

Abbreviations

Abbreviation	Name
ACT	Australian Capital Territory
ACTEW	ACTEW Corporation Limited, the proponent
ACTPLA	Australian Capital Territory Planning and Land Authority
ANZECC	Australian and New Zealand Environment Conservation Council
ARI	average recurrence interval
AS/NZS	Australian Standard/New Zealand Standard
AusRivAS	Australian River Assessment System
CH	chainage
CO ² -e	carbon dioxide equivalent emissions
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	development application
dB	decibel
dB(A)	decibel A-weighting
dB(L)	The dB level with no weighting on the frequency response curve
DECC	NSW Department of Environment and Climate Change
DEWHA	Commonwealth Department of Environment, Water, Heritage and the Arts
DPI	NSW Department of Primary Industries
EEC	endangered ecological community
EHN virus	epizootic haematopoietic necrosis virus
GHD	GHD Pty Ltd
GIS	geographical information systems
GL	gigalitre
ha	hectare
ICOMOS	International Council on Monuments and Sites
ISO	International Standards Organisation
kg	kilogram
km	kilometre
km/hr	kilometre/hour
kV	kilovolt
kWh	kilowatt hour

Abbreviation	Name
L/day	litres per day
L_{A10} (18 hour)	The arithmetic average of the L ₁₀ levels for the 18-hour period between 0600 and 2400 hours on a normal working day. It is a common traffic noise descriptor.
L_{A90} (Period)	The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise e.g. L _{A90} (15 min)
L_{Aeq} (15 min)	The L _{Aeq} noise level for a 15 minute period.
L_{Aeq} (1 hr)	The L _{Aeq} noise level for a one-hour period. In the context of the NSW DECC environmental criteria for road traffic noise, it represents the highest tenth percentile hourly A-weighted L _{eq} during the period 7 am to 10 pm, or 10 pm to 7 am, (whichever is relevant). If this cannot be defined accurately, use the highest A-weighted L _{eq} noise level.
L_{Aeq} (9 hr)	The L _{Aeq} noise level for the period 10 pm to 7 am.
L_{Aeq} (15 hr)	The L _{Aeq} noise level for the period 7 am to 10 pm.
m	metre
m²	metre squared
m³	metre cubed
m/s	metres/second
M2G	Murrumbidgee to Googong
ML	megalitre
ML/day	megalitres per day
mm	millimetre
NSW	New South Wales
PPV	peak particle velocity
REALM	REsource ALlocation Model
sp.	species (singular)
spp.	species (plural)
t	tonnes
TAMS	Territory and Municipal Services
°C	degrees Celsius

Glossary of terms

Term	Definition
alien species	Exotic fish species breeding in the wild.
aquifer	Rock or soil formation containing groundwater in recoverable quantities.
bulk transfer	Bulk transportation of potable water from a reservoir to a water treatment plant before household use.
causeway	A raised roadway, as across water or marshland.
catchment	The area drained by a stream, lake or other body of water.
cryptosporidium spp.	A pathogen that is transported in water and can contaminate water supplies.
cumulative impact	An impact created by accumulation or successive additions of individual impacts, which may not in themselves be significant.
cyanotoxins	A cyanotoxin is a toxin produced by certain cyanobacteria. When produced during algal blooms, cyanotoxins can poison and even kill animals and humans.
dB	Decibel, which is 10 times the logarithm (base 10) of the ratio of a given sound pressure to a reference pressure; used as a unit of sound.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
NSW Director Generals requirements	The requirements for an environmental impact statement or environmental assessment prepared in accordance with the NSW <i>Environmental Planning and Assessment Act 1979</i> .
effluent	Liquid industrial waste or wastewater, which may or may not have been passed through a type of purification process.
emission	The release of material into the atmosphere (e.g. gas, noise).
environmental flow	The amount of water needed in a watercourse to maintain a healthy, natural ecosystem.
environmental flow guidelines	Guidelines issues by the ACT Government's Territory and Municipal Services in 1999 concerning environmental flow.
environmental management plan	A document setting out the management, control and monitoring measures to be implemented during construction (a construction environmental management plan) and/or operation (operational environmental management plan) of a development, to avoid or minimise the potential environmental impacts identified during an environmental assessment process.
flora and fauna	Plants and animals.
hydrology	The science dealing with water on the land or under the surface, its properties and distribution.

Term	Definition
inflow	The act or process of water flowing into a water body.
net economic benefit	The sum of all economic benefits.
pathogens	A pathogen is an infectious agent, or (more commonly) germ, is a biological agent that causes disease or illness to its host.
particulate	Small particles, usually occurring in suspension.
pH	Measure of acidity (or alkalinity).
project approval	An approval granted under Section 75J of the NSW <i>Environmental Planning and Assessment Act 1979</i> .
proponent	ACTEW Corporation Limited.
putrescible	Capable of biological decomposition.
rating background level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24 hour period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of: • All the day assessment background levels over the monitoring period for the day; (7 am to 6 pm); • All the evening assessment background levels over the monitoring period for the evening; (6 pm to 10 pm); or • All the night assessment background levels over the monitoring period for the night (10 pm to 7 am).
reservoir	A natural or artificial pond or lake used for the storage and regulation of water.
residential receiver	A dwelling potentially affected by noise or vibration.
scoping document	The ACT scoping document, which outlines the requirements for an environmental impact statement as part of the ACT planning approvals process.
sound pressure level	20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level of 20 micropascals.
study area	Includes the site/s where the project is located, and any additional areas likely to be affected, either directly or indirectly, by the project.
the assessment	This environmental impact assessment.
the project	Murrumbidgee to Googong Water Transfer
threatened species	Species of animals or plants that are at risk of extinction (also known as 'endangered species') or becoming endangered within the next 25 years ('vulnerable species'), defined by the NSW <i>Threatened Species Conservation Act 1995</i> .
vehicles per day	The number of vehicles passing a point on a road in both directions for 24 hours.

