Arrow Energy

LEAP Summit

Understanding risk profiles for environmental assessments and management

5 June 2015

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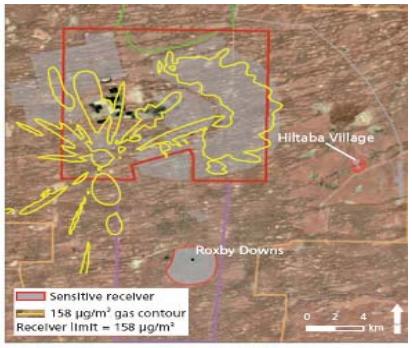
Topics

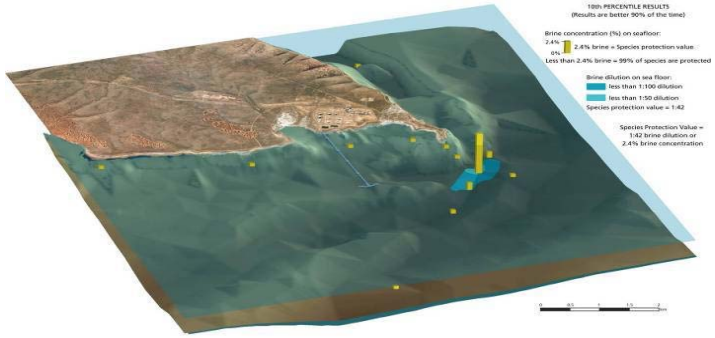
- Participants level of engagement/experience and specific issues to address
- Definitions of the four assessment types (any ideas on the 4 types?)
- Opportunity to raise project examples to discuss / clarify?
- Overview of impact and risk assessment processes
- Detailed understanding of risk assessments
- Group exercise – practical application of risk assessment methods
- Management and conditioning of impacts and risks
- Revisit participants list of issues to address

Impact Assessment:

Environmental Impact Assessment means an examination, analysis and assessment of ***planned activities*** *with a view to ensuring environmentally sound and sustainable development.* (United Nations Environment Programme 1987).



Maximum 1-hour average



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Sensitivity Assessment / Range Analysis:

Sensitivity analysis provides a way to show how a study's results would be affected, and how responsive or sensitive those results would be, to changes in the values of specific variables.

(Cost-Benefit Knowledge Bank for Criminal Justice 2015)

Table 9.1 Summary of Sensitivity Analyses

Sensitivity	Description of Change
Low Storage in the ZAL	The Sc in slices 2, 3 and 4 was assigned to an equivalent S of 0.015
High Storage in the ZAL	The Sc in slices 2, 3 and 4 was assigned to an equivalent S of 0.075
Wellfield Scenario – No Motherwell	The Motherwell Wellfield was not active during the predictive model simulation
Wellfield Scenario – Position	The Motherwell wellfield was shifted to the south-west, further away from Yarra Wurta Spring
High K in the ZWC	Where Kh (Kv) in slice 7 was equal to 0.02 (0.002), this value was increased to 0.05 (0.005)
Increased Seepage from RSF	Seepage from the RSF was increased from 1% of rainfall recharge (281 m^3/d) to 5% of rainfall recharge (1,405 m^3/d)
Recharge (± 40%) – Steady State	The steady state model was run with increased then decreased recharge to the entire model domain.
Recharge (- 40%) – Transient	The predictive model was run with a decreased recharge component.
Change at GAB – change in K	The Kh and Kv of the Torrens Hinge Zone and Adelaide Geosyncline were increased from 1 x 10^{-10} m/s.
Constant Head – Constant Flux	The constant head nodes in slice 2 were replaced by well nodes injecting water into the model at a set rate determine during the steady state model calibration.
Constant Head – Reduced Heads	The constant head nodes in slice 2 were replaced by well nodes injecting water into the model however, the wells were injecting at a reduced rate.

(Olympic Dam Expansion EIS 2009)

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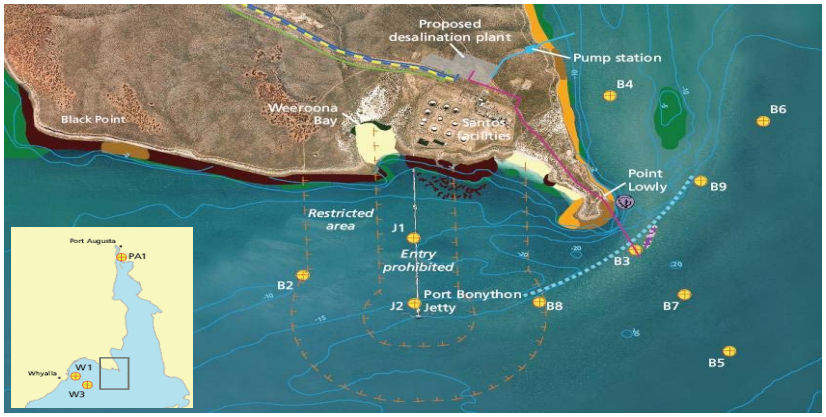
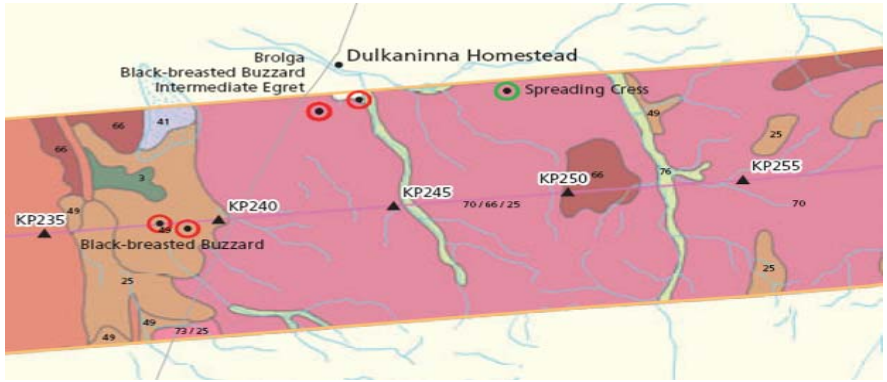
Uncertainty Assessment / Analysis:

A state of incomplete knowledge.

(Cullen and Frey 1999 in: CSIRO 2010 *Uncertainty and Uncertainty Analysis Methods*).





Focus on achieving preferred environmental outcomes

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Risk Assessment:

The process of determining the likelihood that a specified negative event will occur. (Investopedia 2015).

A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking. (Oxford Dictionary 2015).

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Opportunity to raise project examples to discuss / clarify?

Project examples wanting clarification?

Level of project definition - what, where, when and how?

