GOOGONG

Googong Integrated Water Cycle Project Stage D

Review of Environmental Factors

Water Recycling Plant and Permanent Reservoirs

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GOOGONG IWC PROJECT STAGE D REVIEW OF ENVIRONMENTAL FACTORS

Water Recycling Plant and Permanent Reservoirs

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Prepared by:

RPS

Valerie Donat
Senior Consultant - Environment

Level 13, 255 Pitt Street
Sydney NSW 2000

T +61 2 8099 3200
E valerie.donat@rpsgroup.com.au

Prepared for:

Googong Township Propriety Limited

Craig Harris
Assistant Project Director

Level 3, 64 Allara Street
Canberra City ACT 2600

T (02) 6230 0800
E craig.harris@peet.com.au

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TERMS AND ABBREVIATIONS

Abbreviation	Term
4WD	Four-wheel drive vehicle
ACT	Australian Capital Territory
ADWF	Average dry weather flow
AEC	Areas of environmental concern
AGWR	*Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (NRMMC, EPHC and AHMC, 2006)
AHD	Australia Height Datum
AHIMS	Aboriginal Heritage Information Management System
ARI	Annual return interval
APZ	Asset protection zone
BC Act	*Biodiversity Conservation Act 2016*
CCP	Critical control point
CEMP	Construction environmental management plan
CNVG	*Construction Noise and Vibration Guidelines* (RMS, 2016)
CoA	Conditions of Approval
DAWE	Commonwealth Department of Agriculture, Water and the Environment
dB	Decibel
dBA	Decibels A-weighted
DCP	Development Control Plan
DIRD	Commonwealth Department of Infrastructure and Regional Development
DPIE	NSW Department of Planning, Industry and Environment
DPIE – Water	NSW Department of Planning, Industry and Environment – Water (previously NSW Office of Water)
EA	Environmental assessment
EC	Electrical conductivity
EDT	Emergency detention tank
EES	NSW Environment, Energy and Science Division (previously Office of Environment and Heritage)
EP	Equivalent population
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESD	Ecologically sustainable development
FM Act	*Fisheries Management Act 1994*
GFIMS	Googong foreshores Interface Management Strategy
GWMP	Groundwater Monitoring Program
GTPL	Googong Township Propriety Limited
ha	Hectares
Hill 800	Location of the Permanent Reservoirs site
IHO	Interim heritage order
IMP	Irrigation Management Plan
INCG	*Interim Construction Noise Guideline* (DECC, 2009)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
IWC	Integrated Water Cycle

Abbreviation	Term
kL	Kilolitre
L	Litre
L/s	Litres per second
L_{A90}	The percentile sound pressure level exceeded for 90 per cent of the measure period with 'A' frequency weighting calculated by statistical analysis
L_{Aeq}	Equivalent continuous sound pressure level with 'A' frequency weighting
L_{Amax}	The maximum of the sound pressure levels recorded of a measurement period
LEP	Local environmental plan
LES	Local environment study
LPA	Local Planning Agreement
m	Metre
MBR	Membrane bioreactor
MCC	Motor control centre
ML	Megalitre
mm	Millimetre
MNES	Matters of National Environmental Significance
NH	Neighbourhood
NML	Noise monitoring level
NPfI	*Noise Policy for Industry* (EPA, 2017)
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OCF	Odour control facility
OCP	Operational control point
OEMP	Operational environmental management plan
PCS	Plant control system
PLC	Programmable Logic Controller
POEO	*Protection of the Environment Operations Act 1997*
Proposal	Construction and operation of Stage D WRP and Permanent Reservoirs
PWWF	Peak wet weather flows
ou	Odour unit
QCC	Queanbeyan City Council (now QPRC)
QPRC	Queanbeyan-Palerang Regional Council
RBL	Rating background levels
RDT	Rotating drum thickener
REF	Review of Environmental Factors
RMS	Roads and Maritime Services
RNP	*Road Noise Policy*
RWPS	Recycled water pumping station
RWST	Recycled water storage tank
RWQMP	Recycled Water Quality Management Plan
s	Seconds
SCADA	Supervisory Control and Data Acquisition
SHR	State Heritage Register
SPS	Sewage pumping station
SWL	Sound power levels
TDS	Total dissolved solids

Abbreviation	Term
TfNSW	Transport for NSW
TPZ	Tree protection zone
TSS	Total suspended solids
µg/L	Microgram per litre
µS/cm	Micro-Siemens per centimetre
UV	Ultra-violet
UVT	UV transmissivity
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WAS	Waste activated sludge
WM Act	*Water Management Act 2000*
WRP	Water recycling plant

EXECUTIVE SUMMARY

Background

Googong Township Pty Ltd (GTPL) – a joint venture between Peet and Mirvac – is responsible for the development of the new Googong township located in the Canberra region, around seven kilometres south of Queanbeyan in NSW. The new Googong township will be home to about 18,850 people and developed over 25 years.

The Googong township is designed around an integrated water cycle (IWC), with a dedicated Water Recycling Plant (WRP) that would reduce the consumption of potable water in the community by around 60 per cent and recycle the township's water for non-potable use. The Googong IWC Project is being constructed and operated in stages to ensure the infrastructure is appropriately sized to meet the incremental level of demand as development of the Googong township progresses.

On 24 November 2011, the Googong Township Water Cycle Project was approved by the Minister for Planning under Part 3A (now repealed) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval included Concept Approval for the ultimate development (Stages 1 and 2) and the Project Approval for Stage 1 development of the Googong Township IWC Project.

Stage 1 of the IWC project was developed in three stages (Stage A – Network, Stage AB – WRP and Stage B – Network) and has commenced operation. The Googong township development reached capacity of the Stage 1 IWC project by late 2016, therefore Stage 2 of the IWC project has commenced.

Stage 2 of the IWC Project is being delivered in two sub-stages, known as Stage C and Stage D, in order to provide the appropriate IWC infrastructure to accommodate the size and growth of the Googong township. Construction of Stage 2 commenced in August 2016. Stage C has been developed, with construction of Stage C completed in August 2018. As of November 2019, all Stage C assets have been handed over from GTPL to Icon Water and Queanbeyan-Palerang Regional Council (QPRC) and these assets are now operational.

Stage D (the Proposal) is the ultimate capacity of the IWC Project. The purpose of Stage D is to support the ongoing development of the Googong township to increase the capacity of the existing IWC Project to 18,850 equivalent population (EP). The Stage D upgrades would also include allowance for a potential future capacity increase up to 19,550 EP.

Proposal overview

The Proposal would involve the installation of new equipment and upgrades to existing IWC infrastructure to allow for the treatment of wastewater for 18,850 EP.

The Proposal would involve works at the following IWC components:

- Stage AB and C WRP (referred to as the existing WRP), and
- Permanent Reservoirs.

The Stage D upgrade works to be conducted at the WRP include:

- New equipment/process units:
  - Additional membrane bioreactor train with consolidated design along with associated diffusers, mixers, pumps, and pipework
  - Additional tertiary filter train to provide increased tertiary treatment (chemical phosphorus removal) capacity
  - Additional aerobic digester tank along with associated diffusers, pumps, and pipework
  - Additional centrifuge unit to provide increased sludge dewatering capacity
  - Additional chemical dosing skids for the Stage D bioreactors
  - Addition of a fourth recycled water transfer pump.

- Replacements/upgrades:
  - Upgrade of blowers and/or air compressor in the blower room
  - Upgrade of both smaller tertiary feed pump(s)
  - Upgrade of some existing chemical dosing pumps
  - Upgrade of the centrifuge feed pumps with higher capacity units
  - General electrical and control system upgrade to cater to the upgrade works.

The Stage D upgrade works to be conducted at the Permanent Reservoirs located on Hill 800 include:

- A new 9ML reservoir would be built for recycled water storage
- The existing 4.0 ML recycled water reservoir would be cleaned and re-purposed for potable water , bringing the total storage volume up to 5.9 ML
- A new Stage D potable water booster pump skid would be provided to cater to flows in the higher elevation developments of the Googong township
- The Stage C potable water booster pump skid would be decommissioned
- Decommissioning of the Stage C sedimentation bund and associated civil works required to re-purpose the area for the new 9ML recycled water reservoir
- Sodium metabisulphite would be redirected to dose into the Stage D chemical dosing chamber that receives the overflow from the new reservoir
- Recycled Water sodium hypochlorite dosing pumps may need to be replaced with 40 L/h dosing pumps. This is pending review of the operating data at concept design. Potable water sodium hypochlorite dosing pumps can be retained
- Electrical and control system upgrade to cater for the new infrastructure.

The entire Googong township would be supported by the Proposal as the Stage D would provide the required infrastructure for ultimate capacity.

Planning approval process

Clause 106(3A) of the ISEPP permits development for the purpose of a water recycling facility to be carried out by a public authority, such as a council, without consent in a prescribed zone, and Clause 125(1) permits development on any land for the purposes of a water reticulation system to be carried out by or on behalf of a public authority without consent.

The WRP component of the Proposal is classified as a water recycling facility and would be undertaken on land in a prescribed zone. The Permanent Reservoirs component of the Proposal is classified as a water reticulation system. Both these components would be carried out by GTPL as the proponent of the Proposal, acting for and on behalf of QPRC, who would own and operate the IWC Project. As such, the Proposal is permissible without consent and the environmental impacts would be assessed by QPRC and determined under Part 5 of the EP&A Act.

The Queanbeyan LEP permits development for the purpose of “environmental protection works” to be carried out without consent and development for the purpose of “roads” to be carried out with consent in zone E2. The temporary construction access immediately east of the WRP site is located within the E2 zone and is permissible with consent under the provisions of the Queanbeyan LEP. As such, these construction works are subject to assessment and development consent from QPRC under Part 4 of the EP&A Act.

Other approvals licences and permits would also be required as part of the construction and operation of the Proposal and include an EPL under the *Protection of the Environment Operations Act 1997* for construction and operation of the Stage D.

Consultation

Consultation with future operators (QPRC and Icon Water), government agencies, the community and other stakeholders for the Googong township and the IWC Project has been ongoing since the preliminary

development stages in the early 2000s and has continued throughout the planning, construction and operational phases of the project.

GTPL and QPRC have collaborated in the development and delivery of a program of community education activities. Key messages are around the reduction of potable water usage, the appropriate uses of recycled water and alerting visitors to the use of recycled water in the Googong township. Key community consultation activities have included regular meetings with the Bush on Boundary group, project mail outs, flyers in rates notices and drop-in sessions.

The Concept Approval in place for the IWC Project requires community consultation to be undertaken to inform the development of the environmental assessments for each subsequent stage. For this Proposal, government agencies were provided with a letter providing an overview of the Stage D works and invited to provide feedback. A letter was also provided to all current residents of the Googong township, to community members listed on the Googong IWC stakeholder list and to Aboriginal stakeholders. The letter provided an opportunity for members of the community to raise any issues or concerns and also identified that a REF for the Proposal was being prepared.

Environmental assessment

This REF identifies the potential environmental impacts of the Proposal and outlines measures to mitigate the identified impacts. The following potential impacts have been identified should the Proposal proceed:

- temporary construction noise, dust, visual and traffic impacts
- operational visual impacts as a result of the new reservoir tank at the Permanent Reservoir site
- increased flows of excess recycled water discharged to the environment as a result of the Proposal servicing the growing township.

The discharge of excess recycled water from the WRP commenced in 2016, and all recycled water produced has been discharged into the downstream environment at Googong Creek. No material impact, such as scouring, has been observed since the commencement of recycled water discharge and therefore the Proposal is not expected to result in additional material impact to the downstream environment.

Measures to mitigate these and other potential environmental impacts will be delivered through the implementation of Construction Environmental Management Plans (CEMPs) and an amended Operational Environmental Management Plan (OEMP).

Conclusion

The construction and operation of Stage D of the Googong IWC Project (the Proposal) is subject to assessment under Part 4 and Part 5 of the EP&A Act, with consideration of the Part 3A Concept Approval issued by the NSW Minister for Planning in 2011.

The Proposal, as described in the REF, is consistent with the Part 3A Concept Approval and best meets the project objectives. The construction and operation of the Proposal has the potential to result in minor impacts on surface water and groundwater quality, aquatic ecology, noise, air quality, visual amenity, and traffic. These impacts are not considered to be significant and would be managed by the safeguards and mitigation measures as detailed in this REF.

The Proposal is also considered justified as it would provide the ultimate stage of infrastructure to service the growing Googong township through the expansion of the existing WRP and Permanent Reservoirs.

1 INTRODUCTION

1.1 Background

Googong Township Pty Ltd (GTPL) – a joint venture between Peet and Mirvac – is responsible for the development of the new Googong township located in the Canberra region, around seven kilometres south of Queanbeyan in NSW. The new Googong township will be home to about 18,850 people and developed over 25 years.

The Googong township is designed around an integrated water cycle (IWC), with a dedicated Water Recycling Plant (WRP) that would reduce the consumption of potable water in the community by around 60 per cent and recycle the township's water for non-potable use. The Googong IWC Project is being constructed and operated in stages to ensure the infrastructure is appropriately sized to meet the incremental level of demand as development of the Googong township progresses.

On 24 November 2011, the Googong Township Water Cycle Project was approved by the Minister for Planning under Part 3A (now repealed) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval included Concept Approval for the ultimate development (Stages 1 and 2) and the Project Approval for Stage 1 development of the Googong Township IWC Project and was based on the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010).

Stage 1 of the IWC project was developed in three stages (Stage A – Network, Stage AB – WRP and Stage B – Network) and has commenced operation. The Googong township development reached capacity of the Stage 1 IWC project by late 2016, therefore Stage 2 of the IWC project has commenced.

Stage 2 of the IWC Project is being delivered in two sub-stages, known as Stage C and Stage D, in order to provide the appropriate IWC infrastructure to accommodate the size and growth of the Googong township. Construction of Stage 2 commenced in August 2016. Stage C has been developed, with construction of Stage C completed in August 2018. As of November 2019, all Stage C assets have been handed over from GTPL to Icon Water and Queanbeyan-Palerang Regional Council (QPRC) and these assets are now operational.

Stage D (the Proposal) is the ultimate capacity of the IWC Project. The purpose of Stage D is to support the ongoing development of the Googong township to increase the capacity of the existing IWC Project to 18,850 equivalent population (EP). The Stage D upgrades would also include allowance for a potential future capacity increase up to 19,550 EP.

1.2 Proposal overview

GTPL is the proponent of the Proposal acting for and on behalf of QPRC who will own and operate the WRP and most components of the IWC Project, as each stage is completed.

The Stage D works would involve the installation of new equipment and upgrades to existing IWC infrastructure to allow for the treatment of wastewater for an EP of 18,850 (increased from 9,400).

The Stage D works would involve works at the following IWC components:

- Stage AB and C WRP (referred to as existing WRP), and
- Permanent Reservoirs.

The Stage D upgrade works to be conducted at the WRP are shown in Figure 3.2 and include:

- New equipment/process units:
  - Additional membrane bioreactor (MBR) train with consolidated design along with associated diffusers, mixers, pumps, and pipework
  - Additional tertiary filter train to provide increased tertiary treatment (chemical phosphorus removal) capacity
  - Additional aerobic digester tank along with associated diffusers, pumps, and pipework
  - Additional centrifuge unit to provide increased sludge dewatering capacity
  - Additional chemical dosing skids for the Stage D bioreactors

  - Addition of a fourth recycled water transfer pump.
- Replacements/upgrades:
  - Upgrade of blowers and/or air compressor in the blower room
  - Upgrade of one smaller tertiary feed pump(s)
  - Upgrade of some existing chemical dosing pumps
  - Upgrade of the centrifuge feed pumps with higher capacity units
  - General electrical and control system upgrade to cater to the upgrade works.

The Stage D upgrade works to be conducted at the Permanent Reservoirs located on Hill 800 are shown in Figure 3.5 and include:

- A new 9ML reservoir would be built for recycled water storage
- The existing 4.0 ML recycled water reservoir would be cleaned and re-purposed for potable water, bringing the total potable water storage volume up to 5.9 ML
- A new Stage D potable water booster pump skid would be provided to cater to flows in the higher elevation developments of the Googong township
- The Stage C potable booster pump skid would be decommissioned. Supply would be from the new Stage D potable water booster pump skid
- Decommissioning of the Stage C sedimentation bund and associated civil works required to re-purpose the area for the new 9ML recycled water reservoir
- Sodium metabisulphite would be redirected to dose into the Stage D chemical dosing chamber that receives the overflow from the new reservoir
- Recycled Water sodium hypochlorite dosing pumps may need to be replaced with 40 L/h dosing pumps. This is pending review of the operating data at concept design. Potable water sodium hypochlorite dosing pumps can be retained
- Electrical and control system upgrade to cater for the new infrastructure.

The entire Googong township would be supported by the Proposal as the Stage D works would provide the required infrastructure for ultimate capacity. Further details of Stage D works are provided in Section 3.

1.3 Purpose of this document

This REF has been prepared by RPS for GTPL, the proponent of the Proposal. GTPL are acting as the proponent for and on behalf of QPRC. Under the provisions of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP*)* the Proposal is classified as a water recycling facility (WRP) under Division 18 of the ISEPP and also as a water reticulation system (permanent reservoirs) under Division 24 of the ISEPP and therefore development consent for these aspects of the Proposal is not required. Subsequently, it is subject to an environmental impact assessment and determination under Part 5 of the EP&A Act with QPRC as the determining authority.

