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Environmental Impact Statement – Appendix C: Environmental Risk Assessment Procedure

Warragamba Dam Raising

Reference No. 30012078
Prepared for WaterNSW
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Contents

List of Tables

List of Figures

Environmental risk assessment procedure

1.1 Introduction

The purpose of this environmental risk assessment procedure is to provide a common basis for assessing environmental risk for key issue impacts identified in the SEARs (Table 1). All decisions and actions associated with implementation and operation of the Project will have some level of inherent environmental and social risk associated with them. Risk is the likelihood that a harmful consequence will occur because of an action, including those from natural or man-made disasters.

The objective of the environmental risk assessment is to identify situations of potential environmental concern early in the planning phase, which provides decision makers with the information necessary to select management options with the minimum level of acceptable risk.

Risk assessment also provides the information necessary to make decisions that will mitigate and reduce the risks to sensitive receptors. This process requires initial identification of the risks associated with the proposed activities followed by characterisation of the risk in the context of likelihood of an impacting event occurring and the consequences for the sensitive receptors should the event occur. Once this information has been identified, mitigation measures can be modified, or additional measures developed, to minimise inherent risk by reducing the likelihood of occurrence, the magnitude of the consequence, or preferably, both.

What remains is the residual risk. This is the risk remaining after all efforts to mitigate or eliminate risks have been applied. After the risk assessment has been performed, the residual risk will be known but may not be completely controllable, or, it may not be known. In either case, the residual risk is assumed by the Project owner and represents the real or actual risk associated with the Project.

Table 1. Secretary's Environmental Assessment Requirements (SEARs): Risk assessment

Key issue/Desired performance outcome	Where addressed
3. Assessment of Key Issues Key issue impacts are assessed objectively and thoroughly to provide confidence that the project will be constructed and operated within acceptable levels of impact. **Requirement:** 2. For each key issue the Proponent must: (c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts;	This procedure was applied to environmental aspects noted in Performance Outcomes 5 to 21 below.
5. Air Quality The project is designed, constructed, and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	Chapter 7
6. Biodiversity The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	Chapter 8 Chapter 9 Chapter 10 Chapter 11
7. Climate Change Risk The project is designed, constructed, and operated to be resilient to the future impacts of climate change.	Chapter 14
8. Flooding The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	Chapter 15

Key issue/Desired performance outcome	Where addressed
9. Health and Safety The project avoids or minimises any adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety.	Chapters: 7, 8, 9, 10, 11, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27
10. Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long-term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places.	Chapter 17 Chapter 18
11. Noise and Vibration - Amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	Chapter 19
12. Noise and Vibration - Structural Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Increases in noise emissions and vibration affecting environmental heritage as defined in the *Heritage Act 1977* during operation of the project are effectively managed.	Chapter 19
13. Protected and Sensitive Lands The project is designed, constructed, and operated to avoid or minimise impacts on protected and sensitive lands.	Chapter 20
14. Socio-economic, Land Use and Property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings, and infrastructure.	Chapter 21
15. Soils The environmental values of land, including soils, subsoils, and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulphate soils and site contamination.	Chapter 22
16. Sustainability The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	Chapter 23
17. Transport and Traffic Network connectivity, safety, and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	Chapter 24

Key issue/Desired performance outcome	Where addressed
18. Visual Amenity The project minimises adverse impacts on the visual amenity of the built and natural environment (including public open space) and capitalises on opportunities to improve visual amenity.	Chapter 25
19. Waste All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled, and/or disposed of lawfully and in a manner that protects environmental values.	Chapter 26
20. Water - Hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater, and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources.	Chapter 15
21. Water - Quality The project is designed, constructed, and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable). The project should not adversely affect drinking water quality.	Chapter 27

1.2 Identification of key environmental issues

Environmental assessment and identification of key environmental issues included the following:

- A preliminary environmental assessment report was prepared as part of WaterNSW's application to the Department of Planning and Environment (DP&E) to request SEARs for the Warragamba Dam Raising Project.
- Results from the preliminary environmental assessment were used to inform the SEARs, which identifies key issues with potential for high or moderate impacts (actual or perceived) requiring further investigation to identify specific management and mitigation measures.
- The process of key issue identification and analysis continued during EIS studies. More specifically, the analysis:
  - confirmed key issues identified in the SEARs and identified any other issues
  - examined potential impacts and proposed management and mitigation measures
  - identified the impacts likely to remain after management and mitigation measures are applied (that is, the residual impacts).