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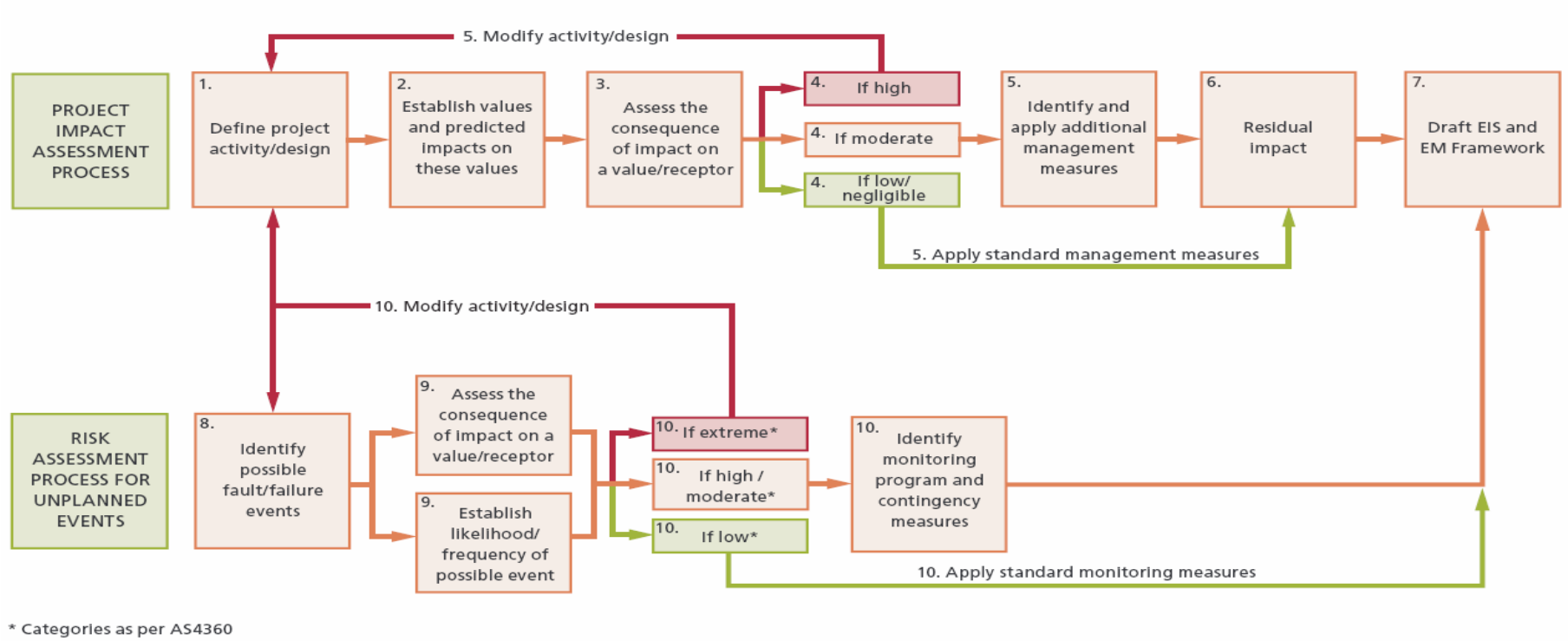
Overview of impact and risk assessment processes



* Categories as per AS4360

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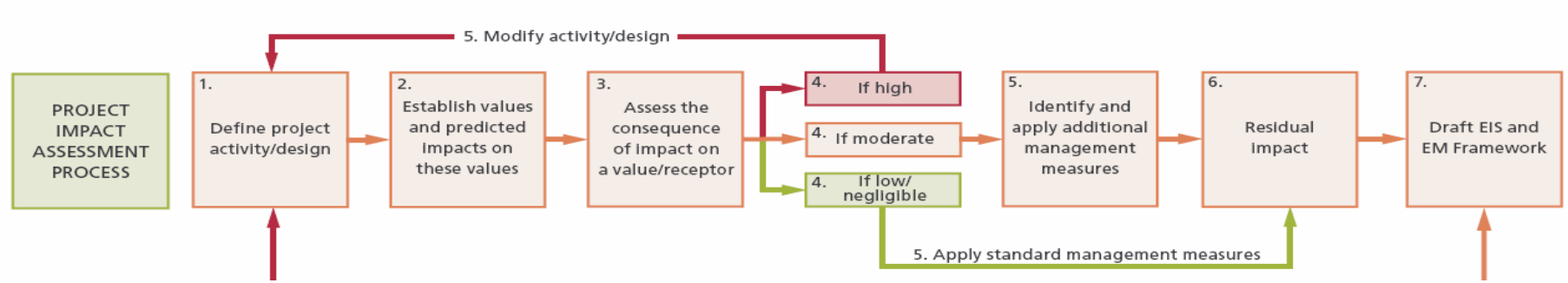
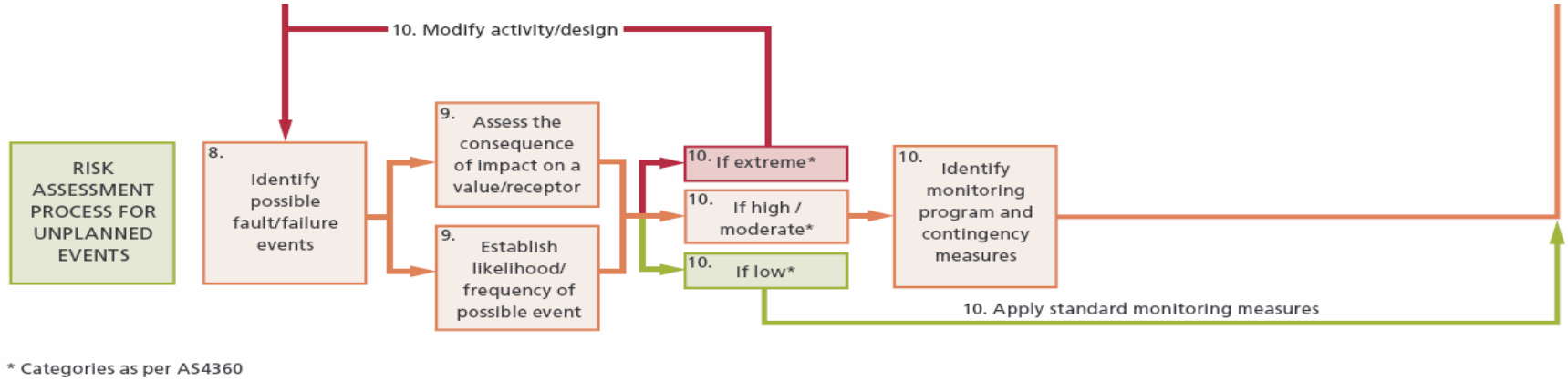
Overview of impact and risk assessment processes