Under the provisions of the *Queanbeyan Local Environment Plan 2012*, the temporary construction access located east of the WRP site is permissible with consent. Assessment and development consent from QPRC under Part 4 of the EP&A Act is required for these construction works. Development consent will be sought by GTPL separate to the determination of the Proposal under Part 5 of the EP&A Act.

The purpose of this REF is to describe the Proposal, assess the likely impacts of the Proposal on the environment, and to recommend measures to mitigate these impacts.

This REF has been prepared within the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Biodiversity Conservation Act 2016*, the *Fisheries Management Act 1994*, and the Australian Governments' *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act that the determining authority examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The REF has also been prepared within the content of Part 4 of the EP&A Act to support a development application for a temporary construction access adjacent to the WRP site. As such, the REF helps to fulfil the requirements of Schedule 1 of the *Environmental Planning and Assessment Regulation 2000* that the development application must provide an indication as to whether the development is likely to significantly affect threatened species, populations or ecological communities, or their habitats.

The findings of the REF would be considered when assessing:

- Whether the Proposal is likely to have a significant impact on the environment and therefore the necessity for an environment impact statement to be prepared and approval sought from the Minister for Planning under Division 5.1 of the EP&A Act.
- The significance of any impact on threatened species as defined by the *Biodiversity Conservation Act* and/or the *Fisheries Management Act*, in section 1.7 of the EP&A & Act and therefore the requirement for a Species Impact Statement
- The development consent for the temporary construction access which will be sought from QPRC under Part 4 of the EP&A Act.

The potential for the Googong IWC Project to significantly impact a matter of national environment significance or Commonwealth land and the need to make a referral to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) for a decision by the Commonwealth Minister for the Environment was previously completed in parallel with the Part 3A Concept Approval process. An approval for the ultimate development of the Googong Township IWC Project (including Stage D) was granted on 19 May 2011 and no additional Commonwealth approvals are required for the Proposal.

2 STRATEGIC NEED

2.1 Background

Googong is a new, master planned township in the Canberra region within NSW, located about seven kilometres south of the Queanbeyan CBD and about 16 kilometres from the Australian Parliament House (refer to Figure 2 1). On 24 December 2009, the NSW government re-zoned the area to provide for the Googong township. The Googong township is being developed on 780 hectares (ha) of former grazing land and will include a town centre and four neighbourhood centres located in five walkable neighbourhoods. As a complete, self-contained township, in addition to housing, Googong would provide community facilities, shops, schools, recreational and employment facilities.

GTPL – a partnership between Peet and Mirvac – is responsible for the development of the new Googong township. The new Googong township would include about 5,500 new homes, which would be home to about 16,000 people and would be developed over 25 years. The Googong township is designed around the IWC system, with a dedicated WRP that would reduce the consumption of potable water in the community by around 60 per cent and recycle the township's water for non-potable use.

On 24 November 2011, the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010) was approved by the Minister for Planning under Part 3A (now repealed) of the EP&A Act. The approval included Concept Approval for the ultimate development (Stage 1 and 2) and the Project Approval for Stage 1 development of the Googong Township IWC Project. The Googong Township IWC Project is being constructed and operated in stages to ensure the infrastructure is correctly sized to meet the incremental level of demand.

2.1.1 IWC Project – Concept Approval

The Concept Approval for the IWC Project provided for the potable water, recycled water and sewerage systems required to service the anticipated population of the Googong township at ultimate development. The key infrastructure elements and the operating process are summarised below (also refer to Figure 2.2):

- **Potable water system**: A new bulk water pumping station located adjacent to the existing Icon Water Treatment Plant to transfer flows from the existing supply system to new potable water reservoirs via a new rising main. Potable water distribution mains then transfer flows from the reservoirs to the Googong township's water reticulation system.
- **Sewerage system**: Wastewater collected from the Googong township is transferred to the WRP via the mains. Wastewater flows by gravity to sewage pumping stations, two of which are constructed and operational. It is then pumped to the WRP.
- **WRP**: A new WRP would treat wastewater from the Googong township to a standard suitable for non-potable urban re-use and discharge to the environment. The WRP utilises physical removal, biological and chemical treatment, and disinfection to meet relevant standards. Membrane bioreactor (MBR) technology is at the core of the treatment process which utilises a bioreactor and microfiltration to treat water. Recycled water from the WRP would primarily be used for the recycled water system (see below). However, when recycled water availability exceeds demand, excess recycled water would be discharged to the environment.
- **Recycled water system**: Recycled (non-potable) water produced by the WRP is pumped to reservoirs. Flows from these reservoirs would then be transferred to the recycled water reticulation system through distribution mains and be used as required within the Googong township for non-potable household uses such as toilet flushing and garden watering, as well as for open space irrigation. This would reduce potable water demand by an estimated 60 per cent. Rainwater would also be collected throughout the township for non-potable uses in houses and commercial facilities. To maintain supply of non-potable water during times of high demand, the potable water system would be used to top up the recycled water system.

Figure 2.1 Googong Township master plan

2.1.2 IWC Project – Stage 1 Project Approval

In addition to the Concept Approval for the Googong IWC Project, a Project Approval for Stage 1 of the IWC Project was also issued in 2011. Stage 1 included construction and operation of infrastructure required to service the initial stages of the Googong township, up to an EP of 4,700.

Stage 1 of the IWC Project included (refer to Figure 2.2):

- Bulk water pumping station – located north of the Googong township, adjacent to the existing Icon Water Icon Water Treatment Plan to pump potable water to the township
- Interim potable and recycled water reservoirs site at 'Hill 765' located at the western extent of the Googong township, off Old Cooma Road, which connect to the township's reticulation systems and through gravity flows provide potable and recycled water to the township
- Two sewage pumping stations (SPSs) to pump wastewater to the WRP for processing (and are also sized for ultimate development):
  - SPS1 is located in the north-eastern part of the Googong township adjacent to Googong Road, near Beltana Pond
  - SPS2 is located within the eastern part of the Googong township
- Stages A and B of the WRP, located off Googong Road in the north-eastern extent of the Googong township which treats wastewater to provide recycled water to the township (via a recycled water pump at the WRP that transfers recycled water to the interim reservoir), and for discharge to the environment
- Rising and distribution mains for wastewater, recycled water, and potable water to connect to the initial development area.

Stage 1 of the IWC Project was also delivered in sub-stages (Stages A and B) to meet the requirements of the developing Googong township. Stage 1 commenced servicing the township in 2015 and is now operated by QPRC.

2.1.3 IWC Project – Stage 2 Project Approval

A concept design for Stage 2 of the IWC Project was outlined in the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010). Stage 2 is being delivered in two sub-stages to meet the requirements of the developing Googong township:

- Stage C – increased the capacity of the IWC system to 9,400 EP and included construction of the initial stages of the permanent reservoir facilities (and associated mains and pumps), increasing the capacity of the WRP; and upgrading the bulk water pumping station (and associated mains and pumps). Stage C was delivered in three separate components and has been operational since 2018.
- Stage D – all final works to bring the IWC to full capacity (18,850 EP, with allowance for a potential future capacity increase up to 19,550 EP).

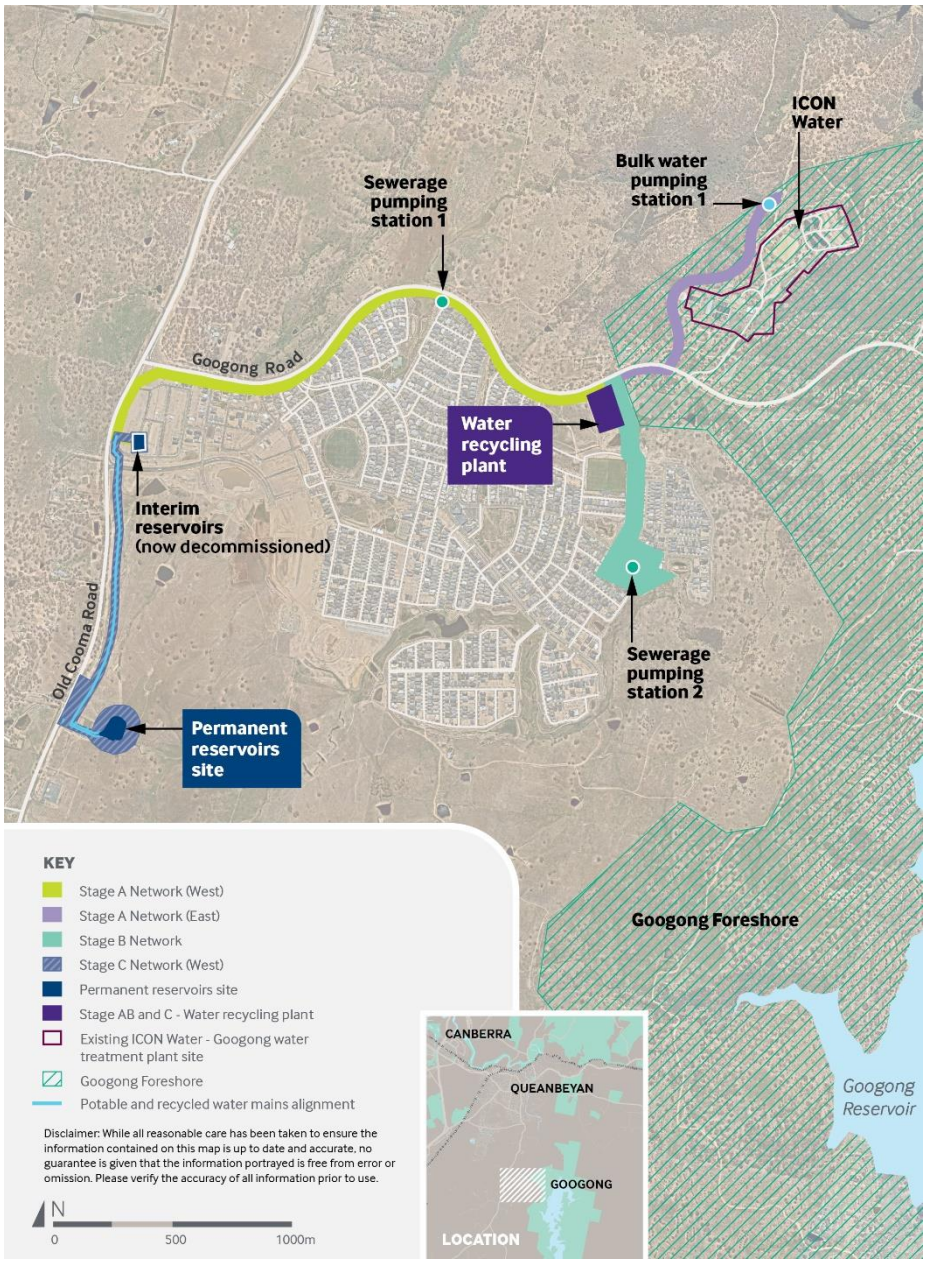

Figure 2.2 Googong Stages AB (Stage 1) and Stage C (part of Stage 2) works under the Part 3A Approval

2.2 Strategic need

Section 2.1 of the Environmental Assessment (Manidis Roberts, 2010) (EA) outlined the strategic need for the IWC Project, which was to provide a sustainable water supply to the Googong township. It also identified that the IWC Project was consistent with the following strategic planning documentation:

- *Sydney – Canberra Regional Strategy 2006 – 2031* (Department of Planning, 2008)
- *Queanbeyan Residential and Economic Strategy 2031* (QCC,2006)
- Memorandum of Understanding on ACT and NSW Cross Border Water Resources (between the Commonwealth, NSW and ACT governments, 2006)
- Memorandum of Understanding on ACT and NSW Cross Border Region Settlement (between the NSW and ACT governments, 2006)
- General regional water security planning
- *Queanbeyan Local Environmental Plan* (Googong) 2009 (subsequently repealed and incorporated into the *Queanbeyan Local Environmental Plan 2012*).

The proposed Stage D works are considered to be justified as they are consistent with and are a critical component of the IWC Project included as part of the Part 3A Concept Approval. Below is a summary of the strategic planning documents and how they are relevant to the Stage D works.

2.2.1 The Sydney – Canberra Regional Strategy 2006-2031

The *Sydney – Canberra Regional Strategy 2006-2031* applies to the Queanbeyan-Palerang local government area and represents the position of the NSW government for the Sydney – Canberra corridor. The strategy has been developed to support the growth between the two major cities whilst maintaining rural character and environmental connectivity. Considerations of the strategy include:

- Rural lands and primary industry
- Economic development and employment growth
- Regional transport
- Housing and settlement
- Natural environment
- Water and energy resources
- Cultural heritage.

The IWC Project and the Googong township meet the objectives of this strategy by providing housing for future growth in a master-planned community and a sustainable water supply from the existing water supply and WRP as addressed in the Concept Approval. The Stage D works would further support this strategy by increasing the sustainable water supply for future residents of the Googong township.

2.2.2 Queanbeyan Residential and Economic Strategy 2031

The *Queanbeyan Residential and Economic Strategy 2031* was developed in 2006, preceding the *Sydney – Canberra Regional Strategy 2006-2031*. The strategy addresses the following key issues:

- Economic development and employment growth
- Transportation
- Housing and settlement
- Natural environment and heritage.

The EA noted that greenfield development that incorporated integrated water cycle management would reduce demand for potable water, compared to traditional developments (Manidis Roberts, 2010). Stage D would allow for further utilisation of recycled water in the Googong township therefore aligning with this strategy.

2.2.3 Queanbeyan Local Environment Plan 2012

The *Queanbeyan Local Environment Plan 2012* (Queanbeyan LEP) is the principal local environmental planning instrument for the Proposal. The Proposal is located within three zones under the Queanbeyan LEP, SP2 Infrastructure, R1 General Residential and E2 Environmental Conservation. The objectives of the zones are outlined below:

- SP2 – to provide for infrastructure and related uses
- R1 – to enable other land uses that provide facilities or services to meet the day to day needs of residents
- E2 – to protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values, and prevent development that could have an adverse effect on those values.

The proposed Stage D works at the WRP and Permanent Reservoirs sites meet the objectives of zones SP2 and R1 as they relate to the provision of infrastructure and services for the Googong township.

A temporary construction access road is proposed within the land east of the WRP (Part Lot 4 DP 1217396). This area is zoned E2, although it is highly disturbed. The temporary access is not in conflict with the E2 zone permissibility, and also supports the objectives pf the zone as the temporary nature of the works will allow for the restoration and recovery of the areas once construction is complete.

2.2.4 Googong Development Control Plan

The *Googong Development Control Plan* (DCP) was developed specifically for the Googong township to guide urban design in the new township.

The Proposal, with the exception of the temporary construction access at the WRP, are not subject to the Googong DCP as it is being assessed under Part 5 of the EP&A Act and does not require development consent. However, the proposed temporary construction access east of the WRP will require development consent under Part 4 of the EP&A Act from QPRC and considers the objectives and controls outlined in the Googong DCP. The provisions of the Googong DCP would apply during the Part 4 approval process for the temporary construction access.

The Proposal aligns with the aims of the DCP as an integrated part of the Master Plan and provides a sustainable water supply for the future residents of Googong. the Environmental management measures outlined in Part 8 of the DCP have been considered in Section 6 of this REF.

2.2.5 Section 94 Contributions Plan (Googong) 2015

The Proposal, with the exception of the temporary construction access at the WRP, is not subject to section 7.11 of the EP&A Act (previously Section 94) as it is being assessed under Part 5 of the EP&A Act. The Googong Development Corporation entered into the Googong Urban Development Local Planning Agreement with QCC for the provision of infrastructure, public amenities, and open space on behalf of Council. Stage 1 of the IWC Project has already been transferred to QPRC under this agreement and it is agreed that Stage D components would also be transferred following completion and verification. Therefore, the *Section 94 Contributions Plan (Googong) 2015* is not applicable to the Proposal.

The temporary construction access east of the WRP site would require further assessment and development consent from QPRC under Part 4 of the EP&A Act. However, this development is not likely to require the provision of or increase the demand for public amenities and public services with the area. Additionally, the construction access would be temporary, and the strip of land would be rehabilitated after construction has been completed. As such, it is not considered that a contribution would be applicable for this development.

2.3 Need for the Proposal

The need for the IWC Project, as an enabler of essential service provision for the Googong township can be justified on two grounds.

A need to provide essential water and wastewater services

The scale and urban framework of the Googong township, permissible under the *Googong Local Environmental Plan 2009* (subsequently repealed and incorporated into the *Queanbeyan Local Environmental Plan 2012*), requires a modern water and wastewater servicing strategy for residents.

These services are essential to urban development and to ensure the Googong township achieves relevant environmental and human health standards.

A need to deliver necessary water conservation outcomes

The Googong township is required to meet best practice water conservation outcomes as part of the rezoning outcome for the site and consistent with regional planning strategies and agreements between the Commonwealth, NSW, and ACT governments.

The design of the Project as a self-contained IWC management system, including production and re-use of recycled water from wastewater, is necessary to meet the stated objectives of these conditions and agreements.

2.4 Proposal objectives

Section 2.5 of the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010) identified that the key objective of the IWC Project is to deliver essential water and wastewater services to the Googong township. In delivering these services, the IWC Project's objectives are to:

- Ensure that the supply of water, recycled water and wastewater services meets the demand profile of the Googong township community
- Ensure that all potential human health impacts from provision of water and wastewater services are mitigated.