Executive summary

Securing our water supply

Inflows into the drinking water storages within the Australian Capital Territory (ACT) and region have been below average for the last 15 years. The Canberra and Queanbeyan communities have been in water restrictions since mid-December 2002. Stage 3 restrictions have been in place since November 2006. These restrictions have had a significant impact on the regional economy. In particular, inflows in 2006 were about 90% below the long term average and so far in 2009 the inflows are below what was received in the same period during 2006. The continuing decline of inflows and continuing uncertainty of climate change highlights the need for prudent investment to ensure future water security for the ACT and region.

In response to this situation, ACTEW recommended to the ACT Government that a diversified portfolio of water supply security measures be adopted. The integrated strategy of diversified water infrastructure investments would increase the security of supply, increase the efficiency of current storage and treatment facilities, supplement inflows into Googong Reservoir and access a source of water that is not wholly dependent on rainfall in the ACT region, the Tantangara Transfer Project.

In 2004 the ACT Government launched its water policy *'Think Water Act Water'*, which required ACTEW to *'provide a long term reliable source of water for the ACT and region'*. This is in addition to the ACT Government's commitment to reduce per capita water use by 25% by 2023. Since 2004, ACTEW has investigated a range of water supply options. The ACT Government has agreed with ACTEW's recommendations that the portfolio of water supply options be implemented. These options include the project, enlargement of the Cotter Dam, the Tantangara Transfer project and to offset greenhouse gas emissions associated with the construction and operations of these projects. ACTEW is committed to delivering these projects consistent with the principles of sustainability.

In response to the current drought, ACTEW has already implemented a number of water supply improvements including the Cotter to Googong Bulk Transfer, abstraction from the Murrumbidgee River at Cotter, building the Mount Stromlo Water Treatment Plant and increasing the capacity of Googong Treatment Plant. In addition to these measures ACTEW has introduced permanent water conservation measures in conjunction with the ACT Government's demand management program. These measures have resulted in a reduction in per capita water use in the order of 13%.

The project

The Murrumbidgee to Googong Transfer project (the project) involves pumping water from the Murrumbidgee River at Angle Crossing within the ACT and transfer through an underground pipeline to Burra Creek in New South Wales (NSW) which flows into Googong Reservoir through the Commonwealth Government's Googong foreshores (refer Figure E.1).

Within the ACT the project comprises a combined intake structure and low lift pump station, a high lift pump station and the first 2.8 km of the pipeline until the ACT/NSW border near the Monaro Highway at Williamsdale. The remaining 10.2 km of the pipeline through Burra is located in NSW, with a discharge structure located in the Commonwealth owned Googong Foreshore area. The intake/low lift pump station would be located on the east bank of the Murrumbidgee River at Angle Crossing, approximately 34 km south of Canberra. The high lift pump station would be located, approximately 290 m to the east of the intake/low lift pump station. The pipeline would cross rural land near Angle Crossing and through Williamsdale, and rural residential land near Burra. The outlet structure would be located in the southern bank of Burra Creek just downstream of Burra Road. From the discharge point the transfer water would flow down Burra Creek for approximately 10 km to Googong Reservoir.

As part of ACTEW's commitment to offset greenhouse gas emissions from the construction and operation of the project a mini-hydro power generation facility would be incorporated into the project. Electricity generated from the mini-hydro facility would be used by the operation of the high lift pump station.

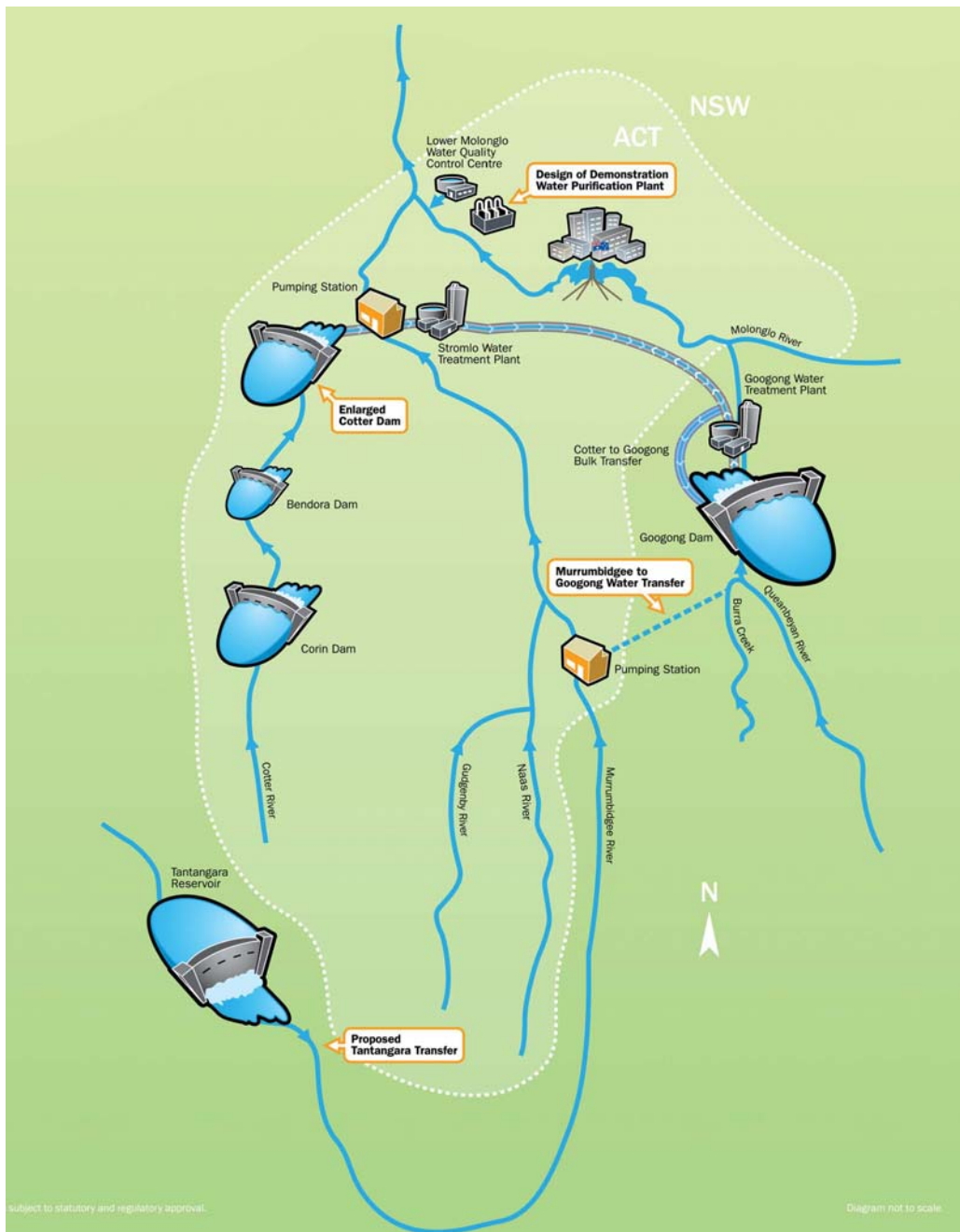


Figure E.1 Proposed ACT and region water security measures, showing the proposed location of the project