Overview of impact and risk assessment processes



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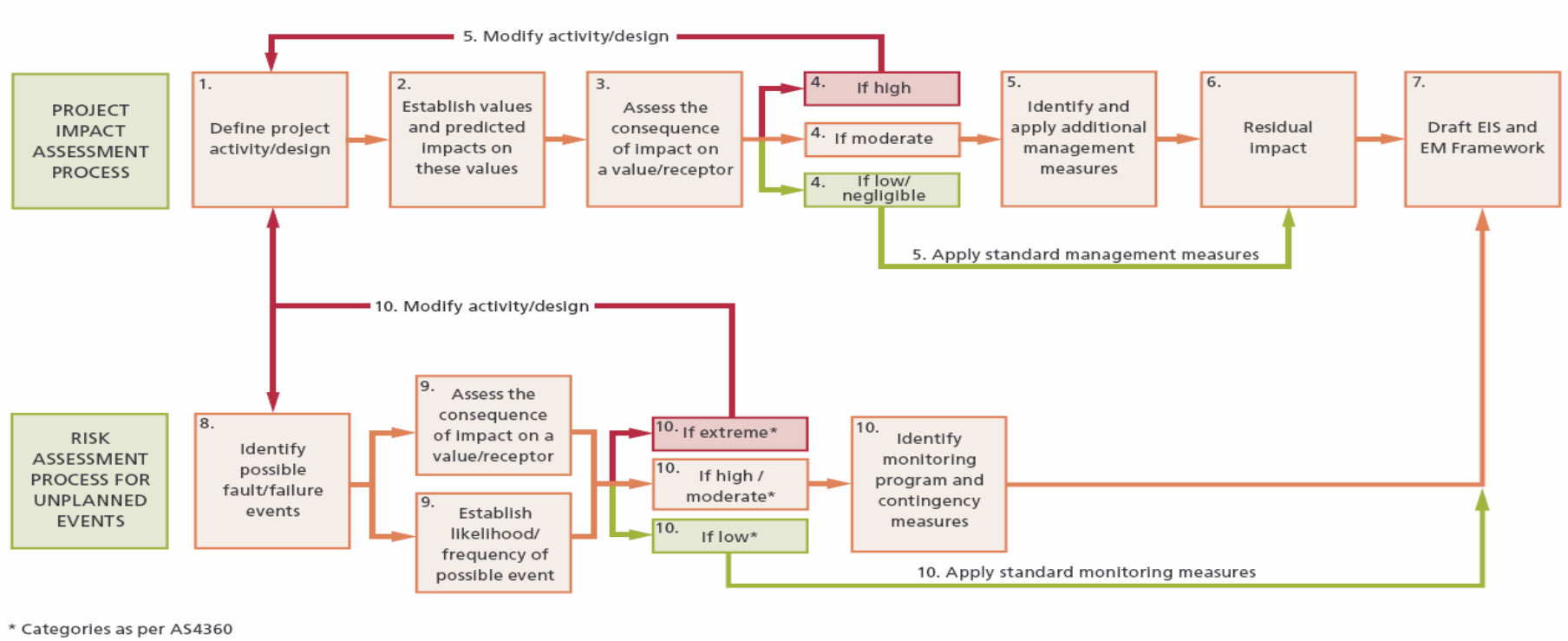
Overview of impact and risk assessment processes



* Categories as per AS4360

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L M H

Leg. / ToR → Leading practice

For each aspect of each impact assessment chapter:

- Community perception / expectations
- Government issues / expectations
- Scientific analysis

Draft to Final ToR - Critical / Routine Matters

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Prioritising impact assessments

L M H

Leg. / ToR → Leading practice

Table 3.1 Information Gap Analysis – Materials Management

Project Component	Issue/Risk	Phase	Overall project priority	Delivery plan priority	Information Required			Information Source	Information Gap			
					Legislative (Leg)	Terms of Reference (ToR)	Best Practice (BP)			Leg	ToR	BP
Mine Expansion	Tailings	P,C,O, D	H	H	EPP Water	TOR S5.6 - The proposed location, site suitability, dimensions and volume of liquid disposal and storage ponds, including their design, method of construction and operation, any changes in technologies proposed to be utilised, management of runoff from overburden and waste rock stockpiles, mine water disposal, and management of liquid wastes from the tailings retention systems, associated seepages and evaporation ponds, is to be discussed and illustrated on appropriately scaled plans.	Review of co-location and other innovative tailings disposal options.	PFS EHS and Processing documents. Monitoring reports	Gap 10: Testing and evaluation of co-locating tailings within the waste rock precinct as defined from PFS package 19 and extending into the EIS Gap 11: Identify and assess the options for tailings disposal, including potential footprint and water use reductions, processing improvements,	N N	N Y	Y Y

Olympic Dam Expansion 2005

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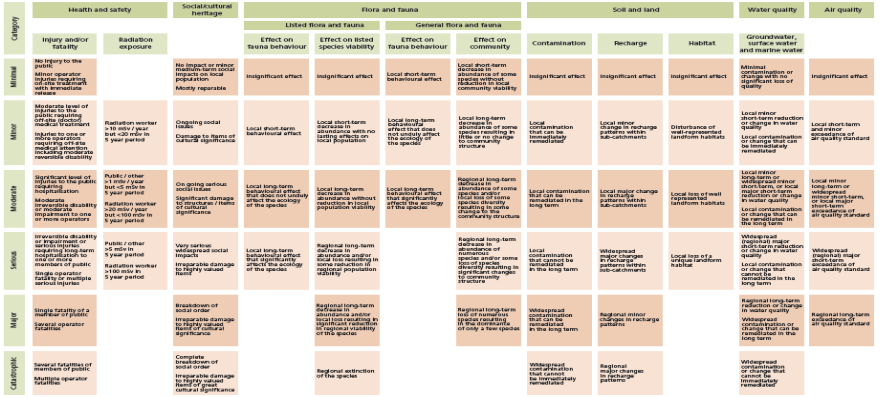
Descriptor	Level	General description	Chance per annum[1]	Project basis (construction phase)[2]	Frequency[3]	
Expected to happen	A	This event will occur – known to always occur in similar situations – expected to occur several (many) times each year	99.9%	Many times during project	1/month	More than 10 per year
Almost certain	B	This event is expected to occur in most circumstances – expected to occur at least once each year	>90%	At least once during project	1/year	One or more times per year
Likely	C	This event may occur in some circumstances – may occur during any given year	10%	At least once in every 10 projects	1/10 years	Once every 2 to 10 years
Possible	D	This event might occur at some time – not likely to occur in any given year, but is possible	1%	At least once in every 100 projects	1/100 years	Once every 11 to 100 years
Unlikely	E	This event could occur at some time – very unlikely to occur in any given year	0.1%	At least once in every 1,000 projects	1/1,000 years	Once every 101 to 1,000 years
Rare	F	This event may occur in very exceptional circumstances – has occurred historically, but is not anticipated	<0.1%	At least once in every 10,000 projects	<1/1,000 years	Less than once every 1,000 years

Describes the probability of an occurrence in any given year during the construction or operation phases.
The frequency of an occurrence during the construction phase.
The frequency of an occurrence (or return period in the case of natural events) during the construction or operation phases.



Level	Rank	Description	Frequency
A	Expected to happen	This event is known to occur >12 times per year	> once a month
B	Likely	This event may occur 4 - 12 times per year	at least once each term
C	Possible	This event may occur each year	once per year
D	Unlikely	This event may occur every 2 - 5 years	once per 2-5 years
E	Rare	This event occurs only in exceptional circumstances	> 5 years

Level	Rank	Student Achievement Target	Safety	Reputation	Operational Efficiency	Governance Efficiency	Service Interruption	Financial Loss / Cost
1	Negligible	Several students not meeting requirements	Near miss incident	Unsubstantiated, contained within the school	Negligible impact	Negligible impact	Several students	<$10,000
2	Low	One class not meeting requirements	Minor injury requiring on-site treatment	Substantiated, contained within the school	Inconvenient delays / efficiencies	Inconvenient delays / efficiencies	One class	$10,001 - $50,000
3	Medium	One unit not meeting requirements	Injury requiring off-site treatment	Substantiated, some community attention	Delays in achieving major objectives / outcomes	Delays in achieving major objectives / outcomes	One Unit	$50,001 - $100,000
4	High	Whole school not meeting requirements	Disability	Substantiated, widespread community attention, media attention, third party action	Non-achievement of major objectives / outcomes	Non-achievement of major objectives / outcomes	Whole school, < 1 year	$100,001 - $250,000
5	Extreme	Whole school not meeting requirements year after year	Fatality(s)	Substantiated, widespread community attention, media attention, third party action, Government (DG/Ministerial) involvement	Non-achievement of major deliverables	Non-achievement of major deliverables	Whole school, < 1 year	<$250,000

