate with the type of impact and receiving environment.

8. ***Determine the best approach to report and communicate information on key cumulative impacts to stakeholders***. For priority impacts reporting should aim to communicate: what is happening in the receiving environment; what is causing it; and what is being done to address it. Again, the scale of reporting should be consistent with the type of impact and the receiving environment, and may be best approached collectively (for example through an industry association or local collaboration) rather than mine-by-mine.

APPENDIX: THE AUSTRALIAN BLACK COAL INDUSTRY

Australia is the world largest exporter of black coal and the fourth largest producer. Black coal is mined for both metallurgical and energy production purposes. The industry generates $54.6 billion in exports and directly employs around 28,000 people (ABARE, 2009; MCA, 2010). Australian black coal production has experienced a period of expansion increasing from 345 Mt (raw) and 273 Mt (saleable) in 2001-02 to 421 Mt (raw) and 327 Mt (saleable) in 2007-08 (though production decreased slightly in 2008-09; ABARE, 2009).

Queensland is the largest producer of black coal in Australia with 54 active mines (15 Underground, 39 open-cut; 2007 figures; ACA, 2009). In 2008-09 Queensland produced 222 Mt up from 135 Mt a decade earlier (1997-98; figures are for raw coal; ABARE, 2009). The large majority of operations are in the Bowen Basin followed by the Surat, Galilee, Clarence-Moreton and Tarong Basins.

New South Wales is the second largest producer of black coal in Australia with 60 active mines (29 underground, 31 open-cut; 2007 figures; ACA, 2009). In 2008-09 the state produced 181 Mt up from 134 Mt a decade earlier (1997-98; figures are for raw coal; ABARE, 2009). The Sydney Basin (that includes the Hunter coalfields) hosts the large majority of mines, with Gunnedah emerging as a prospective region.

The following section profiles four Australian coal provinces to highlight the varied operational contexts: the Bowen Basin, a dispersed mining region; the Hunter Valley coalfield, a 'mature', high density, coal mining region; the Surat Basin, an emerging region; and the Gunnedah Basin a prospective region.

BOWEN BASIN (QUEENSLAND) – A DISPERSED RESOURCE PROVINCE

The Bowen Basin is a relatively dispersed mining region due to the size of the Basin and the relatively even distribution of the mining operations, though there are a number of locations where operations are closely spaced. The Bowen Basin covers an area of approximately 60,000km^2 in Central Queensland stretching from Collinsville in the north to Theodore in the south (see Figure 8). The Basin hosts 47 operational coal mines and produces over 100 million t of black coal annually. A further 31 projects were under development, as of July, 2010. Increasingly the Basin is also attracting development and exploration for coal seam gas extraction.

The Bowen Basin is serviced by communities including Collinsville, Nebo, Glendon, Moranbah, Clermont, Dysart, Middlemount, Tieri, Emerald, Blackwater and Moura. The Basin has a total population of around 70,000, with an additional 10,000 non-resident workers in company accommodation (e.g. single persons quarters) while on roster that drive-in, drive-out (DIDO), fly-in, fly-out (FIFO) and bus-in, bus-out to the coastal centres of Bowen, Mackay, Rockhampton and Gladstone. Coal from the Basin is mostly exported through ports near Mackay, Gladstone and Bowen. Glenden, Dysart, Tieri, Middlemount, Blackwater and Moranbah are purpose built mining communities, while other communities were established to service rural industries, particularly grazing.