1.3 Risk assessment methodology

1.3.1 Introduction

A risk assessment methodology was developed for the Project, which is generally aligned with the requirements of AS/NZS ISO 14001:2016. This standard defines risk in terms of potential probability and consequence. The magnitude of a risk was assessed on the basis of information collected from baseline studies and the types and scale of activities that will be undertaken. Risk was determined by assigning scores to the likelihood (probability) and consequence, as shown below:

$$\boldsymbol{Risk = Likelihood \times Consequence}$$

Once risks were identified and the inherent risk estimated, decisions were made on how best to minimise the risks. The choices to reduce risk were considered in the context of the benefits and costs of each course of action to the Project, the receiving environment, and sensitive receptors.

Mitigation measures are actions that can be implemented to reduce the level of risk associated with an activity. As risk is defined as a product of likelihood and consequence, mitigation measures work by either reducing the likelihood of a negatively impacting event occurring, or minimising the consequences should the event occur. The overall effect of reducing one or both components is to minimise the **residual risk** associated with the Project.

Risk assessments were undertaken of the key issue impacts identified in the SEARs (Table 1) and are presented in the respective Chapters. Separate risk assessment methodologies were used to assess climate change and socio-economic impacts, which are described in the following assessment reports:

- Climate change assessment report (Appendix G): The risk assessment was done in accordance with:
  - Guide to Climate Change Risk Assessments for NSW Local Government OEH (2011)
  - Climate Change in Australia (DotE 2018)
  - AdaptNSW (OEH 2014)
  - AS 5334:2013 – Climate change adaptation for settlements and infrastructure – A risk based approach.
- Socio-economic, land use and property assessment report (Appendix M). The risk assessment was done in accordance with:
  - NSW Social Impact Assessment Guideline (DPE 2017b)

1.3.2 Risk assessment procedure

A Project risk matrix was developed (Figure 1) and risk evaluated by considering:

- the likelihood of an impact occurring over the life of the Project, or after the Project has been decommissioned. The life of the Project is defined in accordance with AS 5338:2013 (Climate change adaptation for settlements and infrastructure – A risk based approach), which describes a negligible (or rare) likelihood as occurring once in 100 years.
- the severity or consequence of the impact in a biophysical and/or socio-economic context, with consideration of:
  - whether the impact will be in breach of regulatory or policy requirements
  - the sensitivity of receptors
  - resilience or tolerance to disturbance, that is whether the impact is permanent or temporary
  - the areal extent of the impact and/or the magnitude of the impact on receptors.

Once the consequence and likelihood of an impact are assessed, the risk matrix provides an associated ranking of risk significance: **Low**; **Moderate**; **High** or **Extreme** for both before and after the application of mitigation measures. Risk definitions are given in Table 2. An example of a Project risk assessment table used in assessing each of the key issue impacts is shown in Table 3.

Where the risk after the application of mitigation measures (residual risk) was assessed as high or very high, mitigation options were reviewed to ascertain whether any further mitigation could be employed to further reduce potential impacts.

Table 2. Risk definitions

Extreme 21 – 25	Widespread and diverse primary and secondary impacts with significant long-term effects on the environment, livelihood and quality of life. Those affected will have irreparable impacts on livelihoods and quality of life.
High 15 – 20	Significant resources and/or Project modification would be required to manage potential environmental damage. These risks can be accommodated in a project of this size, however comprehensive and effective monitoring measures would need to be employed such that Project activities are halted and/or appropriately moderated. Those impacted may be able to adapt to change and regain their livelihoods and quality of life with a degree of difficulty.
Medium 9 – 14	Risk is tolerable if mitigation measures are in place, however management procedures will need to ensure necessary actions are quickly taken in response to perceived or actual environmental damage. Those impacted will be able to adapt to changes.
Low 1 – 8	On-going monitoring is required however resources allocation and responses would have low priority compared to higher ranked risks. Those impacted will be able to adapt to change with relative ease.

Key issues were further categorised per Project elements and phases, for example upstream/downstream and construction/operation. For each issue a level of assessment was undertaken commensurate with the potential degree of impact the Project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures have been recommended to manage impacts to acceptable levels. Both environmental and health and safety[1] aspects were assessed for each of the identified issues.

Environmental management measures will be implemented through the management frameworks put in place by the Construction Environmental Management Plan (CEMP), Operational Environmental Management Plan (OEMP) and relevant sub-plans. In addition to incorporating management measures, these plans will include details of how the measures will be implemented, monitored and audited for compliance.

