24 Health and risk impacts

This chapter provides an assessment of the potential risks of undertaking the preferred project, including a summary of the results of the screening level water quality risk assessment undertaken by Water Futures. A copy of the full report is included in Appendix P.

The matters associated with project risk and health is best addressed at two stages during the life of the preferred project: construction and operation. The information below provides an assessment into and highlights the matters to be considered in an integrated management approach through the life-span of the preferred project.

Given the very small additional number of potential domestic pollution sources resulting from the outlet structure, no additional health risks are expected. The additional 3.2 km of run-of-river flow in Burra Creek may even have a net beneficial impact due to increased aeration and natural biological processes.

24.1 Potential hazards and risk

Construction and operation of the preferred project could generate potential risks to the human environment, specifically:

- Hazard and risks associated with public health and safety during construction and operation; and
- Hazard and risks associated with the transfer of water between catchments and water bodies.

These potential hazards and risks have been identified through a number of environmental, social, economic and technical assessments and are also discussed throughout this report. The following does not re-address all these issues, but rather provides a summary of the key considerations.

24.2 Methodology of the screening level water quality risk assessment

A screening level quantitative risk assessment of the safety of drinking water harvested from the Googong Reservoir following the introduction of the preferred project was undertaken by Water Futures (refer Appendix P). The analysis considers risks arising during construction and commissioning, risks arising during the initial operation of the preferred project (first three years) and risks arising over the long term (future decades).

The overarching framework applied to the risk assessment was consistent with the enHealth *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards* (enHealth 2002) with particular attention being given to Chapter 4, *Environmental Health Risk Assessment for Water*. The approach involves four steps:

1. Hazard identification - determining which hazards are to be considered in the risk assessment;

2. Exposure assessment - predicting exposures to the identified hazards;

3. Dose-response assessment - estimating the response in the exposed population; and

4. Risk characterisation - assessing the acceptability of risks from the identified hazards.

24.3 Impact assessment and mitigation measures

24.3.1 Hazard and risk during construction

General construction activities

General construction activities such as the operation of machinery, excavating and trenching, blasting, working in and adjacent to road areas, working near or under major services (overhead electrical cables) and underground services and utilities can be a hazard and a risk to the safety of construction workers, local residents, members of the public, livestock and crops, as well as to the environment.

Construction of the preferred project will be undertaken consistent with an integrated Health, Safety and Environmental Management System that conforms to *AS/NZS 4801:2001 Occupational Health and Safety Management Systems* and *AS/NZS ISO 14001:2004 Environmental Management Systems* and accounts for findings of the Construction Hazard Assessment Implication Review (CHAIR) and Hazard and Operability (HAZOP) assessments undertaken. Management plans will be developed as follows:

- An occupational health and safety management plan: this will include appropriate safety measures in accordance with applicable standards and regulations such as fencing and warning signs erected around the active works area to clearly delineate the boundary of the construction site and prevent public access, thereby reducing the threat from vandalism and personal injury;
- A CEMP: a full time project environmental manager will oversee the implementation of the environmental management system, including the provision of suitable training to field staff and routine inspections and audits. A system of field monitoring will also be undertaken as part of the environmental management plan. Environmentally sensitive areas, such as the Murrumbidgee River will be protected with extra training provided to construction crews and additional sedimentation controls and protection measures (such as silt curtains around work areas); and
- The CEMP will be supported by a number of sub-plans (as discussed in Chapter 27), to minimise any hazards and risks due to construction of the preferred project.

Health and environmental protection during construction

Potential negative health impacts that may occur as a result of construction activities include the effects of noise and air quality (dust and gaseous emissions) pollution, as well as contamination and degradation of waterways. Such impacts are largely generic to infrastructure development projects and a broad range of Government standards and controls exist in order to ensure that appropriate health outcomes are achieved, as discussed below:

- Noise and vibration:
  - The assessment of noise and vibration impacts was undertaken in accordance with relevant standards and guidelines (Chapter 20);
  - The potential exists for construction activities to exceed the noise and vibration goals for the preferred project in some circumstances. Construction activities will move from one area to another as the construction of the pipeline progresses. Consequently, construction noise at sensitive receivers will occur on a temporary basis;
  - Construction works will generally occur during standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday) to minimise sleep disturbance. The criteria for sleep disturbance is discussed in Chapter 20 of this EIS. No construction works will be conducted on Sundays or public holidays. There may be infrequent occasions where work outside these hours may occur, including the delivery of oversized equipment. The community will be notified prior to any out-of-hours construction activities and, where possible, areas away from residences will be specified to minimise disturbance;
  - The impact of the construction activities will be minimised through the implementation of a noise and vibration management sub-plan, as part of the construction environmental plan. Noise mitigation measures are described in Section 20.6 of Chapter 20; and
  - Ongoing consultation with affected landholders during the construction phase of the preferred project will also help to mitigate against any potentially serious noise impacts;