			Consequences					
			1	2	3	4	5	6
			Minimal	Minor	Moderate	Serious	Major	Catastrophic
Frequency	A	10/yr	H	E	E	E	E	E
	B	1/yr	H	H	E	E	E	E
	C	1/10yrs	M	H	E	E	E	E
	D	1/100yrs	L	M	H	E	E	E
	E	1/1000yrs	L	L	M	H	E	E
	F	>1/1000yrs	L	L	L	M	H	E

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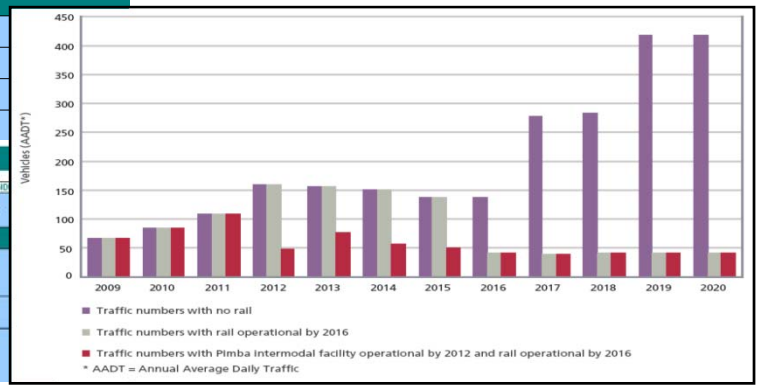
RISK REGISTER

ID	IDENTIFIED RISK EVENT			PROPOSED CONTROLS / MITIGATION MEASURES	P	C	RISK RATING	COMMENTS / CONTINGENCY MEASURE	RESIDUAL		RESIDUAL RISK RANKING
	HAZARD / THREAT	FAULT / FAILURE / CAUSE	RISK EVENT / IMPACTS /						C	L	
INDUSTRIAL NEIGHBOURS											
IN1	Third party use of private haul road	Excessive dust, noise from shared transport routes and loading/unloading facilities, fauna strikes	Potential haul road interaction	Facility design;sealed road, traffic management plan	B	5	N				
IN2	Third party use of private haul road	Collision of haul vehicles, injury to drivers, fatality		Accredited drivers using approved vehicles, traffic management plan, central road barriers	C	1	M				
IN3	Third party use of port facilities	Collision of vessels including tugs	Environmental impact	Harbour Pilot, dedicated berths, emergency response	E	3	N				
IN4	Third party use of port facilities	Collision of vessels including tugs	Injury to personnel	Harbour Pilot, dedicated berths, emergency response	E	1	L				
IN5	Threats from other neighbouring activities	Thermal radiation, explosive overpressures causing damage to critical facilities	Potential explosion, potential injury to workers	Design and location of Air separation unit; compliance with DGSM Regulation	E	2	N				
NATURAL EVENTS											
NE1	Natural events	Storm surges	Injury to personnel	Facility design; SOPs including evacuation procedures	C	3	L				
			Damage to plant and equipment	Facility designed to prevailing standards	C	3	L				
NE2	Natural events	Cyclones	Injury to personnel	Monitoring for early warning; Facility design; SOPs including evacuation procedures	C	3	L				
			Damage to plant and equipment	Facility designed to prevailing standards	C	3	L				

RISK REGISTER

ID	IDENTIFIED RISK EVENT			PROPOSED CONTROLS / MITIGATION MEASURES	P	C	RISK RATING	COMMENTS / CONTINGENCY MEASURE	RESI
	HAZARD / THREAT	FAULT / FAILURE / CAUSE	RISK EVENT / IMPACTS / CONSEQUENCES						C
SLAG TREATMENT									
ST1	Slag treatment	BOF slag treatment processes impacting amenity	Dust and noise impacts	Facility design; Site selection/layout; SOP	C	4	L		
ST2	Slag removal	Hole or break through pot	Injury to personnel	Facility Design; SOP, exclusion zones	B	3	M		
ST3	Slag treatment	BF rock slag treatment processes impacting amenity	Dust and noise impacts	Facility design; Site selection/layout; SOP	C	4	L		



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Detailed understanding of risk assessments - Traffic

Volkswagen: Eyes on the road - YouTube www.youtube.com/watch?v=R22WNkYKeo8

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Group exercise – application of methods

Group exercise – application of risk assessment methods

Group exercise – application of methods

Risk level	Target action
High	Risk is intolerable (i.e. unacceptable). Immediate action is required, activity should not commence until further controls are identified to reduce the risk to an acceptable level.
Moderate	Risk is tolerable (i.e. acceptable). Action is required. Identify and implement controls to reduce risk in accordance with the principles of As Low As Reasonably Practicable (ALARP). These risks should be captured in the Project's environmental management and monitoring plans.
Low	Risk is tolerable (i.e. acceptable). Action is desirable. Identify and implement controls to reduce risk in accordance with the principles of ALARP. These risks should be captured in the Project's environmental management and monitoring plans.
Negligible	Risk is acceptable. Manage by routine / standard processes.

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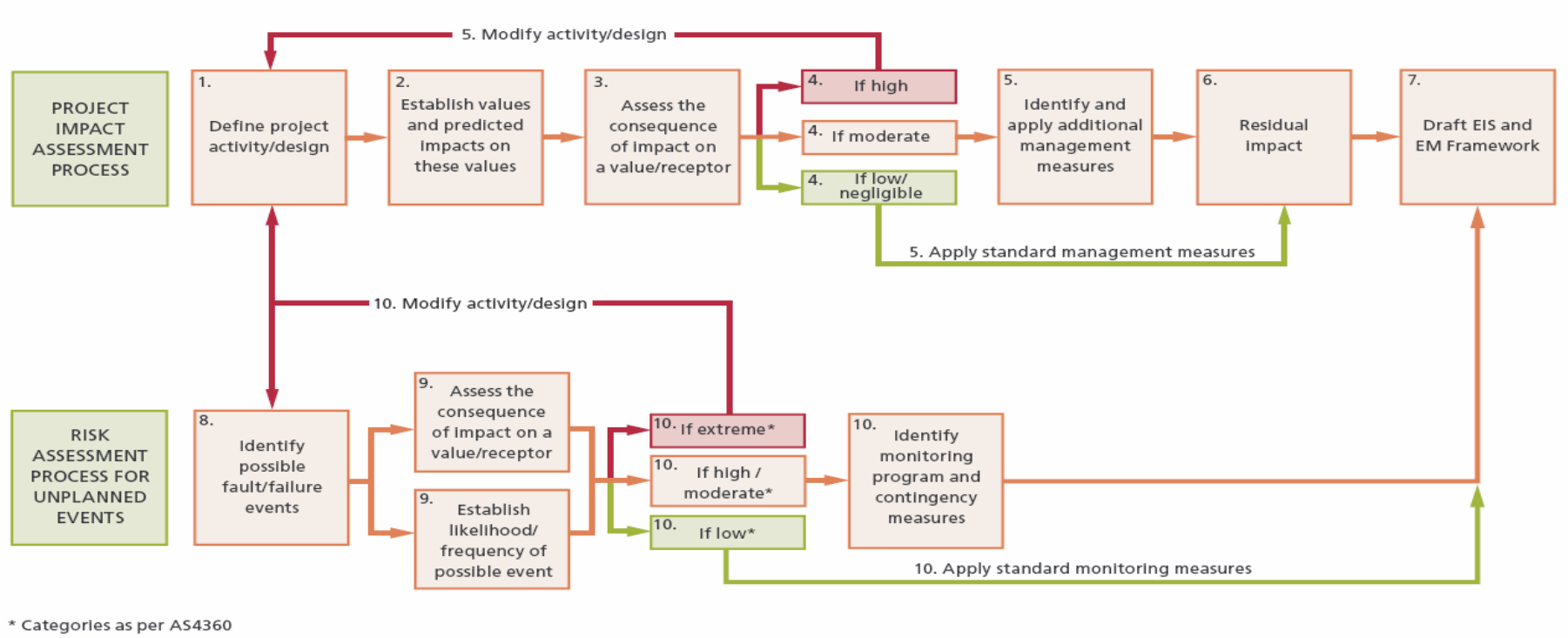
Management and conditioning of impacts and risks