The IWC Project also sets out to:

- Achieve best practice water conservation outcomes relative to other regional urban developments
- Promote ecologically sustainable development (ESD), including the following key ESD objectives:
  - Minimise impacts on the environment from wastewater discharge
  - Minimise impacts on the environment from construction activities
  - Minimise impacts on the environment from location and operation of plant and equipment
- The specific objectives of the IWC Project are to:
  - Provide an IWC system for the Googong township that reduces potable water consumption by at least 60 per cent, when compared with traditional developments
  - Treat all wastewater from the Googong township and produce high quality recycled water suitable for irrigation, household use and discharge to the environment
  - Ensure that environmental and human health risks are adequately managed during construction and operation of the IWC Project
  - Protect the Googong Dam and Foreshores area
  - Gain endorsement from relevant stakeholders
  - Construct and operate an economically feasible water cycle system.

The above objectives are also applicable for the Stage D works.

3 PROPOSAL DESCRIPTION

3.1 Summary of the Proposal

The Stage D works would include works at the following IWC Project components (refer to Figure 3.1):

- WRP
- Permanent Reservoirs.

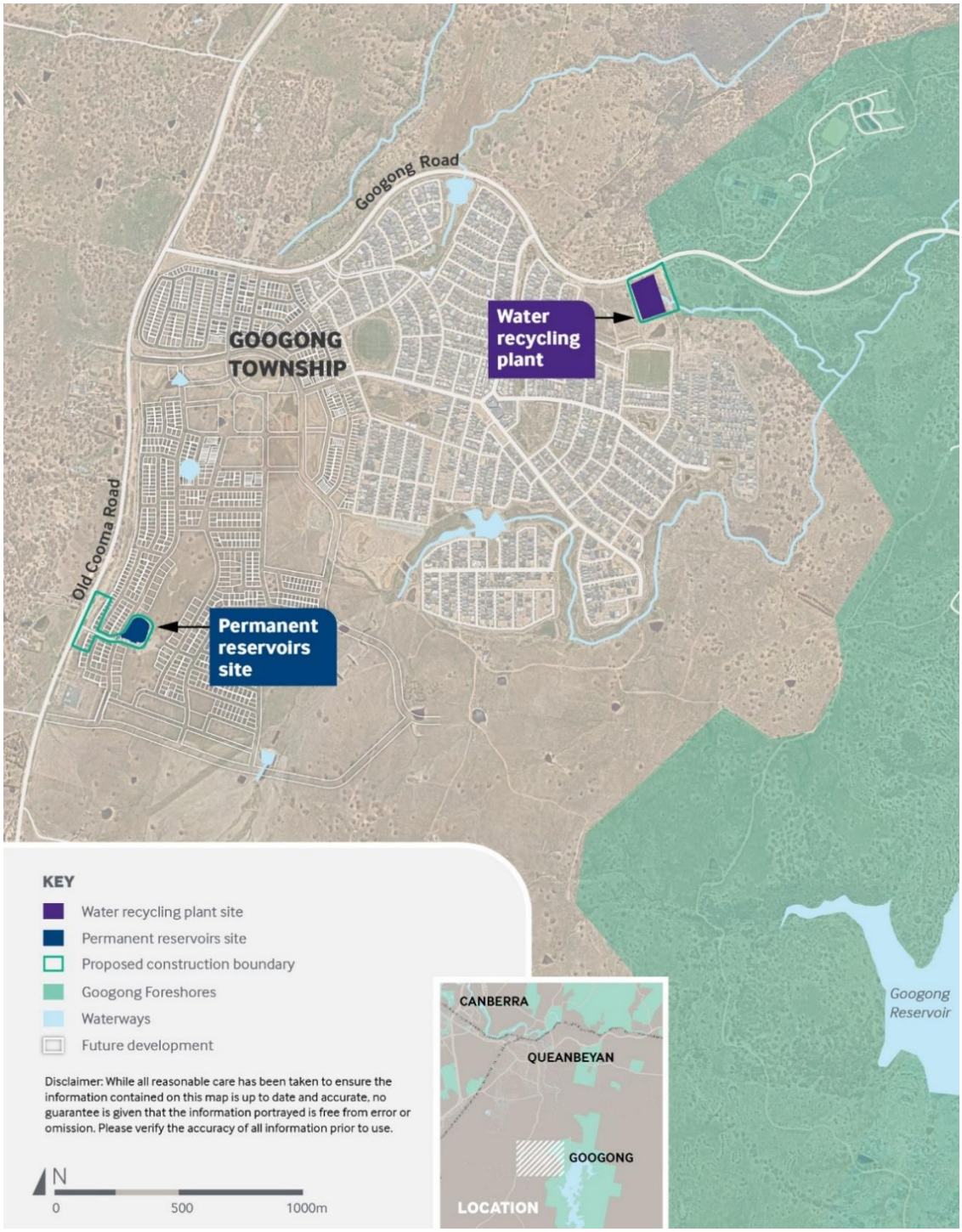

Figure 3.1 Proposed Stage D work areas

Proposed Stage D works is included in Table 3.1 below. Further detailed description of the works is provided in Sections 3.2.1 and 3.2.2.

Table 3.1 Summary of Stage D works

Infrastructure element	Equipment / component	Stage D scope of works
Water Recycling Plant		
Inlet works	Inlet works structure and mechanical equipment	Inlet Works structure and equipment were upgraded to ultimate capacity in Stage C. Minor works required at Stage D include adjustment of mechanical emergency overflow weir and removal of flow diversion chamber stoplogs.
Bioreactor	Bioreactor	Construction of one larger Bioreactor tank, sized for 18,850 EP (with additional buffer capacity for potential future expansion up to 19,550 EP), including all associated ancillaries.
	Diffused aeration system	Install the single bioreactor trains with fine bubble diffused aeration systems.
	Mixed liquor return / membrane feed pumps	Install three A-Recycle pumps, two R-Recycle pumps, and three membrane feed pumps.
	Aeration blowers	Replace the existing blowers with three new larger units and install one additional unit.
MBR Membranes	Membrane tanks	Construction of three MBR membrane tanks sized for 18,850 EP (with additional buffer capacity for potential future expansion up to 19,550 EP), including all associated ancillaries.
	MBR Membranes	Install two sets of MBR membranes. Install one additional set of MBR membranes when required (nominally 2032).
	Membrane filtrate pumps	Install two sets of pumps. Install one additional set of pumps when required (nominally 2032).
	Membrane blowers	Replace existing blowers with three new larger units.
Tertiary feed system	Filtrate storage tank	Filtrate storage tanks installed were for ultimate capacity – no further upgrade required at Stage D.
	Tertiary feed pumps	Replace two existing smaller pumps with new larger pumps (identical model to existing larger pumps).
	Tertiary filters	Install a new tertiary filter skid complete with 56 modules to enable duty/assist/standby trains.
	UV Disinfection units	UV Disinfection units installed at Stage C were for ultimate capacity – no further upgrade works expected at Stage D provided feed water UV Transmissivity (UVT) remains above 60%.
	Chlorine disinfection System	Chlorine disinfection system installed at Stage AB and C were for ultimate capacity – no further upgrade required at Stage D.
Recycled water storage and transfer	Recycled water storage tank (RWST)	Recycled water storage tanks installed at Stage C were for ultimate capacity – no further upgrade required at Stage D.
	Recycled water transfer pump station	Replace one (1) existing smaller transfer pump with a new larger pump identical to the units installed at Stage C.
Aerobic digester	Aerobic digester tank	Construct new aerobic digester tank adjacent to the Stage C digester – hydraulic connection to be via concrete weir cut-out sized for 18,850 EP (with additional buffer capacity for potential future expansion up to 19,550 EP). Install fine bubble diffused aeration system in the new tank as per the existing digesters.
	Aerobic digester blowers	Existing digester blowers installed at Stages AB and C were sufficient to meet the ultimate aeration demand – no further upgrade required at Stage D.
	Rotating drum thickener (RDT)	Relocate and recommission the RDT to the top of the new Stage D aerobic digester tank.

Infrastructure element	Equipment / component	Stage D scope of works
Biosolids dewatering and storage	Dewatering centrifuge unit	Install one new larger dewatering centrifuge (18 m^3/hr capacity). Install an additional centrifuge feed pump to enable feed flow to both smaller and larger centrifuges (up to 7.5 L/s).
	Biosolids outloading conveyor system	Install a new biosolids outloading conveyor system to allow for transfer of dewatered biosolids from the new centrifuge unit to a new biosolids bin area north of the centrifuge building.
	Biosolids bins	Install a new bin weighing system on the north side of the centrifuge building suitable for 10 kL bins to enable duty/standby bins operation.
Chemical storage and dosing	Chemical storage tanks	Chemical storage tanks installed at Stages AB and C were for ultimate capacity – no further upgrade required at Stage D.
	Chemical dosing system	Upgrade the sodium hypochlorite dosing pumps set for chlorine disinfection and RWST. Install new sodium hydroxide dosing line from Dosing Skid 3 to the new bioreactor(s). Install new ferric sulphate dosing line from the Dosing Skid 3 to the new bioreactor(s). Reconfigure the acetic acid dosing skid and run a new dosing line from the chemical area to the new bioreactor Reconfigure and extend the sodium hypochlorite dosing line from south-west corner of Bioreactor No. 2 to the new bioreactor and membrane tanks. Reconfigure and extend the citric acid dosing line from south-west corner of Bioreactor No. 2 to the new membrane tanks.
Emergency Detention Tank (EDT)	EDT tank	The existing EDT storage volume is considered sufficient to cater for wet weather attenuation for Stage D flows. Interconnecting pipework to potential additional EDT storage south of the Neutralisation Pit has been installed at Stage C. It is proposed that QPRC utilises the combined 1,500 kL storages at the SPS for the 1 in 10 year ARI events. Any additional EDT storage provided at the WRP will likely remain empty and unused for wet weather storage until close to full development (i.e. in 15-20 years).
	EDT return pumps	No further upgrade required to the existing EDT return pumps.
Off-Spec / Effluent transfer system	Off-Spec Water Tank	Off-Spec water tanks installed at Stages AB and C were for ultimate capacity – no further upgrade required at Stage D.
	Effluent Transfer Pumps	Replace the existing pumps with larger capacity units.
Compressed air system	Air compressors	Replace the existing air compressors with two larger capacity units.
Odour control	Odour extraction network	Install odour covers for the new bioreactor and aerobic digester tanks. Expand odour extraction network to service the new bioreactor, aerobic digester, centrifuge and biosolids conveyor system. This includes fit-out of odour covers and ductwork for the empty membrane tanks. Replace existing odour discharge stack efflux cone with larger diameter cone.
	Activated carbon units	No further upgrade required to the activated carbon units at Stage D.
Yard piping	Yard piping	Yard piping to suit the new Stage D assets.
Electrical and control systems	Motor Control Centre (MCC) and electrical systems	Install MCC No. 4 and drives associated with new Stage D assets. Upgrade uninterrupted power supply to meet requirements of Stage D assets.

Infrastructure element	Equipment / component	Stage D scope of works
	Programmable Logic Controller (PLC) and Supervisory Control And Data Acquisition (SCADA) systems	Upgrade PLC and SCADA as required to reflect new Stage D assets.
	Generator	No further upgrade required to the standby generator system at Stage D.
Permanent Reservoirs		
Recycled water reservoir	Existing Stage C sedimentation bund	Decommission of the existing Stage C sedimentation bund.
	New 9 ML recycled water Reservoir	Construct a new 9 ML recycled water reservoir (concrete) and associated pipework. Piped connections to the new 9 ML recycled water reservoir extended sufficiently far from the Stage C services terminating in direct buried isolation valves have all been included in Stage C.
Potable water reservoir	Existing 4 ML recycled water reservoir	Convert the existing 4.0 ML recycled water reservoir into a potable water reservoir (5.9 ML total capacity). This includes emptying and cleaning (scrubbing, high pressure cleaning, super-chlorination, and bacteriological sampling and testing) of the existing reservoir for it to be repurposed for PW use.
Potable water transfer	Potable Water booster pumps	Decommission the existing Stage C potable water booster pump station. Install a new Stage D potable water booster pump station and associated pipework to cater to flows for the higher elevation development areas.
Chemical storage and dosing	Sodium Metabisulfite Dosing	Modify sodium metabisulfite dosing pipework to dose into the new Stage D chemical dosing chamber which would receive overflow stream from the new recycled water reservoir.
	Sodium Hypochlorite Dosing	Replace the existing recycled water sodium hypochlorite dosing pumps with new larger units (40 L/hr), if required.
Electrical and control Systems	MCC and electrical systems	Upgrade the existing MCC and drives to reflect new Stage D assets.
	PLC and SCADA systems	Upgrade PLC and SCADA as required to reflect new Stage D assets.

Notes:

The requirement to upgrade some equipment (e.g. aeration blowers, membrane blowers, digester blowers, UV disinfection units, chlorination static mixer, chemical dosing pumps, air compressor/receiver units) would be subject to further review and confirmation at the Detailed Design stage.

The current approval sought for Stage D infrastructure is based on 18,850 EP, however GTPL have identified possible additional yield up to a total of 19,550 EP. Any yield beyond 18,850 EP will be subject to further approval and confirmation by design and demand modelling.

Due to the possibility of a future total equivalent population of up to 19,550, some Stage D infrastructure (i.e. the new recycled water reservoir and potable/recycled water booster pumps) have been sized with slightly increased capacity to allow for a population increased without replacing the Stage D assets. An additional 0.5 ML of recycled water storage has been provided, which simply provides more operating volume than is necessary for the 18,850 EP.

3.2 Detailed description of the Proposal

3.2.1 Stage D WRP

The Googong township IWC Project Concept Approval allows for the WRP to ultimately serve an EP of up to 18,850 EP. This capacity would be provided via four equally sized bioreactors, each representing a capacity of approximately 4,700 EP. The Stage AB WRP delivered a single bioreactor, representing a quarter of the

ultimate plant capacity (4,700 EP) and Stage C provided a second bioreactor and all other associated process units, nominally doubling the WRP capacity to 9,400 EP.

Stage D would provide the remaining infrastructure to double the WRP capacity to 18,850 EP, and includes allowance for a potential future capacity increase up to 19,550 EP. The WRP areas currently identified as requiring upgrade are highlighted in Figure 3.2.

The existing inlet works, screenings and grit handling system, chlorination system, odour control facility, and storage tanks are already installed for the ultimate (Stage D) capacity and no further augmentation is required for these process units.

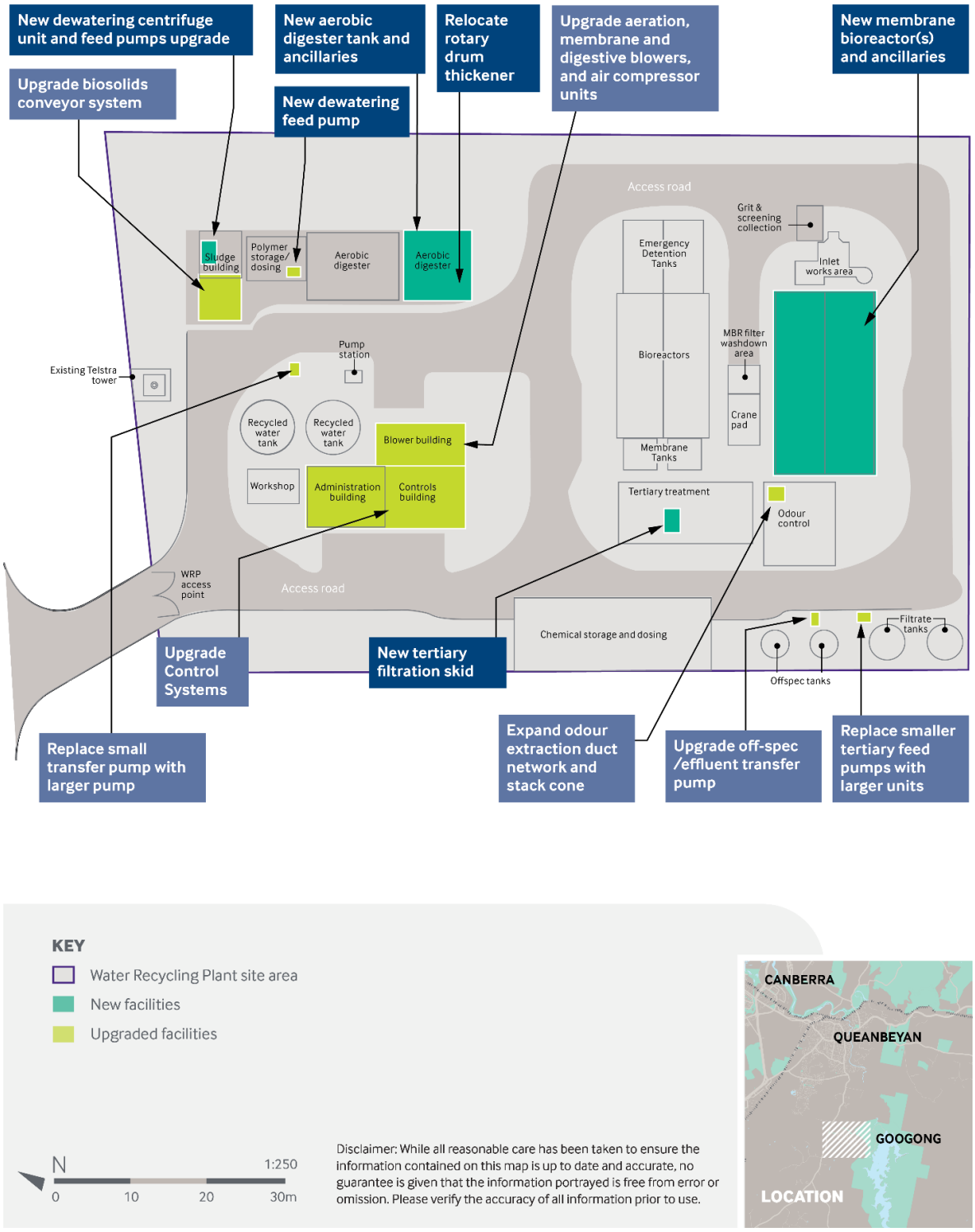

Figure 3.2 Stage D WRP proposed works

WRP operating process

The Stage D WRP process for treating wastewater is unchanged from the existing WRP and comprises the following major unit operations, which are detailed further in this section and are represented in Figure 3.4:

1. Preliminary treatment – inlet works
2. Emergency detention tanks – for temporary storage of untreated or partially treated wastewater and off specification recycled water
3. Secondary treatment – MBR for the removal of nutrients, organic loads, and suspended solids
4. Tertiary treatment – a combination of microfiltration membranes for tertiary phosphorus removal, UV disinfection and chlorination.