- Air quality - potential sources of discharges to air associated with construction of the preferred project include:
  - Dust and particulate emissions associated with earthworks, operation of construction equipment, initiation of explosives, material handling (including stockpiling, loading and haulage) and vehicle movements over unsealed areas / roads; and
  - Products of fuel combustion emitted as a result of construction vehicle movements, including site personnel commuting, delivery of construction materials and removal (haulage) of spoil and other waste materials.

  The potential for off-site impacts is considered to be very low, as any potential emissions will be minimised through the management practices described in Chapter 21.
- Water quality:

  Erosion and sedimentation has the potential to impact water quality in downstream waterways through increased turbidity, siltation and degradation of aquatic habitats. These impacts will be managed through rigorous implementation, monitoring and auditing of the soils management sub-plan and measures listed in Chapters 9, 10, 11 and 16. The construction phase is not considered to present significant risks to drinking water quality due to the restrictions in placed to protect local water quality objectives.

  Officers trained and experienced in erosion and sediment control will undertake regular inspections and maintenance of the project site.

24.3.2 Hazard and risk during operation

Operation impacts on public health and safety

The operation of the high lift pump station, the pipeline itself and the outlet works are not considered to significantly impact on public health and safety provided all standard management practices are adhered to.

The intake will be located within the bank of the Murrumbidgee River and is designed to integrate with the surrounding landscape, and as a result, fencing and buffering is not required. The design has incorporated safety considerations, as the area is a popular public recreational area, used for swimming. The structure will include a screen covering the intake that will allow a flow of no greater than 0.14 m/s, which will be adequate to provide safety in the event that people swim right up to the screen. In addition, warning signs will be erected. Access to the structure will be limited, and there will be no openings via which members of the public could enter.

A security fence will be provided around the switchyard of the substation for public safety. Strict procedures will require gates to be closed and locked when not in immediate use. The fence will carry a number of warning signs to advise would-be intruders of the danger from high voltage apparatus inside. With these measures, the operation of the substation is not expected to impact on public health and safety.

Project infrastructure itself is at risk of vandalism, but will be afforded standard protection measures.

Operational noise

The predicted operational noise levels for the low lift pump station, high lift pump station, pipeline air release valves and outlet structure are discussed in Chapter 20, with additional consideration provided in the Noise and Vibration Assessment Addendum in Appendix L.

There are residential receivers located in the ACT and NSW that will potentially be affected by noise from the operation of the new structures. These are shown in Tables 20.9, 20.10 and 20.11 in Chapter 20 and in Figures 4.6 and 4.7 in Appendix L. However, operational noise levels at these areas are expected to comply with the noise criteria at surrounding receivers. The new structures will be designed to keep noise emission levels to a minimum.

Chapter 20 identifies residential receivers in NSW as most likely to be impacted by operational noise from the pipeline scour and air release valves. Section 4.1.3 of Chapter 20 provides an assessment of the potential operational noise impacts associated with these valves.

Scour valves will be located on each of the low points of the pipeline and are used if there is ever a need to repair the pipeline or perform maintenance work – there are no noise associated with the operation of scour valves.

Air valves automatically release air which can accumulate in water transfer pipelines. This is for efficient operation of the pipeline and to minimise damage to the pipes in the event of an emergency shutdown of the pumps.

Under normal operation of the pipeline, these air valves will not be required to function, hence, there will not be audible noise generated by the air valves. However, the air valves would be required to operate during special maintenance operations, pipeline filling and emergency conditions, which may lead to noise being generated by air released from the valves. Air release valves generally only operate for a short duration when required. Air release, and hence noise emission, are mostly predicted to be gradual under controlled maintenance conditions but could occur suddenly under emergency conditions.

The determination of the actual air valve noise levels is difficult because the level of noise emitted is a function essentially of the pressure and the volume that has to be released, which, for any given pipeline or section of pipeline, is different at each of the air valves where column separation is occurring. Hence, the measurement of actual air valve noise levels associated with other existing pipelines was considered to be of limited value.