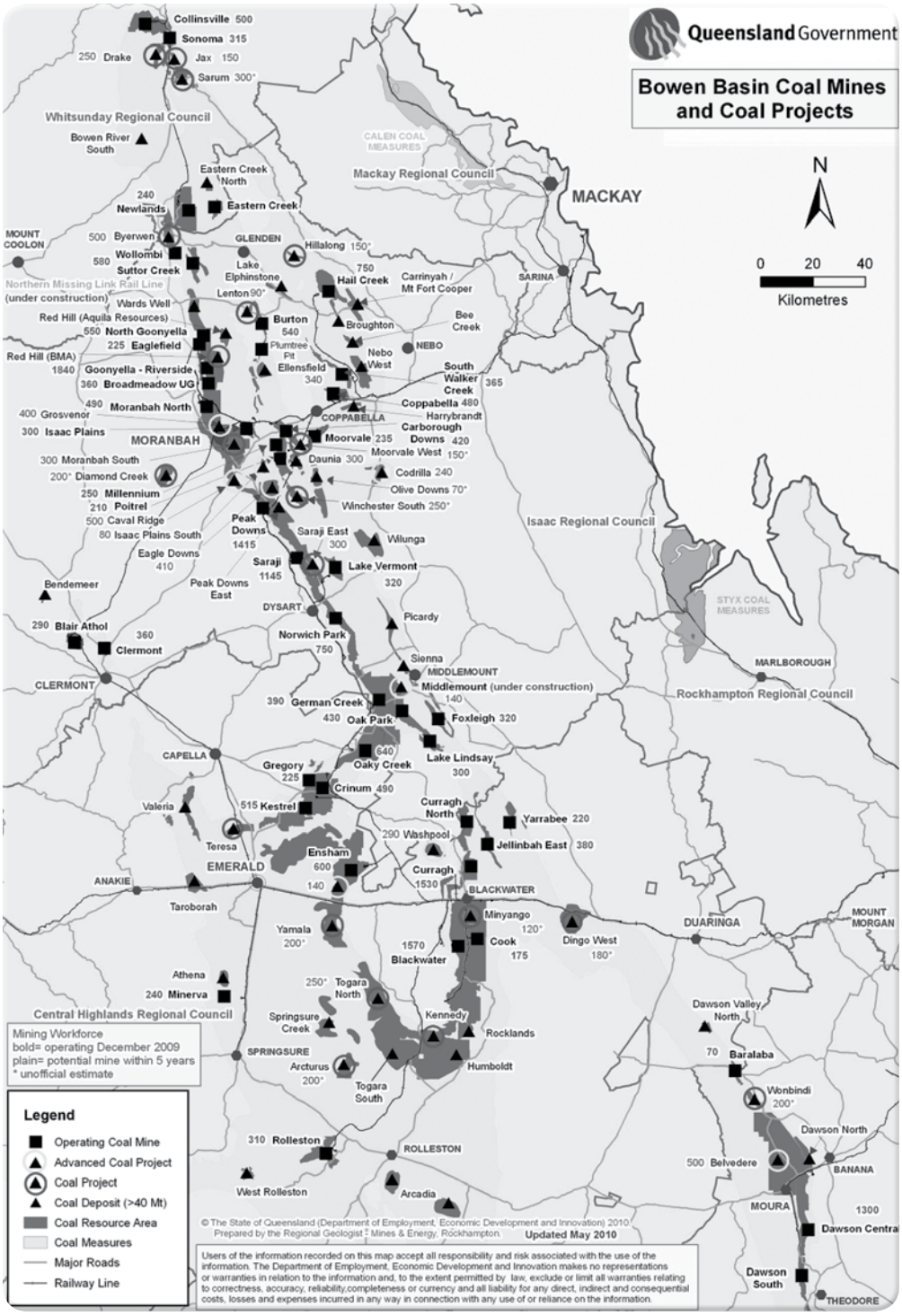
Expansion of coal mining in the Bowen Basin has contributed to the generation of a number of cumulative impacts, particularly pressure on social and economic infrastructure. The region has reported shortages in affordable accommodation and housing (e.g. rents in Emerald and Moranbah have been up to 95% more expensive than the state capital city of Brisbane; Rolfe et al., 2007; McKenzie et al., 2009), skills shortages in trades, difficulties in retaining staff in the non-mining sectors, and pressure on community services such as child care, employment and skills training, local medical and dental services (QDIP, 2009a).