The biosolids waste treatment stream for the Stage D WRP is also unchanged from the existing WRP, with capacity augmentation where required. New process units installed in Stage D would include odour containment covers to maintain the current level of odour management and manage potential odour impacts. Finally, the existing site services for the WRP are outlined below and some would require capacity upgrade as described in this Proposal:

- Compressed air distribution – capacity upgrade required for compressor and air receiver units
- Potable water distribution – new yard piping required for additional potable water supply points (e.g. wash basins, emergency shower, etc.).

Preliminary treatment – inlet works

The purpose of the inlet works is to remove gross solids from the incoming wastewater. Wastewater pumped from the SPSs is currently received by an elevated inlet works structure at the WRP. The existing inlet works and associated civil and mechanical components are already sized for the ultimate WRP capacity. The influent wastewater is received in a raw sewage receival chamber before being passed through coarse screening, followed by grit removal and then fine screening. Grit and screened materials are washed, compacted, and taken off site to a licensed disposal facility.

In the event of a power failure, the raw sewage receival chamber level would rise and overflow into the manual bar screen channel, hence bypassing the coarse screens. There is also an overflow weir between the grit removal chamber and the fine screens which diverts flow greater than three times average dry weather flow (ADWF) to the EDT. This weir also acts as emergency overflow for if both fine screens failed to operate due to faults or power failure. Flow diverted to the EDT would be returned to the fine screen inlet channel for treatment when the plant returns to dry weather or normal operation.

The final chamber of the inlet works functions as a flow splitter which evenly distributes primary treated flows to the downstream MBRs.

Table 3.2 provides a summary of the works associated with the inlet works for the Proposal.

The inlet works also receives return flow from other stages of the treatment process, including:

- EDT
- Neutralised spent chemical from the MBR cleaning activities
- Scouring backwash from tertiary filtration
- Screen washing
- Launder sprays
- Sludge thickening and dewatering liquors

Table 3.2 Summary of inlet works for the Proposal

Process unit	Existing WRP	Stage D WRP
Raw Sewage Receival Chamber	Inlet chamber sized to receive the maximum Stage D pumped flow from SPS1 and SPS2 (~200 L/s or ~9 x ADWF)	No change required
Coarse Screens	2 Nos. 6 mm band screens sized to treat the maximum Stage D pumped flow from SPS1 and SPS2 (~200 L/s or ~9 x ADWF)	No change required
Grit Removal	Rotating grit chamber sized to treat the maximum Stage D pumped flow from SPS1 and SPS2 (~200 L/s or ~9 x ADWF)	No change required
Emergency Overflow Weir	Weir plate set to divert >3 ADWF for Stage C (~70 L/s) to the EDT	New weir plate set to divert >3 ADWF for Stage D (~140 L/s) to the EDT
Fine Screens	2 Nos. 1.5 mm drum screens sized to treat maximum Stage D flow to the MBR (~140 L/s + return flows)	No change required
Flow Splitter Chamber	Flow split chambers to Stages AB and C in operation. Stage D chambers isolated.	Remove isolation stop-boards from the Stage D flow splitter chambers

Emergency detention tank

During operation, there are fluctuations in flows to the WRP during dry weather and wet weather. The EDT is able to store excess flows during significant or prolonged wet weather events until there is capacity in the WRP to process.

The existing EDT has has a capacity of 660 kL and receives wet weather flows greater than 3 ADWF, which have been screened and de-gritted during the preliminary treatment (but have not progressed through the fine screens). Stored volumes from the EDT are later returned to the inlet works via the EDT return pumps.

Secondary treatment

The preliminary treated flows are then transferred to two MBR trains (for Stages AB and C WRP) for biological nutrient removal along with the removal of carbon-based material, ammonia and suspended solids and this is represented in Figure 3.3. The MBR uses a combination of biological treatment and followed by membrane filtration to produce a high-quality filtrate. The filtrate (i.e. treated flows) is then pumped to a filtrate storage tank for balancing storage prior to tertiary treatment. The management of biosolids, a waste product from this process, is discussed later in this section.

The Proposal would provide a third bioreactor including an additional further three membrane tanks which contain the filtration membranes to complete the MBR secondary treatment. The third bioreactor would double the hydraulic and biological capacity of the existing secondary treatment process.

The additional bioreactor would operate as an independent stand-alone system with a separate inlet to receive screened wastewater, chemicals and independent mixed liquor recycle streams along with a dedicated outlets for filtrate (i.e. treated flows) which may be discharged to the off-spec tank or the filtrate tank (subject to measured water quality). The additional bioreactor would have a dedicated set of equipment (such as recycle pumps and mixers) and instrumentation (such as dissolved oxygen) and oxidation reduction potential) monitoring.

Secondary treatment requires aeration, and the Proposal would include a new dedicated aeration diffuser grid and upgrades to the existing aeration blowers for the additional bioreactor. The existing aeration air manifold, which is already sized for the ultimate plant capacity, would be extended to supply air to the new Bioreactor.

The new bioreactor would be covered, with foul-air extracted from below the covers and transferred to the odour treatment facility.

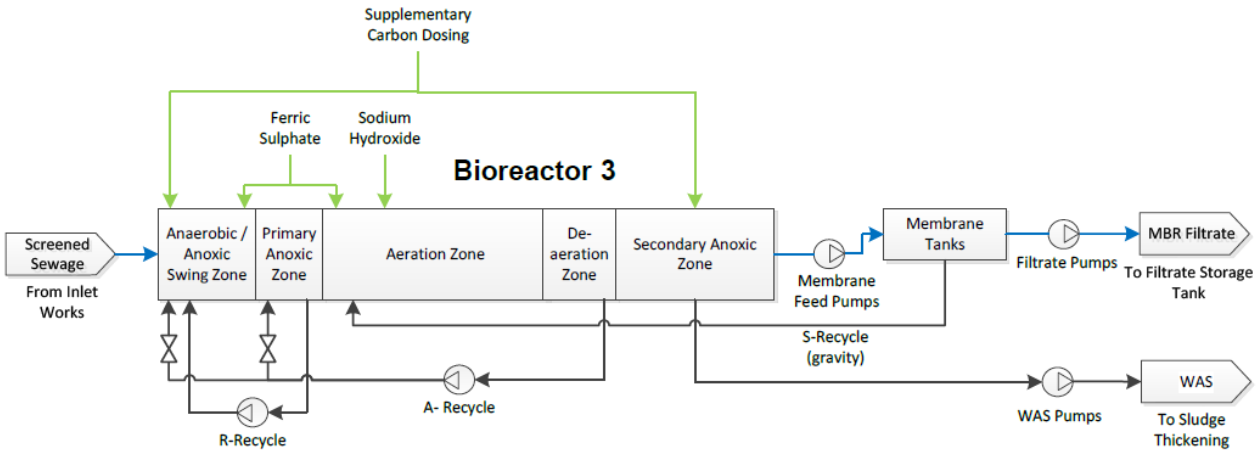

Figure 3.3 Schematic of the membrane bioreactor process (source: MWH Stage C WRP Concept Design Report, April 2016)

Tertiary treatment.

Tertiary treatment provides disinfection and further reduces the phosphorus concentration. The tertiary treatment system comprises the following components which are also represented in Figure 3.2:

- Tertiary phosphorus removal and alum dosing – which is a two-stage chemical precipitation process undertaken to reduce the amount of chemicals required to achieve the required concentration of phosphorus. This involves firstly dosing ferric sulphate into the bioreactor and also dosing alum into the filtrate. This process would be retained with minor modifications to increase capacity as part of the Stage D WRP works.
- Tertiary filtration feed pumps – which supply treated flows from the filtrate storage tank to the tertiary treatment area. The Stage AB WRP tertiary feed pump station currently has three pumps. One of the existing pumps would be replaced with a larger capacity pump, and another larger capacity pump would be added for the Stage D WRP.
- Tertiary filtration – this system comprises a pressurised microfiltration system to filter out flocculated phosphorus precipitates, residual microorganisms, and suspended particles. The capacity of the tertiary filtration membranes for Stage AB WRP would be increased by adding additional membrane modules to the existing membrane trains.
- UV disinfection through lamps would be expanded by installing a third UV reactor in the tertiary treatment area.
- Chlorine disinfection via a chlorine contact pipe before being transferred to the recycled water storage tank.

The Stage D WRP process for treating wastewater is shown in Figure 3.4 below.

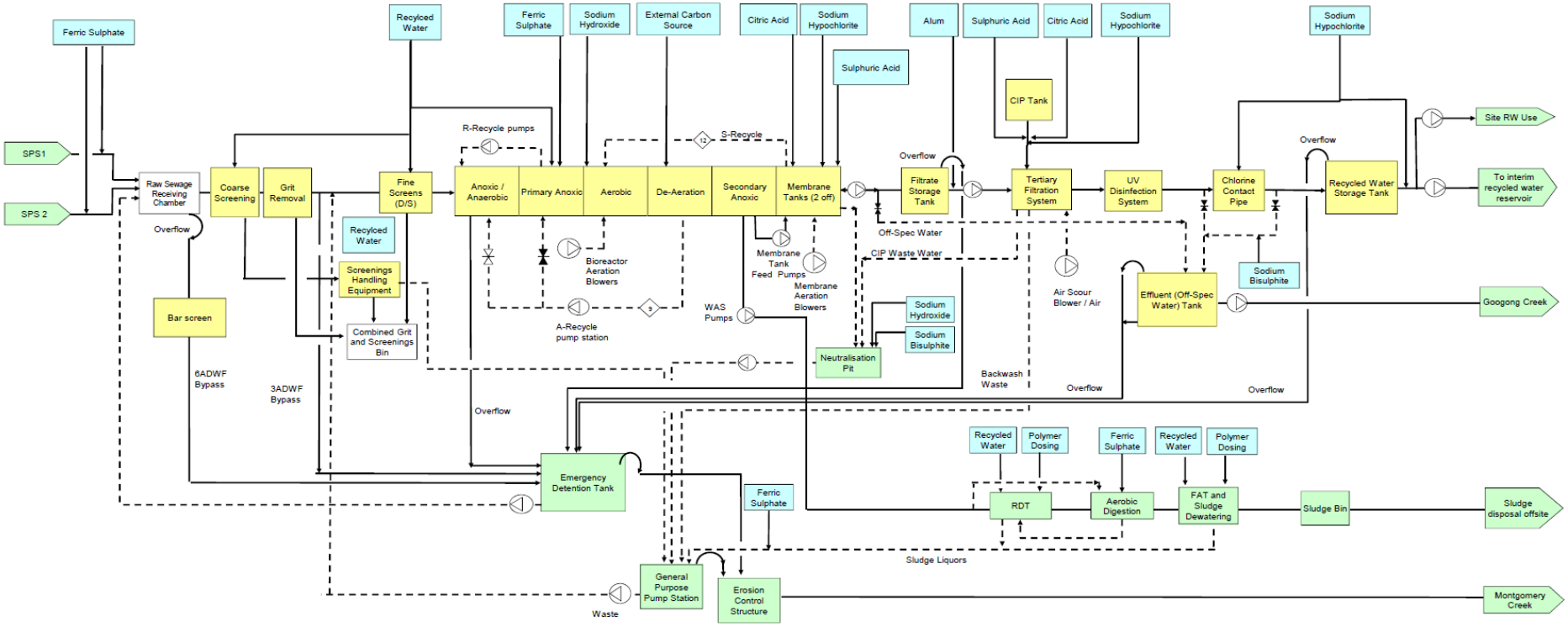

Figure 3.4 Stage D WRP process flow

Biosolids and sludge treatment

Waste activated sludge (WAS) produced from the existing bioreactor is currently transferred to the onsite biosolids processing area for stabilisation prior to disposal to an offsite waste facility. Additional WAS facilities for the second bioreactor would be provided as part of the Proposal.

Sludge processing at the WRP comprises thickening, aerobic digestion, dewatering, and dewatered sludge storage. The Proposal would also provide for additional aerobic digestion capacity and the relocation of the existing rotary drum thickener to align with the aerobic digester expansion.

Odour management

The aim of the odour management strategy at the existing WRP is to reduce the odour impact to a level suitable to ensure no adverse odour impact to nearby sensitive receivers. The existing WRP is equipped with a number of odour control measures to minimise odour nuisance, including:

- Iron salts, which are dosed into the incoming wastewater to reduce the septicity and odour potential of the wastewater on arrival at the WRP.
- Use of sealed, protective covers to contain the release of odorous emissions from all process units containing potentially odorous material. Foul air is extracted from these units and conveyed via sealed aboveground ducting to a central odour control facility (OCF).

The OCF uses activated carbon to absorb odours, with remaining emissions vented through a 16-metre-high stack.

The new Stage D infrastructure would be installed with odour containment covers and connected to the existing odour ventilation system. These include:

- New bioreactor and membrane tanks
- Aerobic digester
- New dewatering centrifuge unit
- New biosolids bins.

The existing OCF has sufficient capacity to treat the anticipated foul air volumes. However, the existing stack efflux cone, a tapered cone at the top of the stack to increase exit velocity and improve dispersion/dilution, would be replaced with a larger cone to maintain the discharge velocity required.

Under the original concept design, new bio-trickling filters would be installed as part of the Stage D WRP works. However, analysis on available odour testing data suggests that the new bio-trickling filters will not be needed. Therefore, new bio-trickling filters are considered as an option for the Proposal.

Site services

The following site services form part of the WRP:

- A general-purpose pump station collects water streams from across the WRP site and returns them to the inlet works. No modification to this pump station is proposed as part of the Proposal as it has sufficient capacity for the ultimate WRP.
- The neutralisation pit receives chemical waste from the membrane tanks and tertiary filtration ‘clean-in-place’ process under gravity. The neutralisation pit provided as part of the existing WRP has sufficient capacity for the ultimate WRP and no modifications to the neutralisation pit are proposed as part of the Proposal.
- Site service water is taken from the onsite recycled water storage tank. A packaged booster system supplies a number of areas including hoses, screens, and chemical dosing. The booster system installed at the existing WRP has sufficient capacity to meet the increased demand at Stage D and no modifications are required as part of the Proposal.
- A plant air system provides instrument air for actuation of valves and dampers along with supply to the tertiary area process air receiver which provides process air for scour/cleaning of the tertiary

membranes. A number of tie-ins are required to provide instrument air to the additional equipment and instrumentation required as part of the Proposal.

- Potable water is provided in a number of locations such as the amenities building and the safety showers. In addition, potable water is used for preparation of polymer solutions to aid sludge thickening and dewatering. A potable water top-up is also provided to the recycled water storage tank in the event that no recycled water is available and service water is still required.

3.2.2 Stage D Permanent Reservoirs

Stage D works at the Permanent Reservoirs site on Hill 800 involves construction of a new recycled water reservoir and repurposing the existing recycled water reservoir into potable water storage. The Permanent Reservoirs areas currently identified as requiring upgrade are highlighted in Figure 3.5.