The project would transfer up to 100 ML/day of water from the Murrumbidgee River to Googong Reservoir. The amount of water that can be transferred each day would be contingent upon the availability of water in the Murrumbidgee River, maintenance of Murrumbidgee River environmental flows and the available storage capacity within Googong Reservoir. Minimising construction impacts, rehabilitation of the disturbed areas, mitigation and offsetting of impacts are all elements of the project.

The Tantangara Transfer project is closely linked to the project. For this project it is proposed that water be released to the Murrumbidgee River via the Snowy Mountains Scheme so that it can be transferred to Googong Reservoir via the Murrumbidgee to Googong Transfer project. The Tantangara Transfer project requires the following steps to take place:

- ACTEW purchase of the equivalent of about 11 GL of high security water entitlement;
- Intergovernmental arrangements to allow water trade to occur between NSW and ACT; and

- A commercial agreement between ACTEW and Snowy Hydro Ltd for use of infrastructure to store and release purchased water to the ACT when required from Tantangara Reservoir.

Project justification

The total inflow into ACTEW's three main storages over the period 2003–2009 has averaged approximately 71 GL/year, well below the long term average inflow of 200 GL/year. In 2006 alone, water storage decreased from 51% to 39%. The continuing risk to water supply security for Canberra and Queanbeyan is confirmed by climate change studies conducted by CSIRO, the medium and long term outlook (i.e. beyond 2030) for water supply suggests a further decline to inflows.

A key aspect of ACTEW's planning to secure the water supply for the ACT and region determined that a portfolio of supply options was required. If the portfolio of water supply options were not constructed and the current understandings of future climate change come to fruition then the region can expect to suffer longer and more severe water restrictions. Construction of the project would reduce the likelihood of Stage 4 water restrictions. These reduced periods of water restrictions are now estimated to save \$866 million over the period 2010 to 2032 (based on the do nothing approach), resulting in a net economic benefit of over \$500 million.

Project alternatives

Over the past few years, ACTEW has been reviewing options for a secure water supply for the ACT and surrounding region, with a considerable amount of work undertaken in the last four years. The proposal to extract water from the Murrumbidgee River has been considered as part of these investigations. All the options identified between 2004 and 2007 have been the subject of community consultation, and the reports in which they were considered were made available to the public.

Water supply options have been considered in the following reports:

- Think Water, Act Water;
- Future Water Options;
- Options for the next ACT Water Source;
- Water Security for the ACT and Region - Recommendations to ACT Government; and
- Water Security for the ACT and Region – Progress Report and Recommendations to ACT Government.

In October 2007, the ACT Government announced a range of projects that would be implemented to secure the ACT and regional water supply. The ACT Government confirmed its commitment to the project by issuing a media release in March 2009 stating:

'The ACT Government has given the green light to build the Murrumbidgee to Googong pipeline and buy water from Tantangara Reservoir improving Canberra's water security for many years to come. These projects are in addition to the Government's previous decision to enlarge the Cotter Dam. In these tough times, with an ongoing drought resulting in below average-level rainfall, it is essential the Government acts now to ensure adequate supply down the track' (Corbell 2009).

Legislative requirements

As the project is located in NSW and the ACT and impacts on Commonwealth owned land, different planning approval processes apply to the parts of the project located in each jurisdiction. This document has been prepared to meet the requirements of section 216(2) of the ACT *Planning and Development Act 2007* and Part 3A of the NSW *Environmental Planning and Assessment Act 1979*. The project has been declared as 'critical infrastructure' by the Director General of the NSW Department of Planning. The NSW planning requirements also apply to the Commonwealth land known as Googong Foreshores.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* prescribes the Commonwealth's role in environmental assessment. A referral would be required where the project is likely to have a significant impact on matters of national environmental significance.

The National Capital Authority (NCA) administer a National Capital Plan under the Commonwealth *Australian Capital Territory (Planning and Land Management) Act 1988*. Approval from the NCA would be required for the pipeline crossing of the Monaro Highway and for works on the foreshore of the Murrumbidgee River.

Environmental impacts and mitigation measures

Investigations have been undertaken during the preparation of the environmental assessment to assess potential environmental impacts. These included specialist assessments of potential environmental impacts on hydrology, ecology, heritage, soils and groundwater, landscape and visual amenity, noise and vibration, climate, greenhouse gas, social, community traffic, transport and health. A summary of the key findings of the environmental assessments and proposed mitigations follows.

Hydrology and geomorphology

The project would comply with the ACT's obligations in respect of diversions from the Murrumbidgee River under Murray Darling Basin inter-governmental agreements. The ACT's net Cap of 40 GL per annum would not be exceeded as a result of the project. The project has no significant impact on the average flows leaving the ACT and flowing into Burrinjuck Reservoir. Within the ACT, the ACTEW licence to take water from the Murrumbidgee River would include conditions on the use of ACT's Environmental Flows Guidelines as established by the *Water Resources Act 2007*. These requirements would ensure protection of downstream environmental flows within the Murrumbidgee River.

The project would increase the flows in Burra Creek. Modelling has indicated that flow velocities while variable would generally remain low, typically about 0.1 to 0.9 m/s, and the average water depth would increase by around 0.1 to 0.4 m. Initial operation would lead to some flushing of sediments which have been deposited in Burra Creek over recent years. These sediments may be deposited into Googong Reservoir and may cause a short term increase in turbidity in the Reservoir. After the initial disturbance of sediment, the creek is unlikely to experience significant erosion impacts due to the project.