Increased mining activity has also brought positive economic cumulative impacts to the Basin with greater employment, and a larger population base to support services and facilities. In addition, the Bowen Basin has experienced positive cumulative impacts as a result of community development activities and funds, local business development from mine procurement, the development of human capital (skills, employment and training), and the provision (and subsidy) of water and transport infrastructure.

Due to the dispersed nature of mining in the region, impacts have most often arisen in the areas of regional infrastructure and services, rather than amenity issues associated with densely located operations. Where multiple mining operations are located close to towns, such as around Moranbah, the cumulative impacts of dust, noise, visual amenity and vibration are becoming increasingly evident (QDIP, 2009a).

Saline water discharge into the Fitzroy catchment, especially from mining operations subject to major flooding, has recently arisen as an issue due to the cumulative impact on downstream ecosystems. Similarly biodiversity impacts from vegetation clearing, the maintenance of roads, disruption to agricultural enterprises from exploration activities, fugitive greenhouse gas emissions, and the impacts of mining subsidence on flood plains also demonstrate a cumulative component.

FIGURE 8: COAL MINES AND COAL PROJECTS OF THE BOWEN BASIN, QUEENSLAND (SOURCE: QLD DEPARTMENT OF EMPLOYMENT, ECONOMIC DEVELOPMENT AND INNOVATION).



HUNTER VALLEY (NEW SOUTH WALES) – A HIGH DENSITY RESOURCE PROVINCE

Located in New South Wales to the North West of Sydney, the Hunter Valley coalfield is a mature high density mining region. The coalfield hosts 18 mines with 12 expansions and new developments underway (112 Mt coal production in 2007-08). The Hunter is one of a number of coal fields within the Sydney Basin (Figure 9 & 10).

Coalfields in the vicinity of the Hunter Valley include the Western coalfield (10 mines, 4 developments, 25.7 Mt), the Newcastle and Gloucester coalfields (14 mines, 4 developments, 18.9 Mt), the Central coalfield (no active mines), and the Southern coalfields (8 mines, 4 developments, 13 Mt; NSW DPI, 2009).

The Hunter Valley is approximately 50km in width and 100km in length, and has a population of around 50,000 people. The region is located in the headwaters and upper reaches of the Hunter River and the main towns of the region are Singleton, Muswellbrook, Denman, Aberdeen and Scone. Traditionally a rural-based economy the Hunter is now known for equine and wine industries, coal mining and energy production.

Reference to cumulative impacts in the Hunter is most commonly in the context of environmental and amenity impacts (dust, water quality, noise, vibration, greenhouse gases, biodiversity, health, and scenic amenity) though social impacts are also important.

In towns like Muswellbrook there was a distinct shift in focus during the early 1990s from a community focus on direct impacts to one of cumulative impacts of multiple operations (URS, 2000, 199). Muswellbrook, once a rural town in a dairy and farming district, is now surrounded by 5 mining operations (Figure 10). Cumulative issues of concern to the community in Muswellbrook include feelings of 'social dislocation', changing sense of place, biodiversity, dust, noise, vibration, visual amenity, water quality and infrastructure (Brereton et al., 2008; URS, 2000). Biodiversity, salinity discharge into the Hunter River and fugitive greenhouse gas emissions are also cumulative impacts of community concern.

Positive cumulative impacts include employment, local business and human capital development. For example, in Muswellbrook the mining industry directly employed 13-16 per cent of the total Shire workforce between 1996 and 2006. Almost 30% of local businesses reported relying primarily on the mining and energy production industries for their business (Brereton et al., 2008).

FIGURE 9: COAL MINING REGIONS OF NEW SOUTH WALES (SOURCE: NSW DPI, 2009).