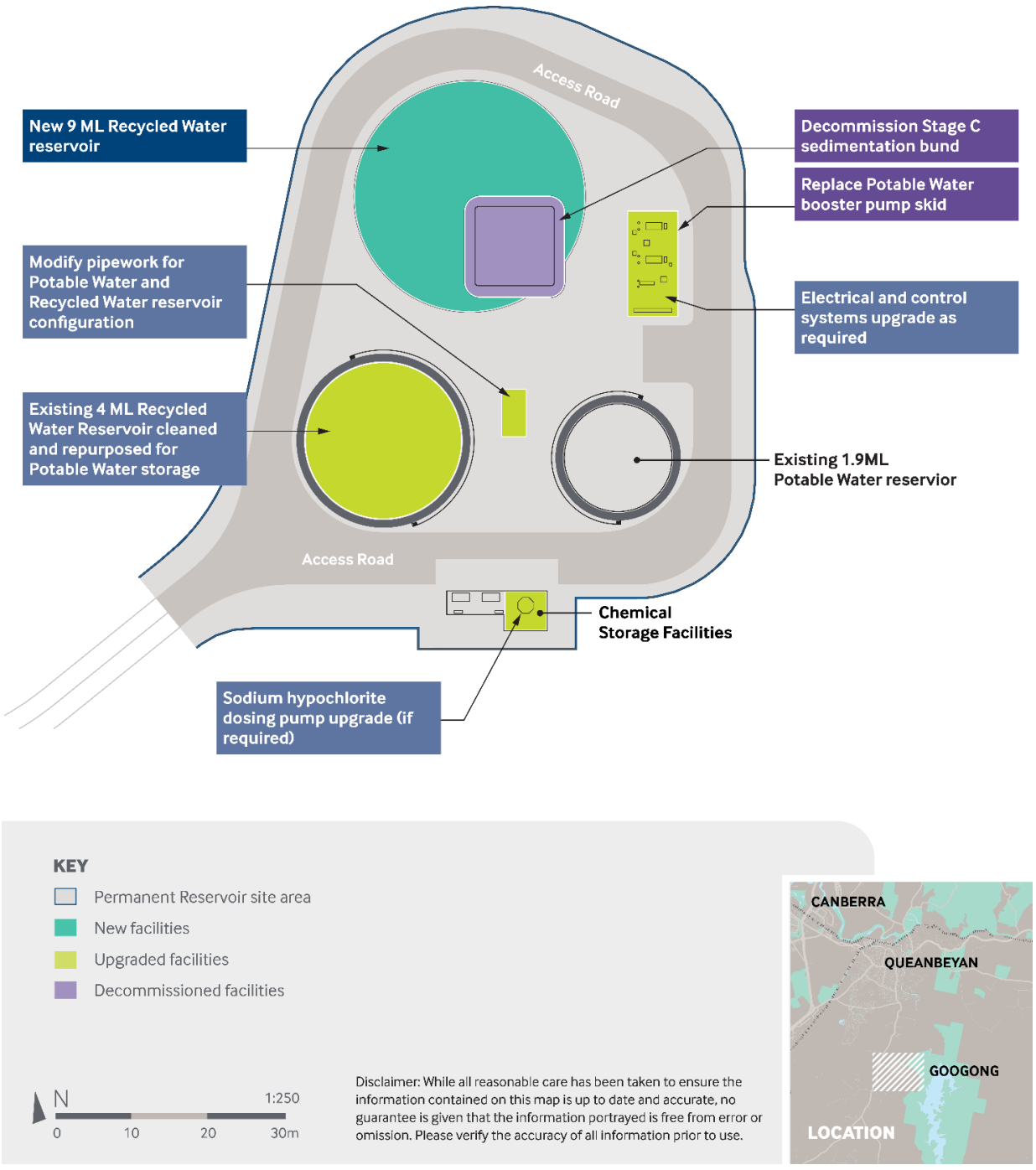

Figure 3.5 Stage D Permanent Reservoirs proposed works

Potable water and recycled water reservoirs

The Permanent Reservoirs site layout developed during the Stage C design included provision for the Stage D infrastructure, and an area for the new reservoir is located north of the existing reservoirs. The new reservoir would be supplied with recycled water from the recycled water storage tank (RWST) at the WRP via the recycled water pumping station (RWPS). Where there is a shortfall in recycled water production by the WRP, the RWST would be topped up with potable water from the potable water top-up pump station, which would then be transferred to the reservoir via the RWPS.

Potable and recycled water booster pumps

The existing potable water booster pump skid would be decommissioned and replaced with a larger skid to supply potable water to the high elevation areas of the Googong township. The new skid would be sized based on the potable water demands agreed with GTPL and would be of similar design and operation to the existing skid.

The existing recycled water pump skid would be retained to continue providing flows for irrigation of sports fields at the Googong Common. A second recycled water booster pump skid would be provided as part of Stage D works to supply recycled water to the high elevation areas of the Googong township. The new skid would also be sized based on potable water demands agreed with GTPL and would be of similar design and operation to the existing skid.

Adequate space within the existing pump station building is available to accommodate the new skids and associated pipework connections. Additionally, pump selection for the booster skids have allowed for potential additional yield up to 19,550 EP.

Chemical dosing

Stage D works would consist of changes to dosing pipework routes to suit the reconfiguration of the site. The sodium hypochlorite dosing pumps would also be replaced with larger units to provide the required Stage D flows. The new dosing pumps would be digital dosing pumps and capable of providing the flow, pressure and turndown requirements for Stage D dosing.

The dosing locations would remain unchanged for Stage D, though the physical layout would change due to the reconfiguration of the Permanent Reservoirs site and construction of the new recycled water reservoir. Chemical dosing locations are listed in Table 3.3 below.

Table 3.3 Chemical dosing locations

Chemical	Dosing locations
Sodium hypochlorite	Potable water reservoir inlet and outlet, recycled water reservoir inlet and new outlet
Sodium metabisulphite	Overflow chemical dosing chamber
Sulfuric acid	Potable water reservoir inlet

Electrical and control systems

New instrumentation and controls would be specified as part of the Stage D upgrade works. The type, location and number of instruments would be selected to maintain the same level of operational control as existing. New instrumentation would be as similar to existing instrumentation for consistency of operations and maintenance.

Upgrades to the existing MCC, drives, PLC and SCADA systems would be required to accommodate the new Stage D assets, however the switchboard was sized at Stage D for ultimate loads.

3.2.3 Materials

The Proposal would require a range of materials consistent with those used for the construction of the existing WRP and Permanent Reservoirs. A general summary of the materials required for Stage D is provided in Table 3.4.

Table 3.4 Stage D materials

Item	Material
Bioreactor Aerobic digester Membrane laydown Crane pad	Reinforced concrete with various surface treatments
Filtrate tank Off-spec tank	Bolted steel panel tanks
Rotary drum area	Structural steel and colour bonded roof (open sides)
Pipe work	Ductile iron cement lined pipe, stainless steel, and plastic
Roads	Asphaltic cement with concrete kerbing
Recycled water reservoir	Reinforced concrete with various surface treatments Aluminium (including rafters, purlins, and sheeting)

3.3 Stage D construction activities

3.3.1 Overview

GTPL would engage a contractor to construct and commission the Stage D works. This section outlines the indicative construction methodology (including equipment) and program, however construction details would be determined by the contractor, once engaged. It is likely that approximately 80 construction personnel would be required during the peak periods of construction.

Works are expected to start in 2023 and estimated to take approximately 12 months to complete. The indicative timing of the Stage D infrastructure upgrade works is for construction to be complete by the end of 2024.

Typically, works would be undertaken during standard working hours (i.e. 7am to 6pm Monday to Friday, 8am to 1pm on Saturday and no work on Sundays or Public Holidays). Any out of hours works would need to be agreed with QPRC and approved the Environment Protection Authority (EPA).

3.3.2 Construction access points

Access to WRP

The WRP site boundary, shown in Figure 3.6, was nominated as part of the concept design to allow for all stages of the WRP works. The land immediately south of the existing MBR has been set aside for Stage D works. Access to the WRP site for construction activities would be via the existing WRP access from Googong Road and from a proposed temporary construction access off Googong Road east of the WRP. The proposed temporary construction access is wholly located within Lot 4 DP 121736, and would provide additional access to the WRP construction areas to limit impact on the existing WRP operations and prevent damage to existing road surfaces within the WRP. The proposed temporary construction access would utilise existing tracks where possible in the previously disturbed corridor, and the corridor would be rehabilitated once construction has been completed.

Figure 3.6 shows the permanent access point and access roads within the WRP to provide access to the entire site and work areas. A construction laydown area is also proposed between Googong Road and the northern boundary of the WRP, to be determined by the Contractor.

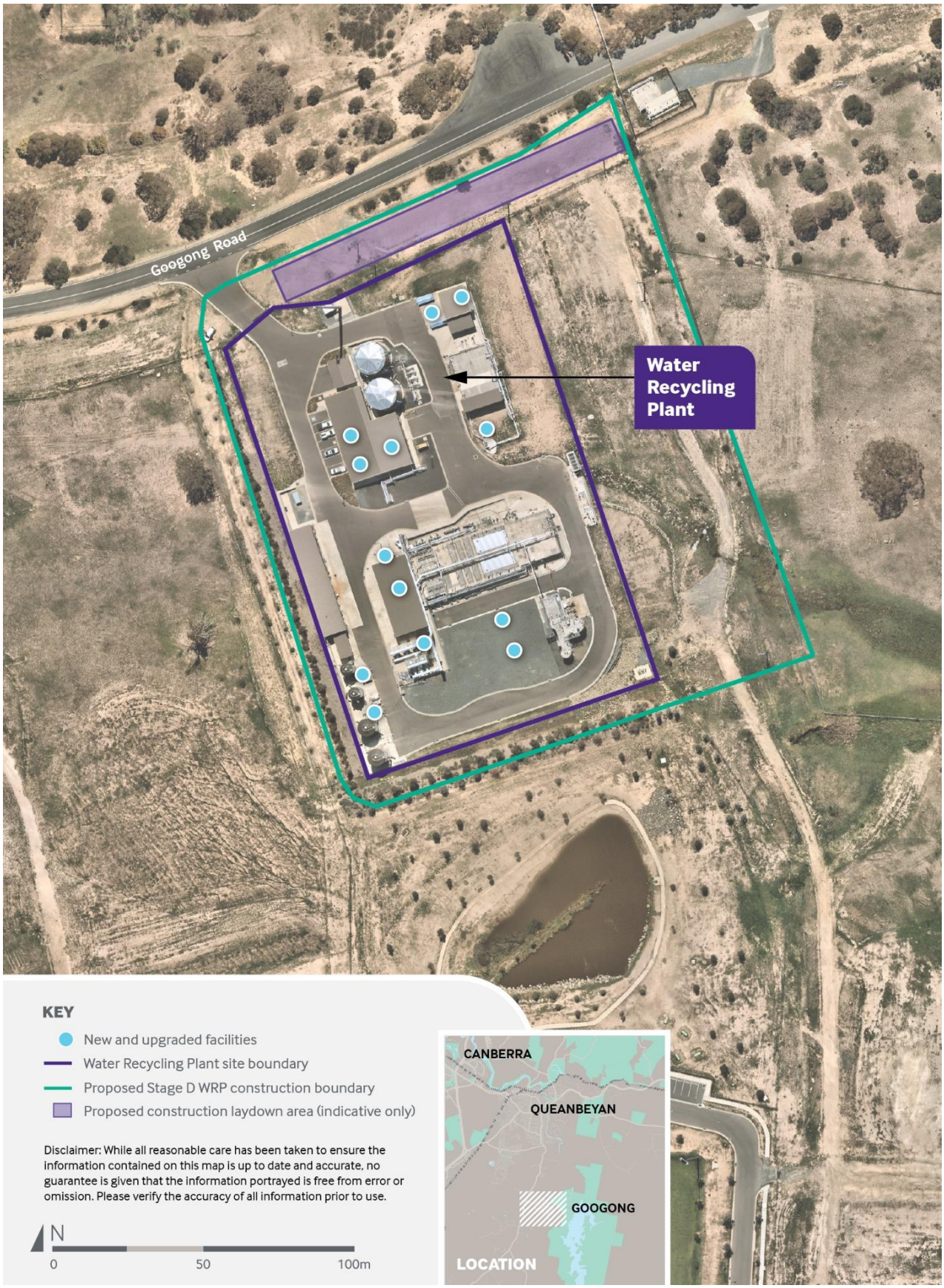

Figure 3.6 Site outline of Stage D WRP

Access to Permanent Reservoirs site

All Stage D Permanent Reservoirs works would be undertaken within the existing Permanent Reservoirs site boundary, Site access to the Permanent Reservoirs site is proposed to be via the existing sealed access road that intersects with Old Cooma Road, at the western boundary of the reservoir site (refer to Figure 3.7). No additional access works would be required for this aspect of the Proposal. Temporary construction laydown areas are proposed on previously disturbed areas along Old Cooma Road to the west of the site, and this would be determined by the Contractor.

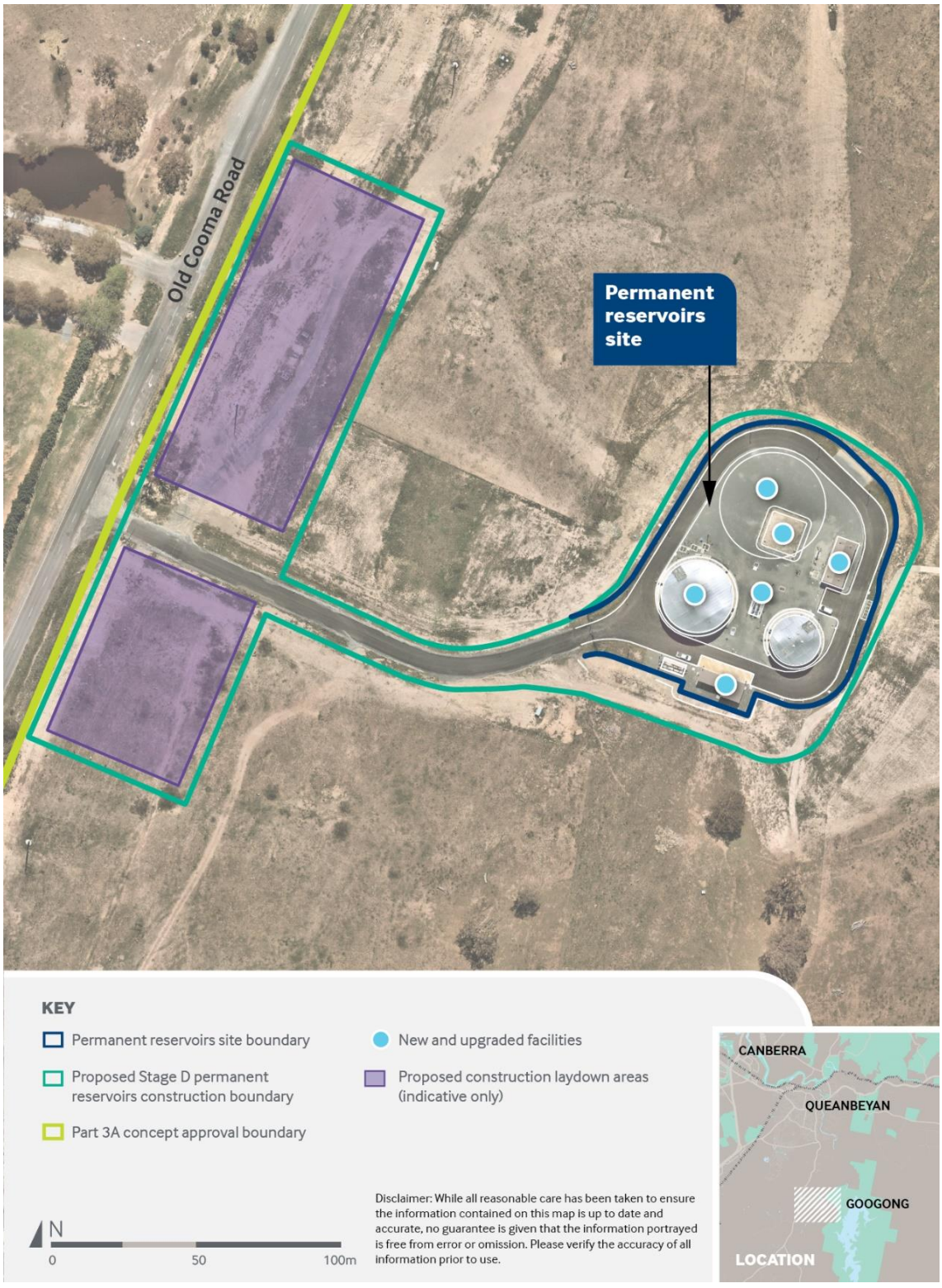

Figure 3.7 Site outline of Stage D Permanent Reservoirs

3.3.3 Site establishment

Site establishment for the Stage D work sites at the WRP and Permanent Reservoirs would consist of:

- Services search on site (both above and below ground)
- Survey location, including dilapidation survey
- Installation of perimeter fencing and gates
- Installation of environmental controls
- Clearing, grubbing, and stockpiling
- Subgrade preparation (i.e. the compacted material underneath concrete or pavement)
- Transport and establishment of required site amenities
- Installation of temporary power supply, water, and plumbing.

Services location

Prior to commencement of work on site, the location and depth/height of existing services on site would be identified, clearly marked, and recorded for future reference.

There are no above ground services within the WRP and Permanent Reservoirs sites, therefore service location would involve the use of cable avoidance tools and non-destructive investigation/potholing that typically consists of vacuum excavation with either air or water pressure to break up the soil and a vacuum device to collect the spoil.

Service location activities would likely require the following equipment:

- Underground services detection scanners
- Vacuum truck to identify service locations
- Water cart for dust suppression
- Staff site vehicles.

Site setting and survey

A surveyor would set out key reference marks and peg construction lines, set-out points and limits of works including stockpile locations and temporary works locations. Survey activities would likely continue through the construction phase to ensure design levels are adhered to.

Mobilisation

Mobilisation would begin with the delivery of construction plant and equipment required for site clearing works, and the formation of temporary access roads and continue with the delivery and establishment of construction amenities and temporary services.

The following equipment would likely be required during mobilisation:

- Heavy vehicles – it is anticipated that the majority of construction plant and facilities would be delivered and removed from site using standard flatbed trucks, 19-25 metre articulated heavy vehicles, with some of the larger equipment requiring over-sized low loader trailers
- Generators
- Excavator for preparing grade materials
- Roller to compact grade materials.

Implementation of erosion and sediment controls

Prior to the commencement of construction or site establishment activities, measures would be undertaken to prevent erosion, contamination, and sedimentation. Works which would likely require erosion and sediment control include:

- Topsoil stripping
- Stockpiling
- Excavation
- Backfilling and compaction
- Road construction
- Topsoil respreading
- Revegetation
- Demobilisation.