Three air valves are highlighted in Chapter 20 as having potential to cause environmental impacts. It is proposed to include design measures for noise attenuation at two of the air valves in question. The third valve is not expected to operate, except under extreme conditions and o attenuation is proposed. Full details on the impacts on air valves are at Chapter 20.

The impacts from air valves during the operation of the preferred project will be mitigated as described in Chapter 20..

Operation impacts on drinking water quality

The proponent has responsibility for providing safe drinking water to the residents of Canberra and the surrounding region.

From a water quality hazard perspective, qualitatively, the upper Murrumbidgee River catchment to Angle Crossing is reasonably comparable to the Googong Reservoir catchment, particularly to the Burra Creek catchment.

Measured pathogen, microbial indicator and nutrient concentrations have previously been compared and were found to be reasonably comparable for the Burra Creek arm of the Googong Reservoir and the Murrumbidgee River. Therefore, the preferred project does not present a fundamentally different water quality range. Furthermore, there are no specific very high hazard sources in the immediate vicinity of the proposed intake point.

Potential impacts to environmental water quality and proposed control measures are provided in Chapter 10.

The screening level quantitative risk assessment of the safety of drinking water harvested from the Googong Reservoir identified two primary hazards, namely the enteric pathogen *Cryptosporidium* and the cyanotoxin microcystin mLA.

The study takes a conservative approach by:

- Assuming any water input to Googong Reservoir from the preferred project pipeline short circuits the reservoir and goes straight to the reservoir outlet without any dilution; and
- Not taking into account existing safeguards built into the reservoir water system including selective depth offtake options and the use of powdered activated carbon.

Residual (mitigated) risks to the drinking water supply arising from pathogens were predicted to be reducible to tolerable levels, equivalent to the currently tolerated residual risks presented to the Mt Stromlo system. Therefore, risks associated with pathogens were considered tolerable and acceptable.

Residual (mitigated) risks to the drinking water supply arising from cyanotoxins were predicted to be reducible to tolerable levels, and only marginally above the currently tolerated residual risks presented in the Googong system. Therefore, risks associated with cyanotoxins were considered tolerable and acceptable.

Operational actions will be required to help set selective river abstraction windows that balance water quality and yield considerations. Treatment at the Googong Water Treatment Plant will be capable of reducing raw water cyanotoxin concentrations by 90% through the action of free chlorination. Monitoring at both the intake/low lift pump station and the Googong water treatment plant will include measurements of pathogens, cyanotoxins and other chemicals.

Residual (mitigated) risks of local impacts from visible, and possibly odorous, algal blooms in the Burra Creek arm of Googong Reservoir will need to be considered with regard to public perception issues in the short term.

In the long term, it is probable that the nutrient balance of Googong Reservoir will be altered by the project leading to a small increase in the risk of problem cyanobacterial blooms arising (e.g. toxins, taste and odours and filter blockers). The frequency, duration and severity of problem blooms will all be marginally increased. However, the result is not expected to be a step change in the risk profile of the source, but rather an incremental and manageable increase in risk. In the long term this incremental increase in risk may lead to the bringing forward of additional investments in reservoir management and/or treatment controls.

Overall results of the screening level quantitative risk assessment indicate that the preferred project presents tolerable risks to the quality of the Googong drinking water supply from a public health perspective.

In order to ensure that the quality of water taken from Googong Reservoir remains within acceptable limits, ACTEW operates a water treatment plant and monitoring scheme. The Googong water treatment plant has a capacity of 270 ML per day.

Googong water treatment plant continues to be used to ease demand on the depleted Corin dam. The Googong water treatment plant produced a total of 14.3 GL of water in 2007–08.

The treatment process at Googong water treatment plant involves:

- Optional powdered activated carbon for organic matter removal, if required;
- Coagulation by liquid alum and a polymer coagulant aid;
- Flocculation;
- Dissolved air flotation and filtration (augmented plant) or clarification and filtration (original plant), depending on operational mode;
- Disinfection by chlorination;
- pH adjustment and stabilisation with lime; and
- Fluoridation by sodium fluorosilicate.

Monitoring occurs at each stage of the process at Googong water treatment plant. Continual monitoring of key water quality parameters is provided by online analysers. Regular laboratory monitoring is also carried out. Results from this monitoring allow changes in the raw water quality to be identified to ensure process optimisation. Also, any process problems that arise can be quickly addressed. Chlorine, pH, turbidity and fluoride are all monitored continuously to ensure the treatment processes are operating correctly. ActewAGL also tests for *Cryptosporidium* and *Giardia* at Googong reservoir. Monitoring results are published in ActewAGL's Annual Drinking water Quality reports and show an extremely high compliance with recognised

drinking water standards. On rare occasions when problems are detected ActewAGL notifies ACT Health and corrective actions are taken urgently.