While there would be some initial change from existing creek conditions, it is evident that Burra Creek has been subject to significant alterations in morphological form in the recent past and is still in a state of adjustment. The potential morphological impacts are highly likely to be within the bounds of recent variability. The general form of Burra Creek would remain consistent with that of the recent past.

Water quality

Construction would involve excavation within the riparian zone of Murrumbidgee River's at Angle Crossing and Burra Creek just downstream of Burra Road. Environmental protection works and adherence to approved environmental management plans within these waterways are expected to mitigate any significant impacts.

The general water qualities of Murrumbidgee River, Burra Creek and Googong Reservoir are essentially similar. The potential operational impacts on the water quality of the Murrumbidgee River is considered to be low and manageable. The potential for impacts on the water quality of Burra Creek is considered to be low to moderate and manageable. In particular, spikes in water quality parameters such as turbidity and nutrients would need to be monitored and management actions established to identify and control the source and/or limit water transfers during this period.

The introduction of a new source of water to the Googong Reservoir may lead to increased levels of nutrients in the Reservoir, which may increase algae bloom potential in the longer term. The quantitative risk assessment for drinking water notes that this risk is manageable, and nutrient levels and algae monitoring would be set up and implemented during operation.

Aquatic ecology

The study area is known or likely to support a number of threatened fish species including Trout Cod, Macquarie Perch, Silver Perch, Murray Cod and Murray River Crayfish. These species were assessed under the ACT, NSW and Commonwealth threatened species provisions including assessment of significance and application of significant impact criteria.

Implementation of the construction environmental management plan would minimise the effect of silt and suspended particles in the vicinity of the work, and the potential for impacts on the water quality of the Murrumbidgee River is considered to be low. As a result, the impact of the project on the river's aquatic ecosystems is assessed as being low, especially since environmental flow would be maintained. The change

in water depth at the Angle Crossing causeway on the Murrumbidgee River during most flow conditions would not have a significant impact on its current status as an obstruction to fish passage. When fish passage is normally possible, during higher flow events, the proposed transfer would have a minimal impact on flow depths and fish passage.

The passive design of the offtake screen would prevent adult and juvenile fish being impinged and is not expected to significantly impact threatened fish species within the Murrumbidgee River. The fish disease epizootic haematopoietic necrosis (EHN) virus is known to exist within the Googong Reservoir. The current degree of infection within Burra Creek is unknown, but as the creek flows into Googong Reservoir it is highly likely the virus would be present.

Two alien species, Carp and Oriental Weatherloach are considered a high risk for translocation, as they are known or suspected to be present in reasonable numbers at Angle Crossing, are hardy and known to impact native fish communities and are not yet established in Googong Reservoir. Carp is, however, present elsewhere in the Googong Reservoir catchment. Transfer of these fish into Googong Reservoir would increase the risk of these species invading the more significant conservation reaches of the upper Queanbeyan River. The proposed 0.5 mm offtake filtering system would minimise the potential risk for the transfer of fish in all their life stages. Monitoring is also proposed to evaluate the screening effectiveness.

Given the relatively low amount of water to be abstracted from the Murrumbidgee River and the proponent's commitment to preserving environmental flows in the river, it is unlikely that there would be a significant impact on the aquatic ecology of the river under projected operating conditions. This would be monitored during the operation of the project.

The aquatic ecosystems of Burra Creek were considered to be in a poor condition in the upper sections and moderate condition in the lower section. Although no threatened species were recorded during surveys of the creek, the local area is known to have potential habitat for three threatened species. Transfers along Burra Creek to the Googong Reservoir have the potential to modify habitat through impacts to macrophyte beds and increased mobilisation of sediment. The additional flow in Burra Creek would have a low to moderate negative impact on the narrow channel in which the flow is contained. This would occur by scouring some sediment from the channel, modifying the extent of reed beds and impacting on macroinvertebrate communities. Given the relatively low flow velocities and depths, and the intermittent nature of flow, it is expected that this impact would be low to moderate. The development of a monitoring program is proposed and the project's operating regime modified as necessary.

Terrestrial ecology

The project area contains a wide range of vegetation and habitat types, which vary from non-native pasture to high conservation value native grassland and woodland. The area of impact has been limited by minimising the width of construction footprints in sensitive areas or by fencing and isolation to prevent losses. As a result the total areas of impact would be around 16.7 ha of native vegetation and around 23.8 ha of non-native vegetation, essentially pasture and weed affected areas.

Highly modified vegetation are typically east of the area Gibraltar 'saddle' and provide minimal opportunities for native flora and fauna. Native vegetation range from poor to high quality and is most common in the area between the Gibraltar 'saddle' and the Murrumbidgee River corridor. It includes Box Gum Grassy Woodland Endangered Ecological Community (EEC) and Natural Temperate Grassland. It includes EEC on the elevated slopes above the Murrumbidgee River corridor. Vegetation along Burra Creek to the east contains high quality Snow Gum Grassy Woodland (recently nominated for listing as an EEC in NSW). Habitat opportunities for threatened species broadly correlate with high quality woodland and forest habitats, native grassland and exposed rock outcrops. Some of these habitats have additional conservation value as regional wildlife movement corridors, such as the Murrumbidgee River corridor.

Three threatened plant species were recorded: *Swainsona recta*, *Swainsona sericea* and *Leucochrysum albicans* var. *tricolor*, and one ROTAP species, *Discaria pubescens*. Eight threatened animal species were also recorded during the surveys: Pink-tailed Worm Lizard, Gang Gang Cockatoo, Speckled Warbler, Diamond Firetail, White-winged Triller, Varied Sittella, Eastern Bent-wing Bat and Large-footed Myotis.

Generally, pipeline construction would have short term impacts on some components of high quality Box Gum Grassy Woodland and Natural Temperate Grassland EECs and probably longer-term impacts on some

components of Pink-tailed Worm Lizard habitat. Permanent structures would however have long lasting but relatively small impacts on affected terrestrial habitats.