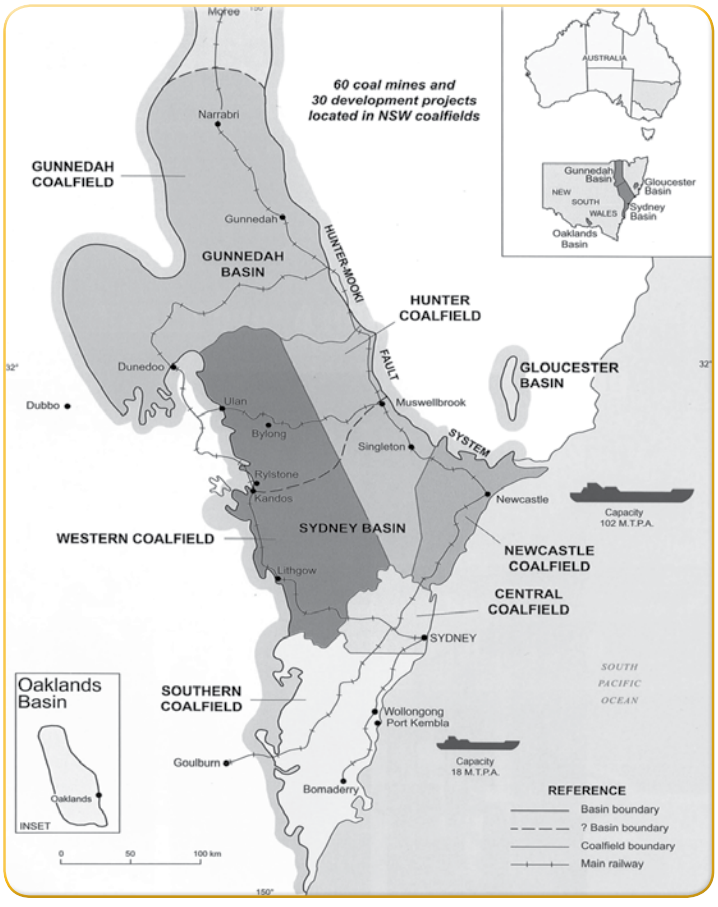
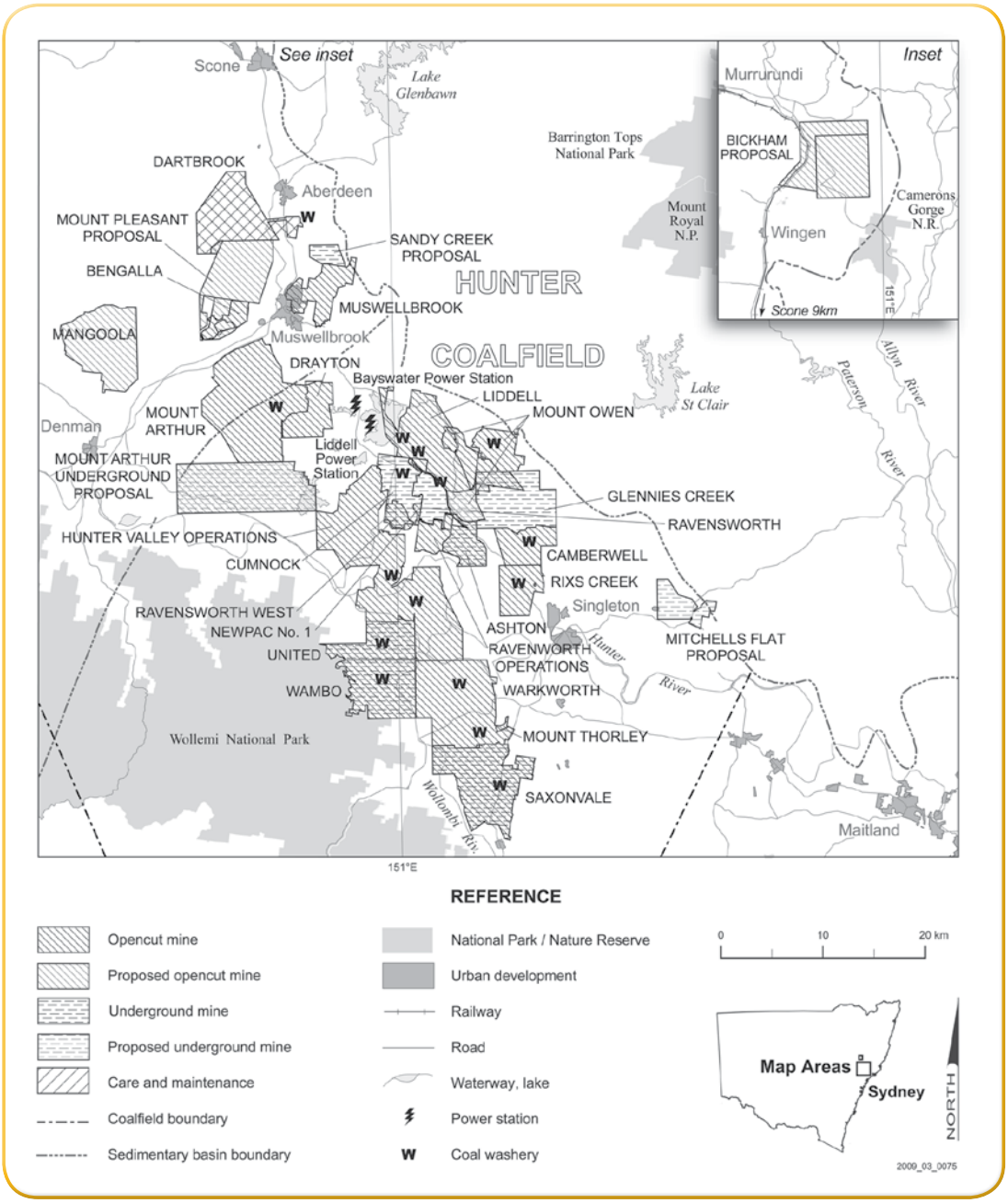