Emergency and incident response plans for water and sewerage networks

The proponent has a comprehensive *Water Supply and Sewerage Emergency Plan* (ACTEW 2006b) which is a single functional emergency and incident response document that combines procedures for managing all emergencies in the ACTEW water and sewerage networks. The plan has been prepared to meet the requirements of the Utilities - Emergency Planning Code 2003, the *Utilities Act 2000* and the *Emergencies Act 2004*. ACTEW has also followed risk management principles for managing emergencies and incidents based on the approach of Australian Standard *AS/NZS 4360:2004 Risk Management*.

The plan links to other ACT and ACTEW emergency and response plans such as ACTEWs dam safety emergency plans.

This plan outlines measures for detection and mitigation of the effects of system or catastrophic failure impacting on the water supply effecting ACT infrastructure, public health, employee health and safety or the environment. The emergency plan provides a framework for assessing and managing the level of emergency, severity of consequences, and response required.

The preferred project in itself assists ACT and Queanbeyan water supply to be more secure in the event of uncontrolled emissions or catastrophic failure because it gives ACTEW the ability to switch water supply from the Cotter Catchment to the Googong Catchment while maintaining normal supply. Such was the case in the 2003 bushfires in ACT, when water from the Cotter catchment was contaminated for an extended period of time. The preferred project will give added assurance that if one catchment is under threat, the other can supply.

Following is a summary of generic response procedures for three specific key incidents, which have the potential for uncontrolled emissions on human health or ecosystems and are likely to constitute an emergency under the Emergency Planning Code.

Natural disasters

The first priority will be to determine the extent of any damage to assets as quickly as possible so the emergency can be assessed and a plan of action developed. This plan of action will be coordinated with the correct agencies. To cope with potential incidents it may be necessary for ACTEW/ActewAGL to declare an emergency in order to provide the correct command and control structure to respond to the emergency directly and under instruction by an external Emergency Controller.

Water supply contamination

Water supply contamination can be through natural causes such as the after effects of fire or heavy rain that can affect water quality in the catchments or in local reservoirs; it may also be because of a deliberate act. The community and industry may be affected by loss of local supply or of fully treated water and resultant possible water restrictions, and health related issues.

Containing the contamination will be the key first response so that the number of people affected is minimised and the supply that can be maintained is free of contamination. This could require shutting off or limiting the water supply to customers.

Terrorism or vandalism to assets

Terrorism or vandalism may include bombing, water contamination, wilful destruction of equipment and pipelines or structures, and siege or hostage situations. Impacts on the community may include loss of water supply, water contamination, and localised flooding. Terrorism alerts are issued and revised on a regular basis and will be a guide to the possible response where there is a deliberate act. The overall objective will be to return normal supply expeditiously.

ACT Regional Source Water Protection Program

A critical element in ensuring safe drinking water is catchment management. ActewAGL, on behalf of ACTEW, is commencing a five year program to improve protection of the sources of the ACT's drinking water supply.

ActewAGL has adopted the risk management approach recommended in the *Australian Drinking Water Guidelines 2004* to manage drinking water from source to consumer. These guidelines state '*source water protection provides the first barrier for the protection of water quality*'. The basis of the risk management approach is to improve our understanding of the risks of contamination in our catchments and to ensure that all stakeholders work together to protect the source water.

The fundamental tenets of the Australian Drinking Water Guidelines are:

- Multiple barriers are required to protect drinking water quality;
- The most efficient barrier is protection of source waters rather than reliance on treatment;
- Source waters should be protected to the maximum degree practicable;
- Water quality should be maintained at the highest practicable quality; and
- Water quality should not be degraded even if it is currently of better quality than the minimum required.

A number of examples of actions that will be undertaken as part of the ACT Regional Source Water Protection Program and with a focus on source water protection are outlined below.

- Formalise partnerships with key stakeholders;
- Conduct catchment condition assessments;
- Develop inter-agency emergency management plans;
- Encourage off-stream stock watering points;
- Develop targeted programs on sewage and stormwater;
- Develop, support or enhance educational programs;
- Identification and management of erosion hot spots;
- Ensure there is signage at all recreational areas; and
- Develop an incentive program to support best land management practices.

24.4 Summary of results

Hazards and risks during construction of the preferred project will be undertaken consistent with an integrated Health, Safety and Environmental Management System that conforms to *AS/NZS 4801:2001 Occupational Health and Safety Management Systems* and *AS/NZS ISO 14001:2004 Environmental Management* Systems as well as CHAIR and HAZOP assessments.