The implementation of erosion and sediment controls across both sites would be predominately achieved with conventional equipment such as dozers, compactors, excavators, rollers, mulchers and trucks.

Clearing, stripping, and stockpiling

The ground surfaces for the Stage D work areas would be stripped of existing topsoil and any remaining vegetation. The strip depth would be approximately 300 millimetres or as specified by design requirements. Material that has been cleared and grubbed would be stockpiled within the proposed construction works footprint.

Clearing, stripping, and stockpiling activities would likely require the following equipment:

- Dozer for clearing and vegetation removal
- Excavator for clearing, stripping, and stockpiling
- Tipper to relocate spoil
- Water cart for dust suppression.

Construction amenities

Road base would be placed in layers above the compacted subgrade for the delivery and set down of demountable site offices and amenities buildings, including toilet and lunchroom facilities for the workforce.

The following equipment would likely be required for site establishment:

- Excavator for the preparation of grade materials
- Roller for the compaction of grade materials
- Water cart for dust suppression
- Staff site vehicles.

The exact location of site compounds would be determined during by the Contractor during construction planning, although they would use the areas identified in Figure 3.6 and Figure 3.7.

Temporary services

Temporary services for power, water and sewer would be required for site compound and construction activities. It is envisaged that the power, recycled water, and water services could be extended from existing services used at the WRP and Permanent Reservoir sites to the desired temporary locations, as required. Installation of temporary services would involve service location activities and excavation for new connections. Sewer service for the site compound would most likely involve port-a-loos.

Subject to a risk assessment and the necessary approvals, recycled water could be used for dust suppression and other non-potable uses. It is noted that recycled water and water supply loops are to be extended as part of Stage D work areas and may potentially be coordinated with temporary works.

The following equipment would likely be required for establishing temporary services:

- Generators for site power
- Excavator for the preparation of grade materials
- Roller for the compaction of grade materials
- Water cart for dust suppression
- Staff site vehicles.

3.3.4 Road works

The ultimate WRP site roads, drainage and access paths were constructed as part of the Stage C expansion. Works associated with these aspects are expected to be minimal for Stage D and constrained to areas local to the new bioreactor and aerobic digester.

The Stage D Permanent Reservoirs upgrade does not include any changes to site roads, drainage, or paths. The Stage C design included sufficient site access and drainage for the ultimate Stage D design.

Upon completion of construction of new infrastructure elements, new roads and any damage to existing access roads would be made good for handover to QPRC.

The following equipment would likely be used during road works:

- Truck and dog for the delivery of road base materials
- Roller for the compaction of backfill materials
- Excavator for the excavation of roadways
- Concrete truck for the delivery of concrete
- Kerb profiler for the concrete vibration and formwork fabrication
- Water cart for dust suppression
- Staff site vehicles.

3.3.5 Earth works

Earthworks for Stage D upgrades at both the WRP and Permanent Reservoirs would include preparation and excavation for the foundations for the new infrastructure elements.

Excavation works across both sites would be predominately achieved with conventional earthmoving equipment such as bucket excavators and tippers for spoil transportation. Bioreactor, aerobic digester, and reservoir foundation construction may extend into existing rock, requiring some dozer ripping or pneumatic rock hammering to facilitate excavation.

Foundations are required to provide adequate structural support for the Stage D WRP and Permanent Reservoirs works and would vary depending on the geotechnical nature of the subsurface materials and the loadings applied by each structure. Foundations would be excavated to the design depth, or where ground conditions are unsuitable, over excavated and backfilled with a suitable material and compacted to design requirements.

Groundwater and rainwater captured within excavations during the construction activities may need to be pumped out. This water would be treated onsite to remove pollutants and suspended solids before being released into the appropriate discharge lines.

3.3.6 Form work, reinforcement, and concrete

Concrete works would involve the construction of formwork and the placement and tying of reinforcing steel, once the formwork is established concrete would be poured to construct the relevant structures. These included foundation slabs, EDT, bioreactor and aerobic digester tank walls and hard stand areas at the WRP and the recycled water reservoir at the Permanent Reservoirs site. The tanks would be constructed as aboveground reinforced concrete liquid retaining structures. Concrete would be sourced from local suppliers in the Canberra area.

Formwork, reinforcement, and concrete activities would likely require the following equipment:

- Crane for lifting formwork and reinforcement steel
- Excavators for excavating, backfilling, and stockpiling
- Concrete truck to supply concrete to the site
- Concrete pump to pump concrete to foundations and walls
- Staff site vehicles.

3.3.7 Services/yard piping

Open trenching would be used for the installation of buried services, conduits, connection to incoming flow lines and site drainage piping. Pipe trenches would be excavated to the required depth, grade and alignment as specified in the final design drawings.

Trenching activities would generally be carried out progressively on an ‘excavate, lay, backfill, compact’ routine to minimise the length and duration of open excavations. Multiple excavators would work concurrently to ensure timely completion of the activities.

Service and yard piping would likely require the following equipment:

- Excavator for trenching, backfilling, and stockpiling
- Roller to compact backfilled materials
- Whacker to compact ground around pipe work
- Water cart for dust suppression.

3.3.8 Mechanical and process equipment

Once the concrete foundations have been poured and have achieved sufficient strength characteristics, the installation of the unit process equipment would commence. The majority of the mechanical and process plant would be delivered to site as pre-assembled modular units on skids (the modules would be permanently mounted on frames for easy transportation), that can be positioned directly where required. Some minor piping works would also be required to connect the process units together.

Mechanical installation would likely require the following equipment:

- Crane for unloading and installation of plant and equipment
- Elevated work platform for installation of piping
- Welder for pipe welding and cutting
- Staff site vehicles.

3.3.9 Electrical

Electrical installation works would include the installation of cable trays, installation and testing of power and instrumentation wiring to the various plant, pumps, modular process units, alarm instrumentation, lighting and control and monitoring equipment.

Individual unit processes within the WRP, such as the new UV reactor, would have their own control system. Other new assets would be interfaced to the existing overall WRP control system.

Electrical installation would likely require the following equipment:

- Crane for unloading and installing the plant and equipment
- Elevated work platform for installation of cable trays and lighting
- Staff site vehicles.

No additional emergency lighting would be required as part of Stage D.

3.3.10 Demolition and demobilisation

As other construction activities are progressively completed, materials and the demobilised plant parts would also be removed from the site. Site offices and amenities buildings would remain on site until construction is complete.

The following equipment would likely be required during demolition and demobilisation:

- Heavy vehicles – it is anticipated that the majority of construction plant and facilities would be delivered and removed from site using standard flatbed trucks, 19 – 25 metre articulated heavy vehicles, with some of the larger equipment requiring over-sized low loader trailers
- Crane for loading demolished plant and equipment
- Staff site vehicles.

3.3.11 Restoration and landscaping

The existing finished site landscaping largely consists of grass, blue metal, concrete slabs, and/or concrete paving. The objective of the landscaping works would be to minimise maintenance requirements such as mowing. Any landscaping required for Stage D works would be consistent with the approach undertaken for the previous stages.

A Landscape Management Plan, as part of the Construction Environmental Management Plan (CEMP), would be developed by the contractor, that would allow for rehabilitation and reinstatement works to be undertaken as soon as practical following completion of construction activities. Once Stage D is constructed, the topsoil would be treated and spread over disturbed areas to encourage vegetation growth. Mulch would be distributed around the site to reduce the risk of erosion of topsoil.

The following equipment is likely to be required to carry out these activities:

- Excavators for distribution of topsoil and mulch
- Tipper cart for the movement of topsoil and mulch
- Water cart for dust suppression.

3.4 Stage D commissioning activities

All additional infrastructure for Stage D would require commissioning prior to the commencement of operations. A general description of the commissioning activities for Stage D WRP and Permanent Reservoirs elements has been provided below.

3.4.1 Stage D WRP

Construction cut over

In general, the new infrastructure and equipment associated with the Stage D WRP would be built offline including all hydro testing and pre-commissioning requirements. Key equipment would also be tested in the factory prior to being delivered to site, where possible.

However, most of the areas would require a shutdown of one or more existing plant areas and processes to allow tie-in of the new plant to the existing WRP. The duration of tie-ins varies for the different plant areas with most anticipated to be completed in less than one day but would need to be planned by the contractor in

consultation with QPRC who would be operating the existing WRP. An indicative cutover schedule would be developed during detailed design.

Commissioning and verification

The proposed commissioning and verification tests associated with the Proposal would be consistent with approach undertaken for previous WRP expansions:

- Microbiological testing of the new stage D MBR train membrane filtrate
- Hydrostatic testing and pre-commissioning (prior to construction cut-over)
- Wet commissioning (depending on asset):
  - Before integration with existing assets (e.g. new bioreactor and aerobic digester)
  - When operating with the existing assets (e.g. tertiary filtration system)
- Process commissioning and verification
  - Commission the new bioreactor by returning membrane filtrate from the new process train to the inlet works until process stabilisation is achieved
  - Commission the new tertiary filter and downstream system when integrated with existing assets
  - Verify performance of new unit processes (e.g. new dewatering centrifuge) by sampling and testing the inlet and outlet samples.

The above approach has been previously endorsed by QPRC and DPIE and was considered appropriate in verifying the new process units. The commissioning strategy would be further development as part of detailed design.

3.4.2 Stage D Permanent Reservoirs

The new reservoir and all associated infrastructure (i.e. new pumps and booster skids) would need to be fully commissioned prior to them being cut over to supply potable water and recycled water to the Googong township.

A commissioning and cut-over plan would be developed towards the conclusion of the detail design phase when the final design is fully understood. The assets would be commissioned as outlined in Table 3.5.

Table 3.5 Stage D Permanent Reservoirs asset commissioning requirements

Component	Requirement	Comment
Potable water rising main extension	Pressure test	Use the bulk water pumping station to fill potable water reservoir via extended potable water rising main
Potable water reservoir	Pre, dry and wet commission potable water reservoir	Use water in reservoir to support commissioning of chemical dosing systems
Chemical dosing systems and yard pipe work	Pre, dry and wet commission dosing system	Use water in the potable water reservoir
Recycled water reservoir	Pre, dry and wet commission recycled water reservoir	Use Bulk Water Pumping Station to fill recycled water reservoir
Chemical dosing systems and yard pipe work	Complete any supplementary commissioning activities needed	There may be some supplementary chemical dosing system commissioning tests that rely on the recycled water reservoir to be available
Telemetry and SCADA	Commission all SCADA and telemetry	-
Recycled water pumping station	Progressively install and replace existing recycled water pumps	New units would be able to continue to supply the interim reservoirs recycled water reservoir
Recycled water rising main extension	Pressure test the mains to the permanent reservoir site	

Component	Requirement	Comment
Recycled water holding tank	Pre-commissioning and hydrostatically test	
Recycled water holding tank	Clean and super-chlorinate	
Recycled water rising main extension to permanent reservoir site	Scour and super-chlorinate	Use water from super-chlorination of recycled water holding tank
Potable water and recycled water reservoirs and yard piping	Clean and super-chlorinate	
Potable water and recycled water gravity mains	Pressure test, scour and super-chlorinate	
Potable water and recycled water reservoirs, yard piping and gravity mains	Charge with potable water and recycled water as required and cut over	Googong recycled water and potable networks now being fed by the upgraded Stage D permanent reservoirs

Additionally, the repurposing of the recycled water reservoir to potable water would require the cleaning of the walls and floor with sodium hypochlorite. The tank and pipework would, at a minimum, need to be flushed and super-chlorinated prior to being used for potable water supply.

3.5 Stage D WRP operation

This section discusses in more detail key operating processes associated with the Stage D WRP.

3.5.1 WRP influent flows

All inflows to the existing WRP are transferred via two sewage pumping stations, referred to as SPS1 and SPS2. The WRP does not receive any gravity flow. This is unchanged from the original approved IWC Concept Design.

The Stage D WRP has been sized to allow for increased pumping capacity for the influent flows from the SPSs. The pumping capacities for SPS1 and SPS2, and the influent flows to the existing WRP and those proposed for the Stage D WRP, are presented in Table 3.6. These include catchment EP, average dry weather flows (ADWF) and peak wet weather flows (PWWF).

Table 3.6 Catchment EP, ADWF and PWWF flow rates for Stages AB/C and Stage D

	Existing WRP (AB/C)				Stage D			
Catchment parameter	SPS1	SPS2	SPS1 & SPS2 combined	Existing WRP	SPS1	SPS2	SPS1 & SPS2 combined	Stage D (Ultimate) WRP
Catchment EP[1]	6,549	3,561	10,110	9,400	7,630	11,736	19,366	18,850
Catchment ADWF	13.5 L/s	7.4 L/s	20.9 L/s	22.8 L/s	15.90 L/s	24.45 L/s	40.35 L/s	45.8 L/s
Catchment PWWF[2]	57.8 L/s	41.8 L/s	99.6 L/s	99.6 L/s	65.1 L/s	128.1 L/s	193.1 L/s	193.1 L/s

Note 1: EP stated is maximum for Stage AB/C and D and would increase as development progresses

Note 2: PWWFs have been determined by wastewater catchment modelling and are generated by a 1:10 year wet weather event. Wet weather flows up to the 1:10 year event are not buffered by the emergency storages at each pumping station.

The existing WRP receives pumped flows intermittently from SPS1 and SPS2. The Stage D treatment process units would be sized to treat the instantaneous flows. The existing Inlet Works was constructed in Stage C and sized to treat the Stage D flows. Flow attenuation for the incoming flows would be provided in the Bioreactors during dry weather periods. During a wet weather event, flows greater than 3 x ADWF would be diverted to the existing EDT and returned to the plant for processing when the inflow returns to normal operating level.

3.5.2 WRP pathogen reduction and critical controls

Log reduction values

The minimum log reduction values to be achieved by the Stage D WRP and associated pathogen reduction technology are listed in Table 3.7. This is consistent with the existing plant and has been endorsed by DPIE.

The Stage D MBR process would utilise the existing pathogen reduction processes, based on the principle of employing pre-validated technology for pathogen reduction (e.g. MBR membranes, UV reactors and chlorination).

Table 3.7 Log reduction values for pathogen reduction processes

Pathogen	Virus	Protozoa	Bacteria
Log reduction value required	6.5	5.5	5.5
WRP log reduction provided	6.5-7.0	7.0	11.0
MBR membrane filtration	2	4	4
UV light disinfection	0.5-1	3	3
Chlorine disinfection	4	0	4

Critical control points

The existing WRP has a number of Critical Control Points (CCPs) for the protection of human health, and operational control points (OCPs) relating to environmental performance. These have been agreed and approved by QPRC and other stakeholders and are documented in the Recycled Water Quality Management Plan (QCC, 2015). These CCPs would be retained and duplicated (where necessary) for the Stage D WRP.

Human health

Human health CCPs relate to the management of the risk of human exposure to pathogens due to the failure of a process and a number of operational conditions are monitored at each CCP. The CCPs relating to human health and the relevant control conditions are outlined in Table 3.8.

Each CCP relating to human health has an alarm trigger level and a fail / bypass trigger level for each control condition. Activation of an alarm trigger level does not mean failure and by-pass of the CCP but would alert operators to resolve any potential issue.

Activation of the CCP fail / by-pass trigger causes automatic diversion of flow from that CCP to the Off-Spec Water Tank and signals an off-specification event.

No changes are proposed to the CCPs as part of the Stage D WRP. The additional bioreactor membranes and UV reactor would all be provided with identical CCPs to the existing systems.

Table 3.8 Critical control points – human health

Critical control point	Control conditions	Description
Downstream of bioreactor membranes	• Flow • Filtrate turbidity	Continuous monitoring of membrane integrity would be in the form of filtrate turbidity monitoring. In the event that filtrate turbidity breaches the pre-set high level; the fail condition would be met.
Downstream of UV disinfection	• Flow • UV dose • UV transmittance • UV intensity	An alarm would activate beyond an alarm level for each of the control conditions, and then a bypass would be automatically activated above the fail-by-pass level.
Downstream of chlorine contact pipeline	• Flow and residual chlorine to infer contact time • pH • Temperature	An alarm would activate beyond an alarm level for each of the control conditions, and then a bypass would be automatically activated above the fail/-by-pass level.

Environmental performance

Environmental performance OCPs relate to the management of the risk of environmental discharge outside of the plant operating licence requirements and which may place receiving waters at an increased risk.

A number of operational conditions are monitored at each OCP. The OCPs relating to environmental performance and their relevant control conditions are outlined in Table 3.9.

These environmental performance OCPs generate an alarm condition when the required plant operating conditions are not met. The operational alarm is responded to by the plant operator, as required. OCPs relating to environmental performance do not precipitate an off-specification event within the plant.

The OCPs would not be modified as part of the Stage D WRP and would be duplicated as required in the additional process units.

Table 3.9 Operational control points – environmental performance

Operational control point	Control conditions	Description
Preliminary treatment	• pH • Flow	Monitoring of pH and flow to ensure plant operation is within the discharge strategy.
Secondary treatment	• Dissolved oxygen	Ensure that dissolved oxygen concentration in the bioreactor is sufficient to maintain stable operation.
Final effluent (outlet of Recycled Water Storage Tank)	• Nutrient removal • Effluent phosphorus	Ongoing monitoring of nutrient removal via manual sampling.
	• Total dissolved solids (TDS) • pH • Residual chlorine • Turbidity	An alarm would activate outset of set operational limits for TDS, pH residual chlorine and turbidity which would be monitoring online.