FIGURE 10: COAL MINING OPERATIONS OF THE HUNTER COALFIELD (SOURCE: NSW DPI, 2009)



SURAT BASIN (QUEENSLAND) – AN EMERGING RESOURCE PROVINCE

The Surat Basin is a sedimentary basin that overlies the Bowen Basin and is located in central southern Queensland and northern New South Wales. In Queensland the Basin stretches from Taroom in the northwest to Goondiwindi in the south, near the Queensland-New South Wales border. The Basin itself is integrated into a larger Surat Energy Resource Province linking resource extraction within the Basin to mainland ports and communities that service the Basin but that are located outside of its boundaries.

The region has recently experienced a significant expansion of coal mining and associated electricity generation and is regarded as a highly prospective thermal coal, coal seam gas and coal gasification province. Oil and natural gas developments in contrast have an established presence in the region. The Queensland Government estimates 4 billion tonnes of known thermal coal deposits exist near Macalister, Chinchilla, Wandoan and Taroom (QDME, 2007). One of the many drivers for coal exploration and mining in the Basin is electricity generation for Southeast Queensland.

The Surat Basin is serviced by the communities of Taroom, Wandoan, Roma, Miles, Kingaroy, Dalby, Chinchilla, Toowoomba, Milmerran and Goondiwindi. The two major regional councils of the Surat Basin are the Western Downs Regional Council and Maranoa Regional Council. In 2008, the estimated resident population for the Western Downs Regional Council was 30,564 people and for the Maranoa Regional Council 12,828 people (QDIP 2008d).

An important feature of the resource development in the Surat Basin is the linkage to the Gladstone and Brisbane ports. Gas pipeline infrastructure from the Surat Basin to ports and liquefied natural gas facilities in, and around, Gladstone, are increasing the energy development potential of the region. The proposed Surat rail link, between Banana and Wandoan, will also make possible the export of coal, freight and agricultural resources to the port facilities in Gladstone (QDIP 2009b).