The overall impact of the project is likely to manifest in different and unequal ways depending upon the species, its local occurrence and habitat preference, but these impacts are unlikely to be significant. Some impact would occur to threatened species and communities that occur within the study area. Biodiversity offsets are proposed for impacted EECs and threatened species habitats. Recognising the cumulative impacts of similar projects in the area, a consolidated land offset proposal would be negotiated to ensure an overall positive biodiversity outcome. A contiguous set of land offsets adjacent to the nearby Murrumbidgee River corridor is considered to be the best way to achieve this outcome.

Indigenous heritage

The majority of the pipeline corridor has been variously impacted by clearing and pasture development, track, road and fencing construction. The field survey for the Aboriginal heritage assessment identified a total of 81 Aboriginal heritage sites in the study area. The sites include isolated finds, artefact scatters, potential archaeological deposits and a possible scarred tree. Four sites were previously recorded in the vicinity of the pipeline corridor.

A significance assessment was undertaken in accordance with the assessment criteria that apply in NSW and the ACT. The assessment identified that 23 sites located in NSW and 5 sites located in the ACT are considered to have moderate scientific significance. For other sites, the scientific significance was low or not able to be determined at this stage. It is noted that only the Aboriginal community can determine Aboriginal cultural significance and that confirmation of this significance component is dependent on written submissions to the heritage assessment by appropriate representative organisations.

No areas of high archaeological significance were identified during the stage one subsurface testing program and no significant issues were identified. The results of the impact assessment indicate that 28 Aboriginal sites have the potential to be directly impacted by the project. All of the Aboriginal sites subject to impact are assessed as having moderate or low archaeological significance.

Non-Indigenous heritage

The study area has been subject to farming and rural residential occupation since the early-mid 1800s. Two heritage listed sites, London Bridge Homestead and London Bridge Natural Arch, are located within or close to the study area in NSW. A detailed assessment of the potential erosion impacts on London Bridge a natural limestone arch concluded that there would not be any significant impact on this structure. The London Bridge homestead and outbuildings are situated some distance from the creek and would not be impacted by the project. The results of the impact assessment indicate that the Goulburn to Cooma railway line, the line of trees at the entrance to Burra Station, the former Williamsdale school site, the refuse dump, a cadastral boundary marker at Angle Crossing and the Moore family 'Lagoon' house site have some heritage value but would not be impacted by the project.

Topography, soils and groundwater

The project would involve extensive excavation along the length of the pipeline route, with additional excavation and earthworks being undertaken at the site of the intake/low lift pump station, high lift pump station, outlet structure and mini-hydro power facility. The potential for impacts to geology, soils, groundwater and soil contamination during excavation works and other construction activities are considered to range from unlikely to moderate and can be managed with the implementation of the proposed erosion and sedimentation controls proposed for the project.

A rehabilitation plan would be developed for the project. The rehabilitation plan would describe the rehabilitation management, objectives and activities necessary to assess and rehabilitate areas impacted by construction works. Rehabilitation would be undertaken with close interaction with the affected local community. Rehabilitated areas would be maintained during the establishment period.

Potential operational impacts to geology, soils, groundwater and soil contamination are likely to be less significant than the potential construction impacts as they have been minimised by the design of the project.

Land use

The major land uses within the pipeline corridor and surrounding area are river corridor/water catchment, agriculture, rural residential development and transport, power supply, water and communications easements.

The potential impacts from activities required for the construction and operational stages of the project are considered to be recreational users at Angle Crossing, local farming activities and local residents along the length of the pipeline corridor. Dwellings located along the pipeline corridor are located on many rural and rural residential properties, each of which may consist of more than one dwelling and are at varying distances from the project. The nearest residences to Angle Crossing are approximately 1,700 m to the west and southwest. The nearest residences to the outlet structure are approximately 300 m to the southwest. There are residences located in the vicinity of the pipeline corridor.

Potential impacts on land use would primarily be during construction of the project. These include disruption to recreational activities at Angle Crossing, impacts on land use and access, particularly with regards to use of land along the pipeline corridor and disruption to roads, underground services and electricity transmission lines. As the pipeline would be constructed in stages and in a linear fashion, any impacts would be short term and limited to the duration of the construction period.

Although the construction of the intake/low lift pump station introduces a new structure into the river in the Angle Crossing area, it would not change the use of this area in the long term. The high lift pump station would result in restrictions to the use of informal overflow car parking at Angle Crossing. However, the impact would be minimal as the car park is informal and under-utilised.

Land use impacts during operation of the project would predominantly relate to restrictions on the use of land within the 15 m permanent pipeline easement (such as building, digging and planting restrictions) and for maintenance access. Agricultural activities such as livestock grazing and small-scale cultivation would be able to continue over the proposed easements during operation of the pipeline. Maintenance access would be infrequent and localised to specific points along the pipeline, mainly the locations of the scour valves, and would not impact on the use of the land. As such, it is considered that operational impacts on land use would not be significant.

Landscape character and visual amenity

The construction of the project would generate visual impacts during the construction period. Impacts would be experienced at the sites for the structures and along the length of the pipeline corridor. During construction works exposed soils would be visible, along with machinery and equipment required for construction and the structures under construction.

Operational impacts of the project would occur as a result of:

- The introduction of new structures in the landscape at the intake/low lift pump station, high lift pump station and outlet sites, ancillary infrastructure and associated access arrangements;
- The linear pipeline corridor, which would need to remain free of trees and shrubs to maximum of approximately 15 m wide; and
- Pipeline infrastructure/structures, including maintenance access, signage, air and scour valves which would increase the number of permanent static elements.

The intake/low lift pump station and the high lift pump station would be the main visual elements of the project and would have moderately adverse landscape and visual impacts. The outlet structure would have a minor adverse impact, as views of the outlet site would be limited. The mini-hydro power facility would be located in the vicinity of the outlet structure and would be predominantly underground. The impact of the pipeline and power supply would be negligible as both are predominantly underground.

Spoil handling and waste management

The main wastes that would be generated during construction include excess spoil, vegetation and landscape materials, construction material, general waste from site personnel, paints and solvents and wastewater and sewage.