3.5.3 WRP operating conditions

The existing WRP is operational and has undergone significant commissioning, testing and process proving. It is controlled automatically via a centralised plant control system (PCS) with a master programmable logic controller and a *ClearSCADA* interface. It is not proposed to fundamentally modify the functionality or operation of the plant as part of the Stage D WRP, other than to extend the processes throughout.

The WRP operates under a variety of operating conditions, including:

- Dry weather flows
- Wet weather flows
- Off-specification water events
- Emergency and power failure scenarios
- Membrane cleaning events

A summary of the anticipated daily flow of Stage D WRP once 18,850 EP is reached is outlined in Table 3.10.

Table 3.10 Summary of inflow scenarios at 18,850 EP (Stage D)

Flow scenarios	Flow rate/volume
Maximum flow (PWWF)	193.1 L/s
Average flow (ADWF)	45.8 L/s
Minimum flow	0 L/s[1]
Annual average flow	1445 ML/year

Note 1: Periods generally from 2am to 4am

Dry weather flows

The proposed operation of Stage D would be unchanged from the existing WRP, where under dry weather flow conditions the WRP receives flows from SPS1 and SPS2, which are located within the Googong township wastewater catchment.

Flow will pass through the WRP inlet works to be screened and de-gritted. The screens will receive spray water operated on an intermittent basis. Screenings and grit will continuously be removed from the screens and grit system. The screenings will then be washed and dewatered in a screenings handling system with the dewatered screenings being collected in a screenings/grit bin.

The screened and de-gritted sewage will flow through a flow distribution chamber which will split the flow equally between the existing Bioreactors and the new Stage D bioreactor using a series of channels and weirs.

Wet weather flows

The ultimate WRP process train will continue to treat a maximum design flow of 3 x ADWF, as per Stages AB and C. This flow will pass through the complete treatment train and the resulting recycled water will be suitable for delivery to the recycled water reservoir at Hill 800. The bioreactor and downstream disinfection process will continue to treat flow at 3 x ADWF in the case that the incoming flow is above 3 x ADWF.

Flow exceeding 3 x ADWF (but below 200 L/s) will be screened and de-gritted before by-passing t the EDT before the fine screens. The WRP inflow should not exceed 200 L/s as the individual capacities of the SPS1 and SPS2 pump sets do not exceed this value. In the case that this inflow limit is exceeded, either due to unforeseen circumstances or both SPS pumping simultaneously at emergency flow rates, then flow in excess of 200 L/s would spill via the emergency overflow weir and be diverted to the EDT. If the coarse screens could not handle flow above 200 L/s, the excess flow will pass through the manual bypass screen.

When influent to the WRP subsides below 3 ADWF, the contents of the EDT will be returned to the inlet works for treatment.

When the EDT reaches a high level, an alarm will be raised and, if the WRP is in an off specification event, the effluent transfer pumps will begin to operate to avoid off-specification volume causing an EDT overflow. If the EDT level continues to rise the EDT will overflow to Montgomery creek. Any material which overflows in a wet weather event will be screened to 6 mm and de-gritted. In an emergency situation, the worst case material will be screened to 10 mm through the manual screen.

Wet weather diversion system

A wet weather diversion system is provided as part of the current concrete inlet works structure. This overflow is located downstream of the grit removal chamber and functions to control the forward flow in a wet weather event through a flow control valve. The nominal allowance for the average general purpose pump station return flow at Stage D is approximately 15 L/s. The Proposal does not include any physical modification to the wet weather diversion system; however, the control set-points would be updated according to the Stage D flows.

Off-specification water events

As described in Section 3.5.2, the operation of the WRP is monitored at a number of CCPs to help ensure the quality of the recycled water meets the relevant requirements for non-potable use. The WRP contains a number of CCPs which are defined as either human health or environmental performance control points.

A recycled water off-specification event at the WRP is then defined as an event where the limits for any of the CCPs for human health are breached. In such events, flows are diverted to the Off-Spec Water Tank for holding until they can be pumped to the EDT and then back into the inlet works for reprocessing. However, if the off specification event lasts longer than 4-8 hours (operator adjustable), excess flows would be pumped from the Off Spec Water Tank via the discharge to Googong Creek, downstream of Beltana Pond. In such cases, these flows would still typically meet the environmental requirements making it safe to discharge but would not be suitable for non-potable use in the Googong township.

Emergency overflow

Emergency overflow is most likely to be triggered by power failure which is outlined below. In wet weather it is estimated that the WRP would only overflow in wet weather events which have an ARI in excess of 1 in 10 years unless this coincides with a power failure event. In the event where a power failure occurs in wet weather, it is not possible to accurately predict how long the storage available in the EDT would last, as this would depend on the intensity of the event. However, the Stage D WRP is designed to receive a maximum of 200 L/s which could occur during extreme weather events and would be the worst case for emergency discharge during wet weather. It should be noted that wastewater during wet weather events is generally diluted by stormwater and has lower levels of pollutants than typical (dry weather) wastewater.

An emergency overflow weir is located adjacent to the wet weather diversion flow control valve and would be utilised in the event that the flow control valve is blocked or otherwise out of service. The weir consists of a mechanical plate, which is currently set to the Stage C overflow level. A new weir plate would be provided and set during commissioning to cater to the Stage D flows and levels.

Power failure scenario

A permanent emergency generator (200 kVA) is provided at the existing WRP to allow critical equipment to operate in a power failure event. The Stage D inlet works would be powered (as per the existing inlet works) to allow for grit removal and screening of incoming wastewater before overflowing into the EDT.

Should the capacity of the EDT be exceeded during a prolonged power failure event, the screened and degritted wastewater would be discharged to Montgomery Creek via gravity through the existing outlet structure. Ferric sulphate dosing in the incoming rising mains would continue to operate to reduce the release of hydrogen sulphide gas in the inlet works to mitigate release of hazardous /odorous gases.

The duty odour control fan would also continue to operate during a power failure event.

The generator capacity would need to be assessed to consider the loads for both the existing and the new Stage D component works, with cut over likely following commissioning of Stage D inlet works.

This would be considered and assessed further in detailed design.

Membrane cleaning events

The bioreactor membranes and tertiary filtration membranes undergo periodic cleaning to maintain the membrane permeability. Two forms of cleaning occur (maintenance and recovery cleans), and these processes would remain the same for the Stage D WRP for the MBR process. For cleaning of the tertiary filtration membranes, a larger chemical volume than for the existing WRP would be required, although the existing ‘clean-in-place’ tank has catered for this need.

The maintenance cleaning protocols are fully automated. The recovery cleaning protocols are manually initiated but would incorporate some automated sequences.

Spent cleaning solution is discharged from the membranes to a neutralisation pit. The cleaning solution is then neutralised using the appropriate chemical before being discharged to the general purpose pump station to be returned to the inlet works. During these events there would be no discharge to the environment.

3.6 Stage D Permanent Reservoirs operation

This section discusses in more detail key operating processes associated with the Stage D Permanent Reservoirs.

3.6.1 Potable water and recycled water reservoirs

Once at the potable reservoirs site, the potable water enters a chemical dosing and flow meter for pH adjustment measures and sodium hypochlorite dosing. Previous water monitoring has identified that at a high water age (approximately 90 days) pH as high as nine has been observed in the potable water supply. This may be attributed to leaching of calcium-based materials from the cement lining of pipelines. Therefore,

dosing of sulphuric acid to the potable water (prior to storage in the potable water reservoir at the permanent reservoir site) is required when the pH increases above 8.5 to achieve a set point of a pH of 7.5.

To maintain chlorine levels in the potable water and recycled water, water is dosed with chlorine (in the form of sodium hypochlorite) prior to entering the reservoirs to achieve a residual set point in the storage system (i.e. storage at the potable water and recycled water reservoir).

The potable water and recycled water are stored in the potable water reservoir and recycled water reservoir respectively, until there is demand. When this occurs, potable water and recycled water is distributed from their respective reservoirs via a sodium hypochlorite dosing unit (for chlorine dosing) and distributed via the potable water and recycled water mains to the Googong township.

The existing recycled water booster pump skid will be retained to continue providing flows for irrigation of sports fields at the Googong Common. A second recycled water booster pump skid will be provided as part of the Proposal to supply recycled water to the higher elevated areas of the Googong township. A new discharge line will be installed around the north and east of the boost pump station building to connect the new pump skid to the existing discharge pipework.

Additionally, the potable water pipe work configuration at the permanent reservoir site also allows for the BWPS to pump directly into the potable distribution network to the Googong township, bypassing the potable water reservoir, should the reservoir be offline for maintenance or any other reason (e.g. in an emergency).

Scour water and collection and treatment at the reservoir site

The existing potable water and recycled water reservoirs contain a scour pipeline passing through the side wall at the base of the respective tanks with an isolation valve located on the external pipe penetration.

The new reservoir base slab will be a reinforced concrete slab on grade and will drain towards a scour outlet at each side of the reservoir to minimise the ponding of water on the floor when emptied or during cleaning. The scour outlet will connect to the recycled water overflow line via a new scour line, which will eventually discharge to the environment at the EPL Monitoring Point 1 east of Hill 800. All new pipework will tie into the existing pipework installed as part of the Stage C works, and will follow the discharge arrangement as overflow from the existing reservoirs.

3.7 Excess recycled water discharges

The Googong township IWC system allows wastewater to be treated at the WRP and recycled for various uses within the township:

- Irrigation of public spaces, such as sporting fields, recreational areas, and streetscapes
- Watering of household gardens
- Non-potable uses within the household, namely toilet flushing.

Recycled water in excess of these uses will continue to be discharged to the environment under the environment protection licence for the system.

3.7.1 Discharge locations

In certain scenarios, depending on the operating situation at the WRP, and when the supply of recycled water exceeds demand, recycled water or partially treated wastewater would need to be discharged to the environment. There are three discharge points as part of the IWC system, shown in Figure 3.8.

Discharge Point 1 is located downstream from the Permanent Reservoirs at Hill 800. Excess recycled water would be discharged into a recycled water overland drainage line where it would flow into the existing stormwater management system to Beltana Pond, and into Googong Creek. Beltana Pond is the final component of the stormwater management system within Googong township. Water discharged from Beltana Pond would contain excess recycled water discharged from the Permanent Reservoirs site and water collected from the stormwater system within the Googong township. The overland discharge line would be incorporated into the stormwater management system when this neighbourhood of the Googong township is developed.

Discharge Point 3 is located immediately downstream of Beltana Pond, where water would be discharged from the WRP and flow into Googong Creek. During operation of the existing IWC system, all recycled water has been discharged from Discharge Point 3 on Googong Creek, just below Beltana Pond, while QPRC has been awaiting approval for the use of recycled water in the Googong township. An emergency discharge point s located at the WRP and would discharge untreated or partially treated wastewater into the Montgomery Creek catchment, where it would eventually discharge into the Queanbeyan River below Googong Reservoir. This discharge point would only be used in emergency events and is not a licensed discharge point

QPRC proposes to retain the location of excess recycled water discharge as Discharge Point 3, while retaining Discharge Point 1 as a discharge location in the event that a discharge from the Permanent Reservoirs site is needed in the event of an emergency or for other operational reasons. Discharge Point 1 could also be used for recycled water for other operational reasons, for example should Beltana Pond require additional water. This change would result in a reduction of energy required to pump water uphill from the WRP to the Permanent Reservoirs and less excess recycled water moving through the Googong township stormwater management system.

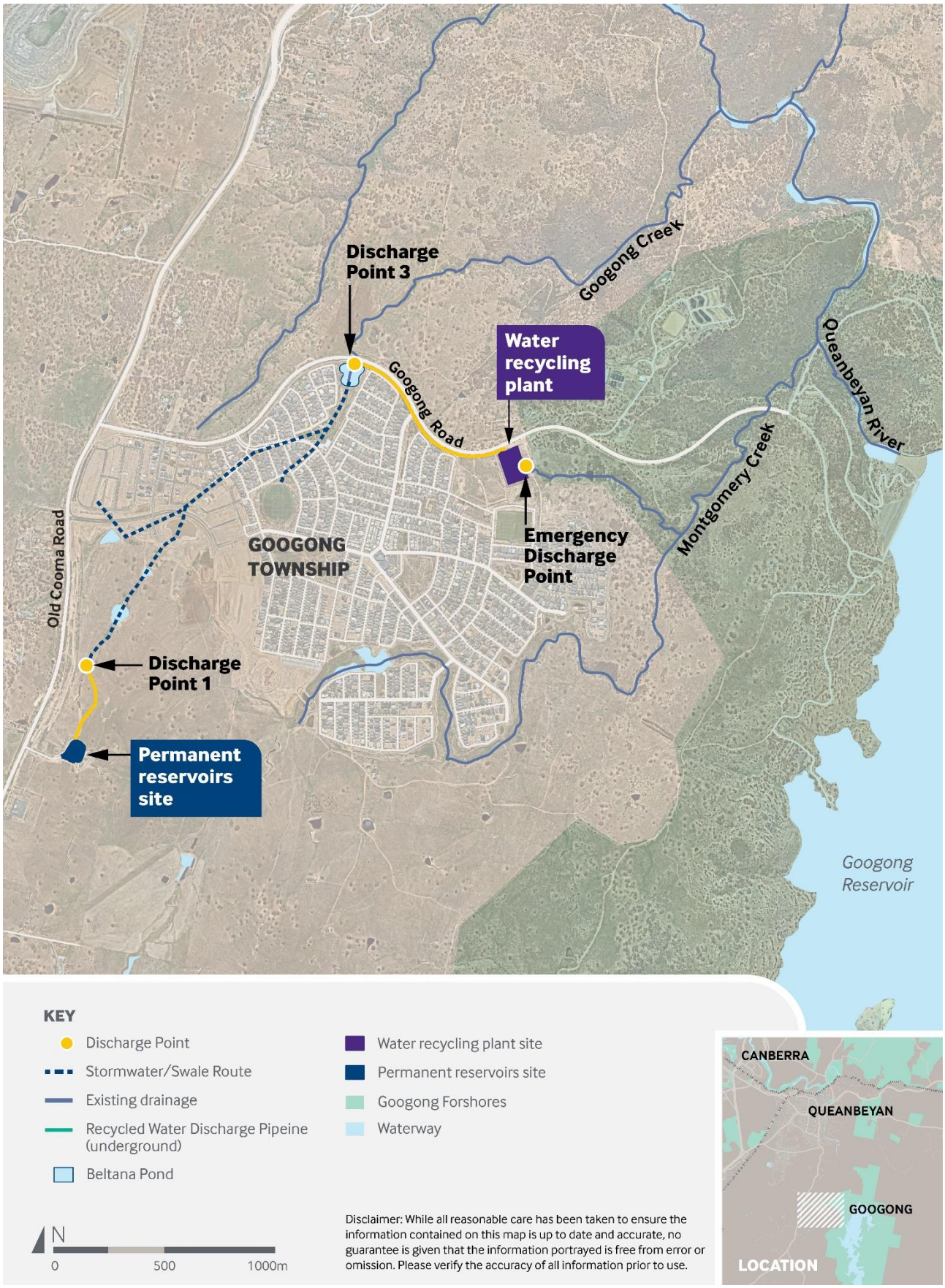

Figure 3.8 Stage D proposed discharge locations

3.7.2 Excess recycled water flows

Modelling has been undertaken to predict the expected discharge of excess recycled water to the environment. The data is based on the water balance model and considers 40 years of climatic data to calculate the daily wastewater flow generation and daily water and recycled water demands. It takes into consideration the low storage in the 9 ML Stage D Recycled Water Reservoir at Hill 800 and assumes 100 per cent of wastewater flow is recycled which is facilitated by flow attenuation measures at the WRP storage facilities.

The results of this modelling are summarised in Table 3.11 and Table 3.12.

Table 3.11 Summary of daily excess recycled water discharges to the environment

Parameter	Excess recycled water discharge
Maximum daily flow	5.53 ML/d
90th percentile daily flow	2.10 ML/d
Average daily flow	1.05 ML/d
Minimum daily flow	0 ML/d
Average annual flow	381 ML

Table 3.12 Summary of monthly excess recycled water discharge

Month	Average environmental discharge (ML/d)	Minimum environmental discharge (ML/d)	Maximum environmental discharge (ML/d)
January	0.30	0	4.33
February	0.36	0	3.54
March	0.50	0	5.53
April	0.92	0	3.81
May	1.39	0	3.98
June	1.84	0	3.81
July	1.95	1.25	3.68
August	1.82	0.21	4.81
September	1.50	0	3.32
October	0.92	0	4.53
November	0.70	0	4.49
December	0.30	0	3.24

The results of the average daily excess recycled water discharges to the environment and percentile flows are shown in Figure 3.9 and Figure 3.10.

The predicted discharges of excess recycled water are lowest in the warmer months when demand for recycled water is expected to be higher than during Winter. The modelling predicts that on most Summer days the demand for recycled water will exceed the volumes produced by the WRP and no discharge of recycled water to the environment would occur. Conversely, discharge of excess recycled water is predicted to occur on almost all days during Winter when the demand for recycled water is lower than the volumes produced.