* Categories as per AS4360

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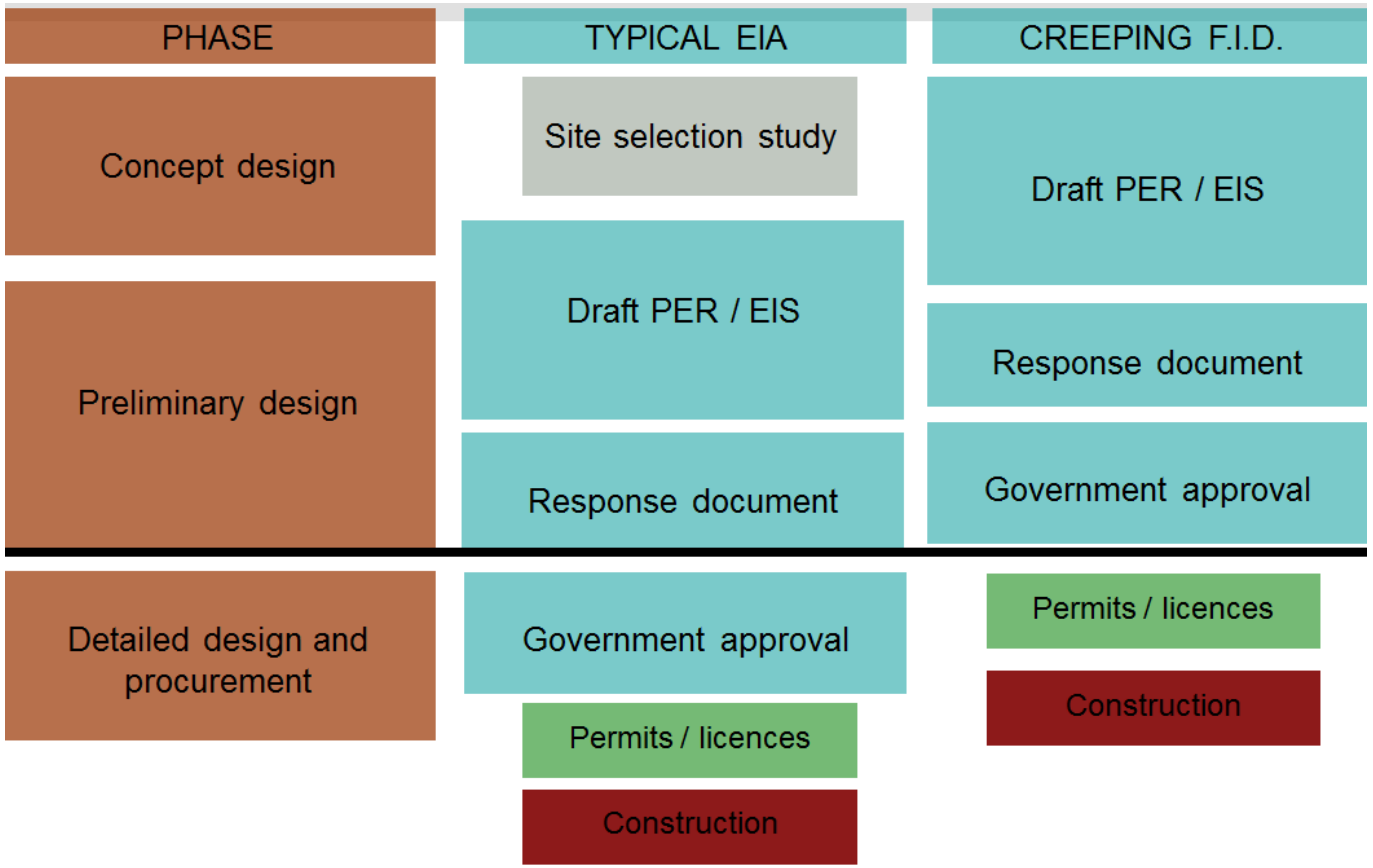
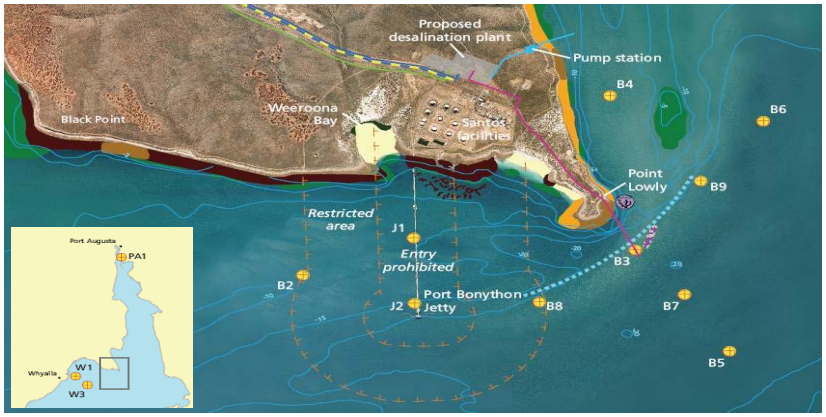
Key driver emerged about 2007 / 2008

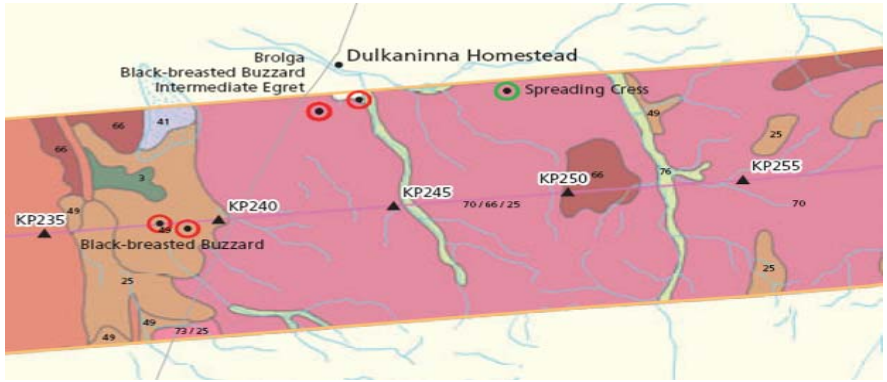


Uncertainty Assessment / Analysis:

Request For Information (RFI) – measure of success

Critical Information List (CIL) / List of Assumptions





Focus on achieving preferred environmental outcomes

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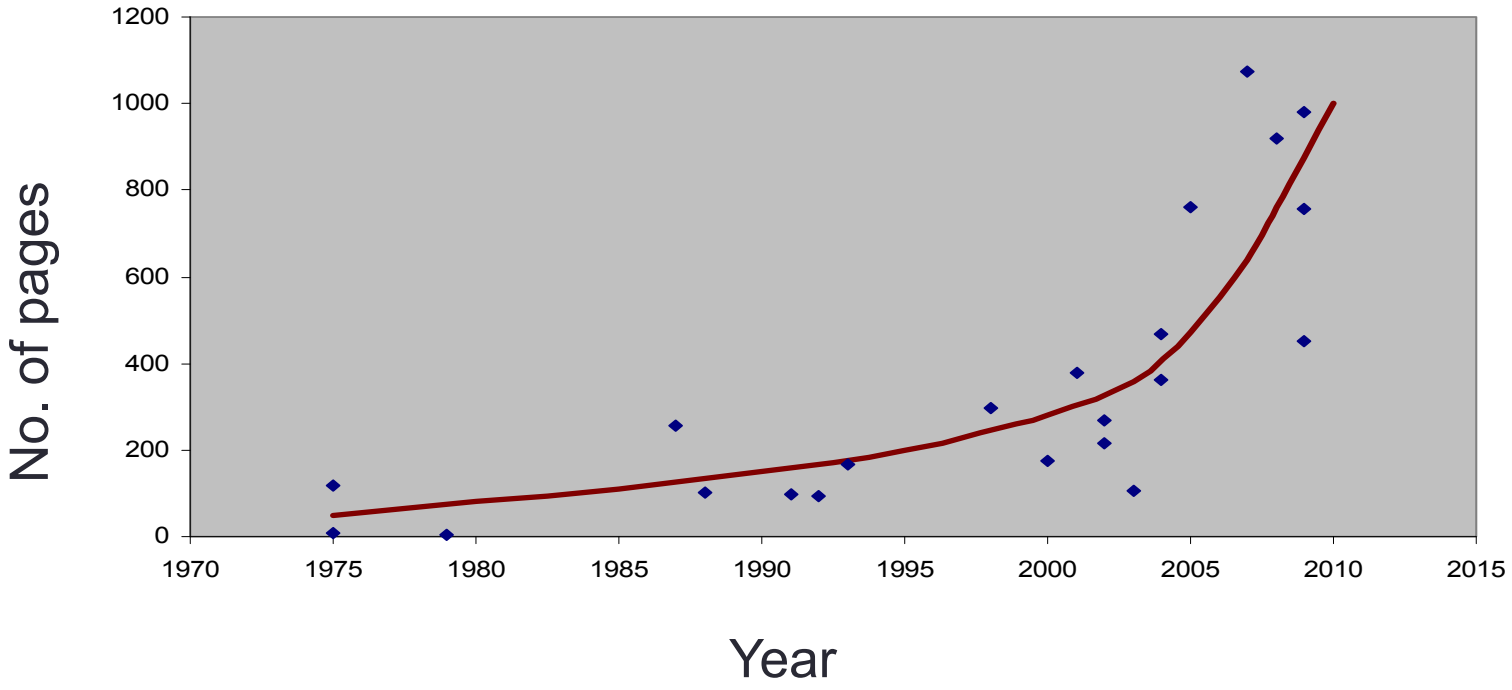
Led to increasing size of EIS documents (2009)



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Addressing the size issue

WA EPA 2009 - *Review of the Environmental Impact Assessment Process in Western Australia*

The key outcomes from the Review will be:

- **A new risk-based approach to EIA** – focus on the environmental risks and impacts that matter, greater consistency, rigour and transparency of decision-making.

Therefore - a prioritising exercise

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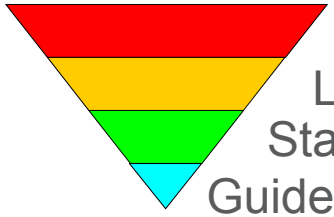
Management and conditioning of impacts and risks

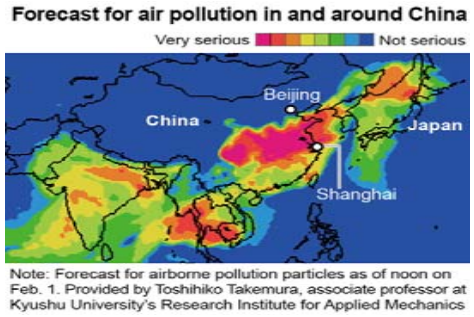
Overly prescriptive law =
slow economic growth



No law =
environmental degradation

Mongolia (Oyu Tolgoi)

China



Note: Forecast for airborne pollution particles as of noon on Feb. 1. Provided by Toshihiko Takemura, associate professor at Kyushu University's Research Institute for Applied Mechanics

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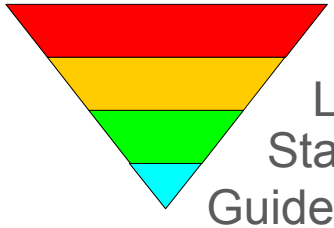
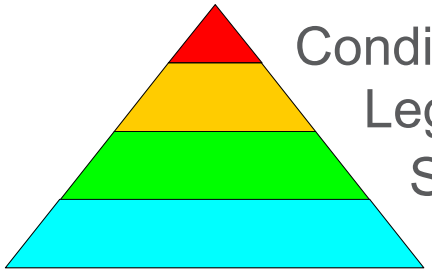
Management and conditioning of impacts and risks

Overly prescriptive law =
slow economic growth



No law =
environmental degradation

Outcome based law =
sustainable development



Note:
My position in 2010

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Australian Government / Gamut Consulting **2010** – EIS Checklist

Impact assessment and management		
Does the EIS:		
- clearly describe the criteria used to assess and categorise the level of impact to a value/receptor in terms of scale, intensity, duration, timing, frequency and overall significance of impacts		
- clearly identify any uncertainties in impact assessment and explain how these have been taken into account, for example, through incorporating worst case scenarios and/or sensitivity analysis		

Management and conditioning of risks

Risk assessment and management		
Does the EIS:		
- provide a flow chart of the risk assessment process used		
- clearly describe the likelihood and consequence criteria used to assess and categorise the level of risk to a value/receptor		
- define what is considered an intolerable and a tolerable risk event		
- discuss how the design/activities/management measures have been modified to avoid/minimise intolerable risks		
- identify the residual risk on values/receptors after modifications to design/activity/ management measures have been incorporated		
- identify the monitoring that will be undertaken during the construction and operation phases to determine if the likelihood of a risk event occurring is increasing above that predicted		
- identify contingency measures in the event that monitoring shows an increased likelihood of a risk event occurring		

Management and conditioning of impacts and risks

This report has indicated that all the identified **impacts as a result of the project are acceptable and can be adequately managed**. However, while the proposed draft environmental authority conditions in the EM Plan are comprehensive and substantially meet the requirements under the Act, numerous details would need to be addressed in consultation with the administering authority before a finalised suite of conditions could be applied through a draft environmental authority.