The majority of landowners have indicated their interest in using spoil remaining after pipeline construction works to address erosion issues. A detailed investigation of these areas would be undertaken as part of the construction program and would require ongoing liaison with the landowners during the construction process. Any commitments to assist landowners would be developed before construction commences.

Any spoil that could not be reused would be sent to a licensed landfill, where it would be beneficially used as a landfill cap. Other construction waste would be reused and recycled where possible. The remaining waste would be disposed of at appropriately licensed facilities.

Potential major haulage routes for offsite disposal or reuse of spoil and other waste materials include Angle Crossing Road, Williamsdale Road, the Monaro Highway and Burra Road.

A detailed waste management sub-plan would be prepared as part of the construction environmental management plan to address relevant legislation and set out the requirements and procedures for the management of spoil and other wastes. Procedures to prevent spillage and emergency plans to manage environmental incidents would be developed as part of the construction environmental management plan.

Noise and vibration

Potential noise and vibration impacts would generally be associated with the construction of the project. Due to very low ambient noise levels the construction of the pipeline may potentially exceed construction noise goals at nearby residences. Up to 10 residences have the potential to exceed *the highly noise affected level*, although they should only be exposed to this level of noise for less than one day. Approximately 100 residences have potential to exceed the *noise affected level* for up to 37 days.

The majority of construction activities along the pipeline would not produce perceptible levels of vibration due to the distance from residences. However, some activities such as excavation, rock breaking, rolling and compacting may produce levels of vibration that are perceptible and potentially intrusive when construction activities are located within 50 m of residence. Up to ten residences have the potential to exceed vibration goals for less than one day.

Approximately 20 residences have the potential to exceed the *noise affected level* during construction of the outlet structure, however the *highly noise affected level* is not expected to be exceeded. The construction of the outlet structure is expected to comply with the vibration criteria at the surrounding residential locations.

Construction traffic is expected to comply with the noise criteria at the surrounding residences, but construction compound noise may potentially exceed the noise criteria at four residential locations.

Blasting during construction may also be required due to the presence of hard rock within the construction corridor. There are up to 22 residents within 800 m of the possible blast locations, where there is the potential to exceed the ANZECC blasting criteria. Once detailed blasting requirements are developed, further ground vibration and airblast overpressure estimates would be undertaken and appropriate control measures implemented.

The construction of the low lift pump station and high lift pump station would comply with noise and vibration criteria. The operation of the low lift pump station, high lift pump station, pipeline air-release valves and outlet structure would also comply with noise and vibration criteria at the surrounding residences.

The location and noise emission levels of the mini-hydro power facility are not yet finalised. However, the facility would be designed to be predominately underground, with appropriate acoustic treatments, so that it does not exceed 35 dB(A) at the surrounding residences.

Air quality

Existing air quality in the vicinity of the pipeline corridor is considered to be good. Potential air quality impacts during construction include dust and particulate emissions and fuel combustion emissions. The potential for emissions would be minimised through a number of mitigation measures and controls and the implementation of a dust management sub-plan. Operational impacts are expected to be negligible.

Greenhouse gas

The major sources of emissions during construction would be diesel for construction vehicles, steel pipes and vegetation clearance. Emissions associated with the consumption of electricity were estimated to contribute 100% of the total emissions during operation of the proposed pipeline and pump station. Around 26% of the pumping electricity would be recovered by the mini-hydro power facility.

The total construction emissions were estimated to be 37,500 tonnes of CO₂-e over the construction period and average annual emissions of 11,000 tonnes of CO₂-e per annum. The total emissions for the first thirty years of operations (including construction emissions) are estimated to be 359,000 tonnes CO₂-e.

ACTEW has committed to offsetting all greenhouse gas emissions associated with the construction and operation of the project. In addition to the proposed mini-hydro, the ACTEW is investigating other options for reducing greenhouse gas emissions where practicable (e.g bio-fuel), and would offset all remaining greenhouse gas emissions.

Social and economic

The location of infrastructure and the alignment of the pipeline have been chosen in consultation with local landowners and the broader community to minimise overall impacts. The proponent is currently in the process of negotiating with landowners over access to their land for the purpose of construction, including land rehabilitation, and operation of the pipeline.

During the construction phase, potential social impacts would be minimised through careful planning and the adoption of appropriate mitigation measures. The increase in traffic, road closures, noise and disturbance to property access would all modify rural ambience to a moderate degree during construction. These impacts are not expected to be severe, and would be of a limited duration.

There is a social benefit to the ACT and region in the improvement in the security of water supply as well as an economic benefit. The net economic benefit of the project resulting primarily from the reduced frequency of high level water restrictions estimated to be over \$500 million (CIE, 2009). Employment generated by the project, both directly and indirectly, would also bring significant benefits.

ACTEW would implement a community engagement program to ensure that the community is informed of any impact and progress of construction of the project.

Health and risk

The available water quality data shows that most parameters are similar between the Murrumbidgee River, Burra Creek and Googong Reservoir. The introduction of a new source of water to the Reservoir may lead to increased levels of nutrients in the Reservoir (as a result of the new water source increasing the overall load of nutrients), which may increase algae bloom potential in the longer term. The quantitative risk assessment for drinking water notes that this risk is manageable and ACTEW's ongoing drinking water quality monitoring program would address this risk during operation.

HAZOP (Hazard and Operability) and CHAIR (NSW Construction Hazard Assessment Implication Review) assessments have been undertaken, and management of residual risks during construction of the project would 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. All operational public safety requirements have been incorporated into the project design.

Traffic and transport

The potential for impacts to traffic and transport would occur due to the additional construction traffic. This additional construction traffic can be adequately accommodated on Angle Crossing Road, Monaro Highway, Williamsdale Road and Burra Road at acceptable levels of service. There is likely to be disruption to traffic including road closures where the pipeline crosses roads and where the pipeline is laid along sections of the road. The engagement strategy would ensure that the community is informed of any such disruptions.