[1] Health and safety has not been assessed as a stand-alone issue, but rather is incorporated in assessments of individual issues.

Figure 1. Risk matrix

			Consequence				
			Negligible	Minor	Medium	Major	Extreme
		LEGAL	No legal consequences	No legal consequences	Incident potentially causing breach of licence conditions	Breach of licence conditions	Breach of licence conditions resulting in shutdown of Project operations.
		SOCIO-ECONOMIC	Impacts that are practically indistinguishable from the social baseline, or consist of solely localised or temporary/short-term effects with no consequences on livelihoods and quality of life.	Short-term or temporary impacts with limited consequences on livelihoods and quality of life. Those affected will be able to adapt to the changes with relative ease and regain their pre-impact livelihoods and quality of life.	Primary and secondary impacts with moderate effects on livelihoods and quality of life. Will be able to adapt to the changes with some difficulty and regain their pre-impact livelihoods and quality of life.	Widespread and diverse primary and secondary impacts with significant long-term effects on livelihoods and quality of life. Those affected may be able to adapt to changes with a degree of difficulty and regain their pre-impact livelihoods and quality of life.	Widespread and diverse primary and secondary impacts with irreparable impacts on livelihoods and quality of life and no possibility to restore livelihoods.
		HEALTH	No health consequences	Accident or illness with little or no impact on ability to function. Medical treatment required is limited or unnecessary.	Accident or illness leading to mild to moderate functional impairment requiring medical treatment.	Accident or illness leading to permanent disability or requiring a high level of medical treatment or management.	Accident, serious illness or chronic exposure resulting in fatality.
		ENVIRONMENT	Localised (on-site), short-term impact on habitat, species or environmental media	Localised or widespread medium-term impact to habitat, species or environmental media	Localised degradation of sensitive habitat or widespread long-term impacts on habitat, species or environmental media. Possible contribution to cumulative impacts.	Widespread and long-term changes to sensitive habitat, species diversity or abundance or environmental media. Temporary loss of ecosystem function at landscape scale. Moderate contribution to cumulative impacts.	Loss of a nationally or internationally recognised threatened species or vegetation community. Permanent loss of ecosystem function on a landscape scale. Major contribution to cumulative effects
			A - negligible	**B** - minor	**C** - medium	**D** - major	**E** - extreme
Likelihood	Expected to occur during the Project or beyond the Project	**a** - expected	**13**	**14**	**20**	**24**	**25**
	May occur during the Project or beyond the Project	**b** - may	**8**	**12**	**19**	**22**	**23**
	Possible under exceptional circumstances	**c** - possible	**6**	**7**	**11**	**18**	**21**
	Unlikely to occur during the Project	**d** - unlikely	**4**	**5**	**10**	**16**	**17**
	Rare or previously unknown to occur	**e** - rare	**1**	**2**	**3**	**9**	**15**

Risk Definition (see Table 2)	Low	Medium	High	Extreme

Table 3. Project risk assessment table (example: Air quality)

Air quality								
Key impacts	**Risk before mitigation**			**Mitigation and management**	**Risk after mitigation**			**Residual risk**
	L	**C**	**R**		**L**	**C**	**R**	
Construction								
Air pollution emissions resulting in nuisance, licence breaches and health issues: *Site establishment works* ▪ land clearing ▪ stockpiling ▪ supporting infrastructure *Construction works* ▪ vehicle movements ▪ material movements and storage ▪ concrete batching	b	C	**19**	AQ1, AQ2	c	C	**11**	Modelling predicted that during Project construction air pollutants would generally be well below air quality criteria. However, for PM_{10} there is one slight exceedance predicted at one receptor (R49). However, any exceedances of the criterion would be rare and likely the result of regional dust events. Although air quality criteria at a sensitive receptor may be exceeded only rarely, if at all, a High risk was determined due to a potential breach of regulatory requirements. Following mitigation, the risk can be reduced to a Medium residual risk, however mitigation will need to ensure that necessary actions are quickly taken in response to adverse weather, such as high wind conditions.
Operation								
Air pollution emissions resulting in nuisance, licence breaches and health issues: ▪ light vehicle movements ▪ exhaust emissions.	d	C	**10**		d	B	**5**	Low residual risk not requiring significant additional mitigation measures.

L: Likelihood

C: Consequence

R: Risk

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