EHP Assessment Report **(2011)**

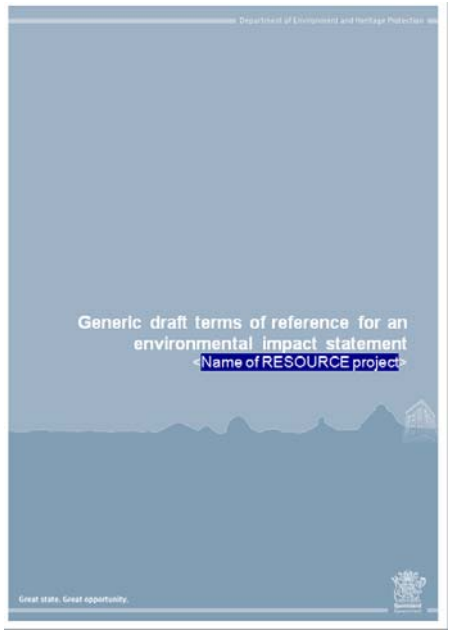
Cannington Life Extension Project EIS, BHP Billiton

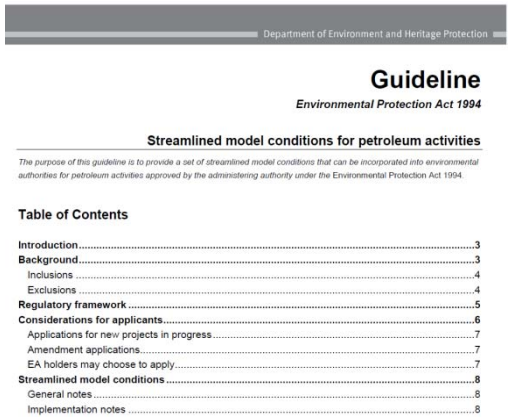
Example of good conditioning:

- Impacts acceptable and can be managed
- Risks in the EM Plan need further consideration

Qld Gov:

- Developed Generic Draft Terms of Reference for EIS (2013)
- Moved to outcome based conditions in 2013 (Mining) and 2014 (Petroleum)




Department of Environment and Heritage Protection

Guideline

Environmental Protection Act 1994

Streamlined model conditions for petroleum activities

The purpose of this guideline is to provide a set of streamlined model conditions that can be incorporated into environmental authorities for petroleum activities approved by the administering authority under the Environmental Protection Act 1994.

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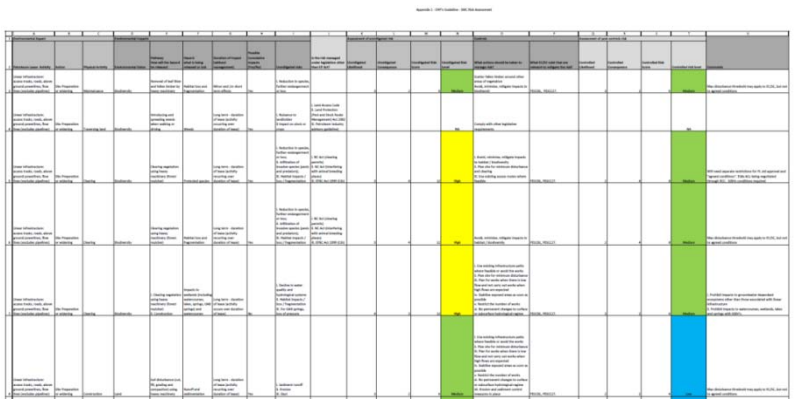

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7 Assessment of critical matters

7.1 Critical Matters

7.1.1 This section sets out the scope of critical matters that should be given detailed treatment in the EIS. A critical matter is an aspect of the proposal that has one or more of the following characteristics:

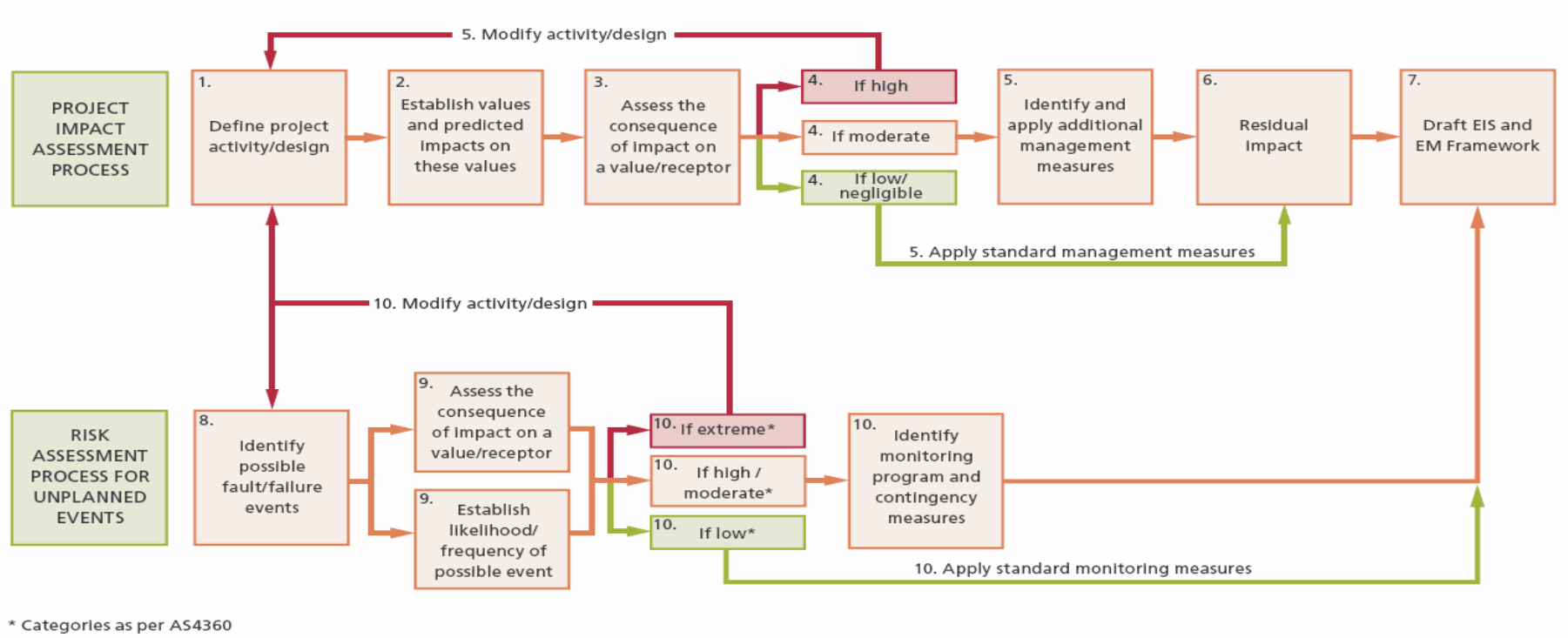
- a **high or medium probability** of causing serious or material environmental harm or a **high probability** of causing an environmental nuisance;
- considered important by the administering authority and/or there is a public perception that an activity has the potential to cause serious or material environmental harm

EHP Final Terms of Reference for Baralaba North Continued Operations EIS; **2014**

Impact example - EIS

- A combination of the CALPUFF modelling system and TAPM was used to model air quality for **three scenarios, specifically three indicative mine plan years 3, 7 and 11**. The modelling **did not take into account any mitigation measures** that could be applied to reduce the potential air quality impacts of the project, so the results represent worst case scenarios.
- The 24-hour average PM10 concentrations during years 3 and 7 of project operations are **predicted to exceed** the air quality objective of 50µg/m3 at **three of the ten** sensitive receptors, without the implementation of dust mitigation measures.
- CCL would implement proactive and reactive dust control measures. These measures would include suitable dust level **monitoring** and wind speed alarms and the use of weather **forecasting** to adapt mining operations to reduce dust emissions at the nearest private receptors in order to achieve compliance with applicable air quality objectives.
- With the proposed dust management measures in place, it is **reasonable to expect** that the air quality objectives would be met during the operation of the BNCOP.