Additional traffic generated during the construction phase can be satisfactorily accommodated within the existing layouts of the intersections of Williamsdale Road/Monaro Highway at acceptable levels of service. At Angle Crossing Road, the increased traffic volume may cause some queuing on the highway and there is an increased risk of collisions at the Burra Road/Williamsdale Road intersection due to the vertical grading of the existing approach to Burra Road.

A Traffic Management Plan would be prepared in accord with Australian Standard AS 1742.3 – 2002. This would include advance warning signs for all works in road reserves and restricted speed zones on Burra Road near the Williamsdale Rd intersection. The pipeline would be trenched through the Monaro Highway and the Highway would be widened to accommodate left turning traffic from Angle Crossing Road. The location of the proposed access road for the outlet structure would be located to ensure sufficient sight distance for construction traffic entering Burra Road.

Cumulative impacts

Cumulative impacts have the potential to arise from the interaction of individual elements within the project; and the additive effects of the project with other projects in the region. During the construction phase, impacts associated with clearing of vegetation, noise, air quality and traffic and transport may have some cumulative impact on the overall amenity of the locality. Specific mitigation measures have been developed to minimise impacts and ensure that the short term effects of construction are appropriately managed. These measures are explained throughout the various chapters of this assessment. The potential long term benefits of the project in terms of improved water security and benefits to the regional economy are considered to outweigh the negative impacts that may occur as a result of any cumulative impact in the short term.

During the construction of the project, it is possible that other projects and infrastructure works would be taking place in the vicinity of the project. There are two unrelated developments that are currently being implemented. Block 1653 in District of Tuggeranong would be the site of a 330 kV/132 kV Transgrid substation to provide a second point of electricity supply into the ACT, and ActewAGL plan to construct 132 kV transmission lines from this substation some 16 km to Theodore in the ACT. Works associated with the first stage have been initiated and are due for completion in 2009.

The environmental assessment for the proposed transformer substation states that the construction of the substation at Williamsdale has the potential for a small loss of vegetation, some minor water impacts from erosion and sedimentation, noise and vibration, air quality and visual amenity impacts. A number of mitigation measures are proposed to minimise the impacts during construction. Also, the environmental assessment for the proposed 132 kV subtransmission line from Williamsdale to Theodore - states that the construction of the transmission line from the Williamsdale Substation to Theodore has the potential for varying impacts along the route from loss of vegetation, site access/egress, and rural amenity. Mitigation measures for the construction of the subtransmission line are also expected to minimise local environmental impacts. Offsets for vegetation loss and/or modification are proposed for vegetation loss impacts. This would assist in ameliorating the cumulative vegetation loss impacts with the Transformer 330/132 kV Electricity Substation and 132 kV Subtransmission Line projects. Transgrid propose to provide compensatory habitat for the agreed level of intrusion through Yellow Box Red Gum Grassy Woodland. To date, an agreement between the Commonwealth Department of Environment Water and Heritage and the Arts and Transgrid has established a nominated land parcel, which would provide 20 ha of compensatory habitat for the Yellow Box Red Gum Grassy Woodland.

The operational impacts from the Williamsdale substation and transmission lines are not expected to have a significant negative cumulative impact with this project. However, the cumulative impacts of improved essential infrastructure (water and electricity supply) would have an overall positive impact.

In April 2009, ACTEW announced that it had purchased land in Williamsdale and that it would seek to be an active participant in the development of commercial solar power generation for the ACT by providing this land as a suitable site. While ACTEW would not develop a solar power proposal in its own right, ACTEW intends to work with ActewAGL or any other potential proponents that may bid to undertake the project in response to the ACT Government's recent call for expressions of interest for development of a solar farm in the ACT.

ACTEW may also use this land to plant trees to mitigate any impact from its major water security projects - the Enlarged Cotter Dam and the Murrumbidgee to Googong Water Transfer. This would be in addition to rehabilitation processes along the pipeline route and would help improve the environment along the Murrumbidgee River.

The Tantangara Transfer project is also proposed. Information on the Tantangara Transfer project is provided in this document. There would be no additional increase in discharge volumes through Burra Creek than those identified in this document. With the Tantangara Transfer operating, there is the potential for an increase in the amount of water flowing in the Murrumbidgee River. This project is the subject of separate negotiations with the NSW Government.

If the other projects were approved after the project is approved, construction management and mitigation measures for the other projects would need to be developed considering the potential for cumulative

construction impacts. The proponent would continue to monitor the progress of other projects through the approval phase of the project to confirm the likely construction timeframes for these projects.

Environmental monitoring

Both the construction and operation of the project would be supported by the implementation of best practice management techniques defined by the construction and operational environmental management plans. The community engagement and stakeholder management plan would form an integral part of these.

Ongoing monitoring is an important component of the project to determine the aquatic ecosystem responses occurring in both the Murrumbidgee River and Burra Creek as a result of the project construction, water abstraction from Angle Crossing and water discharge into Burra Creek. An ongoing monitoring program with an adaptive management approach would be adopted. Adaptive management is a process whereby the results of environmental monitoring are continually assessed and modifications or additional safeguards adopted if necessary. Ongoing ecological monitoring in the Murrumbidgee River and Burra Creek would be established and incorporated into the operational management plan for the project. The monitoring program would provide the necessary information to inform, and if required, adapt the operation of the project.

The proposed monitoring would include:

- Stream-flows;
- Physico-chemical water quality parameters;
- Ecological water quality indicators;
- Fish biota;
- Sediment transportation and deposition;
- Geo-morphology;
- Riverine vegetations; and
- Screening effectiveness at Angle Crossing.

All monitoring would be undertaken according to the relevant Australian Standards and accepted scientific protocols. The local community and other interested stakeholders would be encouraged to participate in the monitoring program and development of any adaptive response measures that may be required.

The summary of commitments listed in this table include the development of construction and operation environmental management and monitoring plans as discussed above, and the additional measures recommended by the individual impact assessment chapters (refer to chapter 28 for the complete list).