Noise and vibration impacts during construction may exceed the noise and vibration goals for the preferred project in some circumstances, but instances will be infrequent, short-lived and temporary in nature and managed through the requirements of the noise and vibration sub-plan.

The potential for off-site air pollution impacts associated with construction activities is considered to be very low.

Erosion and sedimentation impacts will be managed through rigorous implementation, monitoring and auditing of the soils management sub-plan.

The operation of the intake/low lift pump station has the potential to pose a hazard and risk to public health and safety. However, the intake will be located within the bank of the Murrumbidgee River and is designed to integrate with the surrounding landscape, and has incorporated safety considerations.

Operation of the high lift pump station, the pipeline itself and the outlet works are not considered to significantly impact on public health and safety, provided all standard management practices are adhered to.

A screening level quantitative risk assessment of the safety of drinking water harvested from the Googong Reservoir following the introduction of the preferred project identified two primary hazards, namely the enteric pathogen *Cryptosporidium* and the cyanotoxin microcystin mLA (summarised in Table 24.1

Table 24.1 Screening level quantitative risk assessment of the safety of drinking water

Risk to drinking water quality	Mitigating action
Short term risk Additional nutrient load may result in algal blooms near the point of discharge from Burra Creek to the reservoir	Any potential blooms will be far enough from the water supply off take not to present a drinking water quality problem. Some local visual nuisance concerns may arise.
Medium term risk Increased nuturient load could lead to water quality problems related to cyanobacteria	The increased nutrient load could be managed by reservoir management techniques such as mixing and selected offtake depths.
Long term risk The nutrient balance of Googong Reservoir could be altered by the preferred project leading to a small increase in the risk of problem cyanobacterial blooms arising (e.g. toxins, taste and odours and filter blockers). Not expected to be a step change in the risk profile of the source, but rather an incremental and manageable increase in risk.	Either upgrade to water treatment process or limitations on water abstraction from the river and / or the reservoir.

Residual (mitigated) risks to the drinking water supply arising from pathogens were predicted to be reducible to tolerable levels, equivalent to the currently tolerated residual risks presented to the Mt Stromlo system. Therefore, risks associated with pathogens were considered tolerable and acceptable.

Residual (mitigated) risks to the drinking water supply arising from cyanotoxins were predicted to be reducible to tolerable levels, and only marginally above the currently tolerated residual risks presented in the Googong system. Therefore, risks associated with cyanotoxins were considered tolerable and acceptable.

The proponent recognises that if periods of limited abstraction from the reservoir and/or the River are to be avoided in the longer term, then additional water treatment may be needed. The proponent will monitor with a view to identifying early warning signs and will include asset upgrades, including reservoir management and water treatment processes, in its normal capital planning process, as appropriate.

The proponent's Water Supply and Sewerage Emergency Plan, the ACT Regional Source Water Protection Program and the risk management plan for the preferred project provide further measures for the protection of drinking water supply.

24.5 Mitigation measures

Ensuring the management of risk in an integrated fashion is important and the proponent is committed to achieving this by the development of integrated management risk management plans for the distinct stages of construction/commissioning and operation of the preferred project. These integrated risk management plans will draw on the matters/principles assessed in this chapter and will manifest as a specific risk management sub-plan in the construction environmental management plan, and a separate risk management sub-plan for operation of the preferred project. These management plans will be aligned to *ISO 4260* (the international risk management standard) and *AS/NZS 4360:2004 Risk Management* and will provide a systematic pro-active approach of ongoing risk identification, assessment and risk ranking that will identify, analyse, assess, document, accept or mitigate and manage the risks for the different phases of the preferred project.

A full-time project-level risk manager will oversee the risks and their management through the construction period and the proponent will be responsible for implementation of the risk management plan during operation of the preferred project.

The plans will be integrated with other plans being prepared for the preferred project (during construction), as described in this chapter (for example the construction environmental management plan occupational health and safety management plan) as well as with existing (external) management plans already in use (such as the *Water Supply and Sewerage Emergency Plan* (ACTEW 2006b) dam safety emergency plans and the ACT Regional Source Water Protection Program, amongst others).

The integrated risk management plan for construction and commissioning of the preferred project will be presented to the relevant agencies for consideration along with the CEMP prior to construction commencing. The operational integrated risk management plan will be finalised and presented for approval to the relevant Government Agencies prior to the operation of the preferred project.