Management and conditioning of impacts and risks



* Categories as per AS4360

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Impact example – Assessment Report

- Queensland Health **requested the proponent to adequately assess predicted air quality** during the construction and operational phases of the project against the health based air quality objectives.
- In response, the proponent referred (amongst other things) to the findings of the air quality model, which predicted that the project would meet the **annual average PM10** air quality objective for protecting human health.
- In considering the adequacy of the proponent's response to this issue, EHP notes that the predicted **exceedences of the 24-hour average PM10** air quality objective (designed to protect human health) at some sensitive receptors were based on conservative estimates, **without considering the potential reductions** that could be achieved by the implementation of dust mitigation measures.
- Based on this information and the recommended draft EA conditions in Appendix 1 of this report that require the proponent to comply with the health based air quality objectives for PM10 and PM2.5 at sensitive receptors, EHP considers that **this issue has been adequately addressed**. [**Appendix 1 requires compliance with 50µg/m3 limit for PM10**].

Risk example - ToR

Final ToR

- 8.7.1 Describe the **potential risks to people and property** that may be associated with the project in the form of a preliminary risk assessment for all components of the project and in accordance with relevant standards.

- 8.7.2 Provide details on the **safeguards that would reduce the likelihood and severity of hazards, consequences and risks to persons, within and adjacent to the project area(s).** Identify the **residual risk** following application of mitigation measures. Present an assessment of the overall acceptability of the impacts of the project in light of the residual uncertainties and risk profile.

No requirement for assessment of risks to the environment?

4.8 HAZARDS AND SAFETY

Appendix O describes the **potential hazards and safety risks** associated with the BNCOP in the form of a preliminary risk assessment in accordance with Australian Standard/New Zealand Standard (AS/NZS)…

4.8.3 Potential Impacts

A number of **hazardous materials and chemical substances** would be used during construction, operations and decommissioning of the BNCOP.

4.8.4 Mitigation Measures and Management

The following processes and measures would be implemented at the BNCOP to reduce the **risk of impacts on health, safety and the environment** associated with the BNCOP:

- List of control measures - activities undertaken in accordance with legislation

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- Queensland Health requested the proponent to provide information about how they would control and manage **disease vectors**…
- The Queensland Police Service (QPS) requested the proponent to incorporate into their planning **crime-scene preservation requirements** for incidents on-site that require a police investigation.
- QPS requested the proponent to include **evacuation procedures** at camps and work-sites into the emergency response plan.
- The Queensland Ambulance Service (QAS) requested the proponent to identify **potential landing sites for both a rescue helicopter and fixed wing aircraft** in the event of an emergency.

5.11.6.5 Conclusions and recommendations

The EIS adequately addressed the requirements of the final TOR with regard to **hazard and safety risks** associated with the project. **The major hazards and risks were identified and suitable mitigation measures were proposed to minimise the potential impacts to people and property.**

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Common throughout recent EIS'

*8.5.3 Potential **impacts** and mitigation measures*

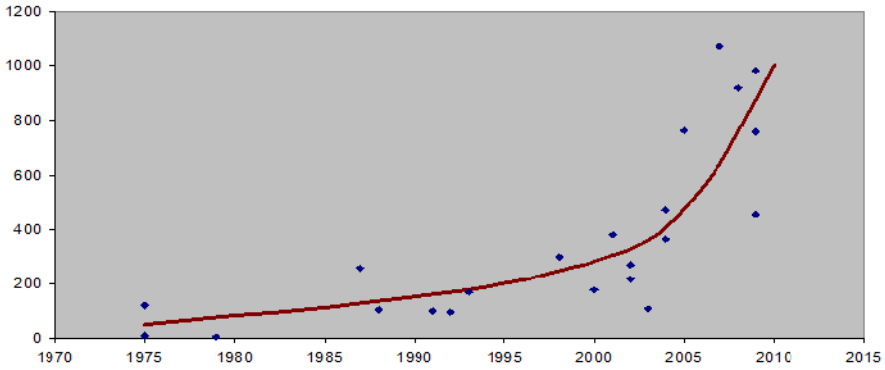
*The most serious potential **risks** to water quality in XX Creek, XX Creek, XX Creek and the XX River would be during the construction phase, through export of sediment and associated pollutants, such as nutrients, and the discharge of untreated acid drainage from acid sulfate soils.*

*4.4.3 Potential **Impacts***

*Key waste management **risks** associated with the XX include inappropriate storage or disposal of waste material that have the potential to impact on the following environmental values:*

Has it reduced the size of an EIS?

- 1,670 (2010) Alpha Coal
- 1,135 (2012) South Galilee Coal Project
- 966 (2012) Bowen Gas Project
- 1,940 (2013) Carmichael Mine and Rail
- 1,010 (2014) Red Hill Mining Lease
- 1,105 (2014) New Acland Coal Mine Stage 3



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Why the confusion?

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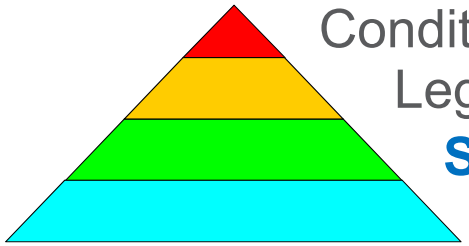
What should we be striving for?

Do we need a change or more education?

Do we need an EIS or just the Environmental Authority (EA)?

Outcome based law = sustainable development



Conditions

Legislation

Standards

Guidelines

Consultants….

Proponents….

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Risk assessments are important!

Videos courtesy of Shell: http://www.shell.com/hsse/global-programmes/safety-day.html

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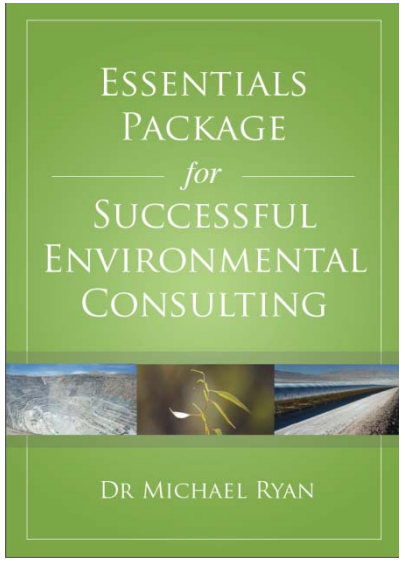
Revisit participants list of issues to address



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