Table E.1 Summary of commitments

Issue	Commitment
Environmental management, rehabilitation and monitoring	The construction and operation environmental management plans, rehabilitation plan and ongoing monitoring plan, would be prepared and implemented.
Hydrology and geomorphology	Regular reviews of the geomorphological monitoring program including management actions to address any observed morphological changes. Consultation with the NSW Department of Water and Energy with regard to watercourse crossing methodologies and site-specific mitigation measures.
Water quality	All discharges from the area of works would meet ACT EPA and NSW DECC legislative requirements. A standard operating procedure would be developed for access to the pipeline during maintenance activities. ACTEW's Regional Source Water Protection Program would address

Issue	Commitment
	improvements to water quality in the Murrumbidgee River and the quality of water pumped to Burra Creek and the Googong Reservoir. Installation of grit collection hopper at the low lift pump station and discharge of captured sediments back to the Murrumbidgee River with an automatic timer on the grit collection hopper discharging sediments continuously. Ongoing monitoring and adjustments to the timers or release volumes if required. Water abstracted from the Murrumbidgee River would be released into Burra Creek without delay to minimise deoxygenisation and cooling. Operational rules would be developed to acceptable levels of turbidity in the Murrumbidgee.
Aquatic ecology	Maintenance of flow transfers where possible during the fish breeding season. If flows need be altered, then the 48 hour step up/down regime would be utilised. Installation of a 0.5 mm mesh on the intake screen to prevent transfer of fish and eggs and regular monitoring at the outlet into Burra Creek. Prior to construction, inspection of river and creek banks within the construction footprint for platypus burrows and procedures for transfer of platypus if required. Regular review of the results of the aquatic monitoring program and development of management actions if required.
Terrestrial ecology	Pipeline construction in the identified construction impact zone as identified in this assessment with further reductions investigated during preparation of the construction environmental management plan. Where the removal of hollow-bearing trees and/or hollow limbs is unavoidable, an appropriately qualified arborist would be employed. Tree-hollows would be inspected for resident fauna by a qualified ecologist/zoologist prior to felling or trimming. Any trees or limbs that are removed would be retained on site for ground based habitat. Future targeted surveys for Pink-tailed Worm Lizard in areas where access was difficult during the survey period. Additional surveys within the Goulburn-Cooma Railway corridor for <i>Swainsona recta</i> in consultation with the NSW Department of Environment and Climate Change, to avoid impacts on the species. Offsets for the removal and/or modification of approximately 16.7 ha of native vegetation, including 11.1 ha of Box Gum Grassy Woodland (and secondary grassland) that ranges from poor to good condition, 1.7 ha of Natural Temperate Grassland and 0.3 ha of Snow Gum Grassy Woodland and 3.6 ha of other native vegetation occurring within the construction footprint, would be provided. ACTEW will continue to liaise closely and seek advice from all relevant regulators throughout the development of the Offset Plan.
Indigenous heritage	Impact to Aboriginal sites/objects along Burra Creek and at London Bridge would be avoided. A second stage of subsurface archaeological investigations would be undertaken following approval. Management of recovered material should be developed with statutory authorities and Aboriginal stakeholder groups. A salvage of a representative sample of surface Aboriginal artefacts would be undertaken prior to ground surface disturbance within the construction footprint. The management of material recovered should be developed with statutory authorities and Aboriginal stakeholder groups. Consultation with the registered Aboriginal organisations would be ongoing.
Non-Indigenous heritage	Temporary fencing of the Williamsdale School during construction to avoid indirect impact. An archival recording would be made and any historic material collected would be lodged with the ACT Historic Society. The Goulburn to Cooma railway line would be reinstated following completion of

Issue	Commitment
	construction at the location where the pipeline needs to pass under the railway. Temporary fencing would be erected at a distance of 3 m around the Moore family 'Lagoon' house site and Burra Creek to protect it from indirect impact. Disturbance to the line of tree making the driveway for Burra Station would be minimised and any lost trees would be replaced with the same species.
Topography, soils and groundwater	Should groundwater be intercepted during construction in a volume that would necessitate dewatering, the NSW Department of Water and Energy would be consulted to determine if approval under the Water Act 1912 is required.
Land use	The detailed design of the project would aim to ensure that disruption to any recreational uses in the vicinity of the project is minimised. The proponent prepare agreements with landholders to manage potential construction impacts to each property affected by the project. Periodic inspections of rehabilitation and stabilisation works. Consultation with land owners would be ongoing for operation and maintenance.
Landscape character and visual amenity	Vegetation rehabilitation and landscaping would be undertaken in accordance with the rehabilitation plan. The detailed design of all structures to minimise the potential visibility of the project with aboveground structures being designed and located as visually unobtrusive as practicable.
Spoil handling and waste management	Wherever practicable spoil would be reused. Any surplus spoil that cannot be reused would be transported off-site to recycling depots or approved landfill sites after testing. The proponent would continue dialogue with local landowners and Palerang Council regarding spoil reuse options.
Climate and air quality	A climate change risk management sub-plan would be developed and would include a monitoring program to manage climate change risks to the project.
Greenhouse gas	All greenhouse gas emissions associated with the construction and operation of the project would be offset. Potential options for reducing greenhouse gas emissions would be assessed, including use of biodiesel during construction and energy efficiency measures.
Social and economic	Consultation with the community throughout the project planning and construction phases.
Health and risk impacts	An integrated risk management plan would be developed for the project, to provide a systematic proactive approach to identifying, analysing, assessing, documenting, accepting or mitigating and managing risks. The plan would cross-reference the other plans being prepared for the project.
Traffic and transport	Monaro Highway/ Angle Crossing Road intersection would be improved. Grading of Angle Crossing Road and unsealed sections of Williamsdale Road would be undertaken. Disruption to private property access would be minimised for the duration of the construction works and access would be restored as soon as practicable. Any damage to road surfaces that result from the project would be repaired. Consultation with the lessee of the rail crossing to ensure construction timing minimises impacts.

Conclusion

The proposal to transfer water from the Murrumbidgee River to Googong Reservoir via Burra Creek represents a major investment in securing the water supply for the ACT region and has substantial economic and social benefits. The environmental assessment indicates that while there are some potentially significant impacts, appropriate mitigation measures would be applied to minimise these impacts to acceptable levels. As a result, there is unlikely to be any significant residual impacts as a result of the project.

A high standard of environmental management would guide this project and the significant economic and social benefits of the project would positively impact on this region for many years to come.