The region is known internationally for its agricultural production, which includes beef cattle, wheat, grain, cotton and forestry products. The majority of towns in the Surat are service centres for the agricultural industry. In contrast to the Bowen Basin very few communities have been purpose built for mining development. The transition and adjustment by communities to the increasing resource investment in the Surat requires planning and due consideration for the potential for cumulative impacts: for example, effects on the existing community infrastructure such as schools, childcare and health facilities. The potential increase in the workforce is also likely to place pressure upon the amount of adequate, affordable housing and accommodation in the region. The increase in the labour force also has implications for potential skills shortages and the retaining of workers in industries such as agriculture (QDIP 2009a). Like the Bowen Basin and Hunter Valley, the Surat is likely to experience significant positive impacts through increased regional and economic development, employment and services.

The issues of land access for exploration and development and the ability of the mining, petroleum and agriculture industries to coexist have also featured prominently in discussions about the future of the region (QDIP 2008d). The issue of coexistence is particularly acute for coal seam gas extraction due to the semi-intensive use of land where an agricultural presence will in many circumstances continue in production regions. The production of saline water from coal seam gas creates additional opportunities and potential problems (QDIP 2009c).

GUNNEDAH BASIN (NEW SOUTH WALES) – A PROSPECTIVE RESOURCE PROVINCE

The Gunnedah Basin is a prospective coal province in New South Wales (see Figure 9). There are 4 current and 4 proposed coal mining projects in the Basin. In 2007-08 the Gunnedah Basin produced just 4.3 Mt of coal; however, the New South Wales government projects the development of a number of small to medium sized mines with prospects for larger operations in the coming decade (NSW DPI, 2009). In 2006 the New South Wales Government issued an exploration license for the Caroona area to BHP Billiton, and in 2008 an exploration licence was issued for the adjacent Watermark area to the China Shenhua Energy Company. Like the Surat and Bowen Basins there has also been significant interest and activity in the coal seam gas sector.

The Basin is approximately 150km wide and 200km in length, stretching from Dunedoo in the south to Narribri in the north (Figure 9). Towns in the Basin include Gunnedah, Tamworth, Quirindi, Narrabri, Caroona, Curlewis and Coonabarabran.

The Liverpool plains, one of Australia's most productive farming regions is located in the Basin. These black soil alluvial plains lie between Gunnedah in the north and Murrurundi in the south and produce around one third of Australia's durum wheat and one fifth of its sorghum. Further coal development in the Basin would require that mining coexist with broadscale agriculture and protect the features of the flood plain that make it attractive to farming. The farming community has raised the prospect that coal mining may contribute to the generation of adverse cumulative impacts through interaction and aggregation with the existing impacts from non-mining activities, particularly the impacts on the regional groundwater regime. A regional groundwater study is currently underway to assess the potential impacts of mining development in the region.

APPENDIX 1 FURTHER RESOURCES

For more information on the Australian coal mining industry see:

- NSW Department of Primary Industries (2009). Coal Industry Profile. Sydney. 302p.
- Qld Department of Mines and Energy (2007). Queensland's World-class Coals: Mine Production and Developments. November. Brisbane. 46p.
- Australian Bureau of Agricultural and Resource Economics (2009). Australian Mineral Statistics 2009. June Quarter. 36p.

For information on the impacts of coal mining on regional communities, economies and environments see:

- Queensland Department of Infrastructure and Planning (2009). Resource Community Summits Final Reports – Dysart, Dalby and Mt Isa. The State of Queensland. Brisbane.
- Brereton, D, Moran, CJ, McIlwain, G, McIntosh, J and K Parkinson (2008). Assessing the Cumulative Impacts of Mining on Regional Communities: An exploratory study of coal mining in the Muswellbrook area of New South Wales. Centre for Social Responsibility in Mining, Centre for Water in the Minerals Industry, The University of Queensland. Australian Coal Association Research Program (C14047). 145p.
- CSRM (2005). A Sourcebook of Community Impact Monitoring Measures for the Australian Coal Mining Industry. 27p.
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