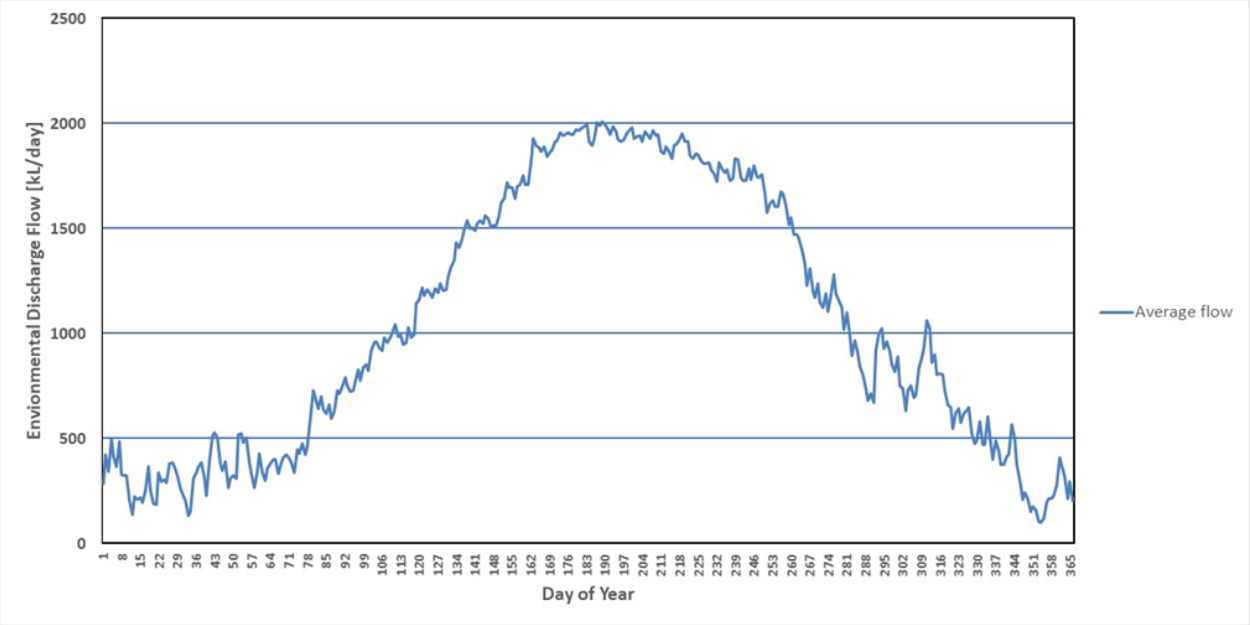

Figure 3.9 Summary of average daily excess recycled water discharges to the environment (kL/day) (Stantec, 2020)

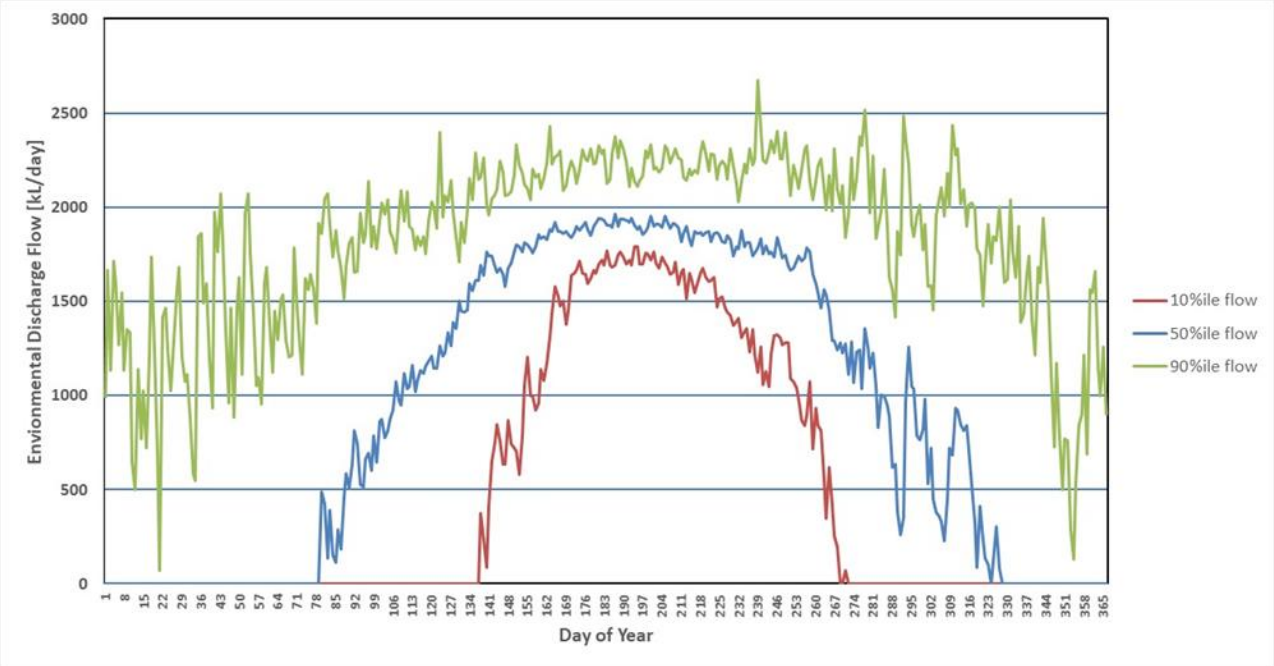

Figure 3.10 Summary of percentile daily excess recycled water discharges to the environment (kL/day) (Stantec, 2020)

3.8 Stage D irrigation of public spaces and gardens

Once Stage D is completed, recycled water from the WRP would be used on public spaces (including sports fields) and residential and other properties across all neighbourhoods within the Googong township. These include both current and future public spaces and properties. Figure 2.1 presents the ultimate Googong township development plan with neighbourhood layout and open spaces consisting of parks, sporting fields and protected areas. There are currently six existing open spaces available for irrigation, and 21 planned open spaces within the Googong township.

The impacts of recycled water use for irrigation in the township are assessed in Section 6.3.

3.9 Options considered for Stage D

With respect to options for the IWC Project, Chapter 4 of the G*oogong Township Water Cycle Project Environmental Assessment* (EA) (Manidis Roberts, 2010) considered:

- The alternative water and wastewater systems investigated for the Googong township
- Why a self-contained IWC system was the only feasible alternative, when considered against the project objectives
- The environmental costs and benefits of an IWC system versus a traditional system, highlighting the superior environmental outcomes achieved by an integrated system incorporating the use of recycled water
- The IWC scenarios that were assessed and identified the preferred scenario
- The options assessed for the key elements of the system, including alternative wastewater treatment processes, excess recycled water discharge management and service water reservoirs.

The Proposal is generally consistent with the Concept Approval for the Googong IWC Project and the options assessment contained within the EA. The design and operation of the existing WRP and permanent reservoir sites also limits the feasibility of options that could be considered for the Stage D works. For example, it would not be feasible to relocate or provide alternative treatment technology for the WRP or Permanent Reservoirs.

Two options that have been considered are the designs for the MBR and the Recycled Water Reservoir. These options are discussed below.

The ‘do-nothing’ option (i.e. not progress with Stage D) is not consistent with the project objectives and would not meet the water supply and wastewater management requirements for the Googong township.

3.9.1 Membrane bioreactor design

The existing MBR system consists of two bioreactor trains each with two membrane tanks. The bioreactors are nominally sized for 3 x ADWF plus return flows.

For Stage D WRP, the additional bioreactor would be larger than the existing bioreactors at the WRP. The new bioreactor would contain three membrane tanks to double the hydraulic and biological capacity of the existing secondary treatment process. While the overall process would remain identical to the existing bioreactors, options to reduce the tank footprint and achieve simpler operations (by minimising interfaces and maintainable items) of the new bioreactor were considered and adopted.

The modified design would result in:

- Fewer membrane tanks (reduced from four to three larger tanks) to minimise maintainable equipment (actuators, solenoid valves, ejector pump, etc.) and instruments, as well as reduce membrane cleaning requirements.
- Consolidated pumps and ancillaries to minimise the quantity of pumps, electrical works and provide common standby units, where applicable.

3.9.2 Recycled water reservoir design

The existing Permanent Reservoirs consists of two reservoir tanks constructed from steel panels. For Stage D, alternative materials for the additional recycled water reservoir were considered. It was agreed with QPRC that this reservoir would be constructed from reinforced concrete, with a steel roof structure.

The modified design is expected to result in a simplification of the detailed design process and a higher quality of the finished product.

4 STATUTORY AND PLANNING FRAMEWORK

4.1 Environmental Planning and Assessment Act 1979

On 24 November 2011, the Googong Township Water Cycle Project was approved by the Minister for Planning under Part 3A (now repealed) of the EP&A Act. The approval included Concept Approval for the ultimate development (Stages 1 and 2) and the Project Approval for Stage 1 development of the Googong Township IWC Project. Individual Conditions for Approval (CoAs) were included for both the Stage 1 Project Approvals and the overall Concept Approval.

The *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act) commenced 1 October 2011. Under the Part 3A Repeal Act, projects deemed to be 'transitional Part 3A projects' would continue to be subject to Part 3A of the EP&A Act (as in force immediately before the repeal and as modified by the Part 3A Repeal Act).

Transitional Part 3A projects include certain projects that were the subject of an existing approval under Part 3A. As the IWC Project Concept Approval was issued under Part 3A, it is considered to be a transitional Part 3A project. The provisions of Part 3A (as in force immediately prior to its repeal) continue to be applicable.

In issuing the Part 3A approval under Section 75O of the EP&A Act the Minister for Planning determined that further assessment would be required for projects developed under Stage 2 of the Concept Plan in accordance with the EP&A Act. It identified that under section 75P(2)(C):

i. where development is subject to Part 4 of the EP&A Act, that development is subject to the further environmental assessment requirements specified in Schedule 2 of this approval.

ii. where development is subject to Part 5 of the EP&A Act, that development is subject to the further environmental assessment requirements specified in Schedule 3 of this approval.

As no Schedule 3 was provided as part of the Concept Approval, the assumption has been made that this clause should be referring to the requirements outlined in Schedule 2 instead. These requirements have been addressed as part of this assessment and are reproduced in Appendix B of this REF, with a reference to the section of the REF where each requirement is addressed. Where relevant, each section of this REF starts with an excerpt from Schedule 2 of the Concept Approval which lists the specific requirements relevant to each section and summarises the response to the requirement.

The clause 228 checklist has been addressed as part of this assessment and is included in Appendix A of this REF, outlining the factors considered and their expected impact. In addition, the provisions of Part 4.15 of the EP&A Act have been considered as part of this assessment for proposed temporary construction access, included in Appendix C.

4.1.1 Assessment against the objects of the Environmental Planning and Assessment Act 1979

As assessment of the Proposal against the objects of the EP&A Act has been undertaken in Table 4.1. The Proposal is consistent with the objects of the EP&A Act.

Table 4.1 Assessment of the Proposal against objects of the EP&A Act

Object	Comment
(a) To promote the social and economic welfare of the community, and a better environment by the proper management, development and conservation of the State's natural and other resources,	The Proposal would provide infrastructure for the future management of wastewater and provision of recycled water for ongoing use within the Googong township. Water recycling reduces the footprint of the development on the existing land use capacity and the overall impact of the development by reducing pressure on natural water resources and promoting more sustainable living.
(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	The Proposal supports the continued development of the Googong township as a sustainable development that considers economic, environment and social factors throughout the decision-making process.

Object	Comment
(c) To promote the orderly and economic use and development of land,	The Proposal provides for the ongoing development of the Googong township.
(d) To promote the delivery and maintenance of affordable housing,	Not relevant to the Proposal.
(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The Proposal would have minimal impacts within the local area with many of the impacts being temporary in nature throughout construction.
(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposal has considered the impacts of the proposed works on the existing built and cultural heritage (refer to Sections 6.10 and 6.11). The Proposal is not expected to result in impacts to existing built and cultural heritage within proximity to proposed works areas.
(g) To promote good design and amenity of the built environment,	The Proposal is expected to utilise similar design features and materials of those used in previous stages of the IWC Project.
(h) To promote the proper construction and maintenance of buildings, including the protection of health and safety of their occupants,	Not relevant to the Proposal.
(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State, and	The Proposal has been developed for and on behalf of QPRC and in consultation with relevant State and Federal government agencies.
(j) To provide increased opportunity for community participation in environmental planning and assessment.	Section 5 of this REF outlines the community consultation that has been undertaken for this Proposal and as part of the overall Concept Approval. In addition, this REF would be placed on public display for the community to provide feedback about the Proposal. Any feedback would be considered by QPRC while determining the Proposal.

4.1.2 Land and Environment Court settlement

GTPL seeks consent from QPRC under Part 4 of the EP&A Act for the ongoing development of neighbourhoods (i.e. subdivisions) within the Googong township. In November 2019, a Notice of Order was made by the Land and Environmental Court regarding the proposed Neighbourhood 1A Stage 4D subdivision, located in the land immediately west of the WRP. The Land and Environment Court determined that GTPL would enter into a Local Planning Agreement (LPA) with QPRC for the proposed subdivision. The LPA included a condition for noise at the WRP:

> *GTPL hereby offers to enter into a Stage 4D LPA with council for the carrying out of noise attenuation works on Stage D of the Googong Water Recycling Plant to reduce noise emanating from the facility by 1dBA, to be detailed in the future Water Recycling Plant Stage D Deed of Agreement*.

Noise attenuation covers are proposed for the recycled water transfer pumps as part of the Proposal in order to achieve the 1 dBA reduction. It should also be noted that 1 dBA is considered a negligible noise measure and for all intents and purposes is within error range of noise measuring instruments.

A noise and vibration assessment has been undertaken for the Proposal and is summarised in Section 6.6.

4.2 State environmental planning policies

4.2.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State and is the key environmental planning instrument which determines the permissibility of a proposal. Additionally, the ISEPP prevails over all other environmental planning instruments, including the *Queanbeyan Local Environmental Plan 2012*.

WRP

Clause 106(1a) of ISEPP permits development for the purpose of sewage systems to be carried out in prescribed circumstances by or on behalf of a public authority without consent. Further, under clause 106(3A), development for the purpose of a water recycling facility may be carried out by a public authority without consent in a prescribed zone, and under clause 106(3B) development for the purpose of sewage reticulation systems may be carried out without consent on any land. Clause 125(1) also provides that development for the purpose of water reticulation systems may be carried out by a public authority without consent on any land.

Under these provisions, the Stage D WRP component of the Proposal is classified as a water recycling facility, and as GTPL is carrying out the development of Stage D WRP for and on behalf of QPRC the proposed Stage D WRP works are permissible without consent. Therefore, the Proposal is assessed under Division 5.1 of the EP&A Act with QPRC acting as the determining authority.

Permanent Reservoirs

Clause 125(1) of ISEPP permits development on any land for the purposes of a water reticulation system to be carried out by or on behalf of a public authority without consent. A water reticulation system is defined under Clause 124 of ISEPP as a facility for the transport of water, including pipes, tunnels, canals, bores, pumping stations, related electricity infrastructure, dosing facilities and water supply reservoirs.

As the Stage D Permanent Reservoirs component of the Proposal meets the definition of water reticulation system and is being carried out by GTPL for and on behalf of QPRC, development consent under Part 4 of the EP&A Act is not required. Therefore, the Proposal is assessed under Division 5.1 of the EP&A Act with QPRC acting as the determining authority.

ISEPP consultation

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Clauses 13-15 require a public authority to consult with local council where certain conditions are met. However, Clause 17 of ISEPP provides exceptions for the need to consult with the local council. This includes Clause 17(1)(a) which removes the need for a local council to be consulted where approval is being sought from the local council. As such, only Clause 16 applies to this Proposal. Consultation including consultation as required by ISEPP (where applicable), is discussed in Section 5 of this REF.

4.2.2 Other state environmental planning policies

The Proposal does not affect land or development regulated by State Environmental Planning Policies including *State Environmental Planning Policy No.14 – Coastal Wetlands*, *State Environmental Planning Policy No. 26 – Littoral Rainforests*, or *State Environmental Planning Policy No. 44 – Koala Habitat Protection*.

4.3 Local environment plans

4.3.1 Queanbeyan Local Environmental Plan 2012

The *Queanbeyan Local Environment Plan (LEP) 2012* provides for the planning requirements and zoning classifications for the Proposal. The Proposal is located within three zones under the Queanbeyan LEP, as outlined below and shown in Figure 4.1:

- **SP2 Infrastructure** – Proposal works within this zoning includes all works associated with the WRP. Under this zone classification the Queanbeyan LEP provides for development consistent with the purpose shown on the land zoning map (in this case "sewage treatment plant" or “road”) to be permitted with consent.
- **R1 General Residential** – Proposal works within this zoning includes all works associated with the installation of the new permanent reservoir, upgrades to existing infrastructure and decommissioning of

the existing sedimentation bund at the Permanent Reservoirs site. Under this zone classification the Queanbeyan LEP outlines that "water and resource management facilities" are permitted with consent.

- **E2 Environmental Conservation** – Proposal works within this zoning include the temporary construction access located east of the WRP site. Under this zone classification the Queanbeyan LEP provides that “roads” are permitted with consent.

Under the Queanbeyan LEP the proposed works at the WRP and Permanent Reservoir sites would be permitted with consent from QPRC. As outlined in Section 4.2.1, clauses 106(2), 106(3) and 125(1) of ISEPP provide for the proposed works at the WRP and Permanent Reservoir sites undertaken without development consent and therefore the provisions of the Queanbeyan LEP do not apply to these aspects of the Proposal.

The temporary construction access in land zoned E2 is also permissible with consent from QPRC. As such, Part 4 of the EP&A Act does apply to these works adjacent to the WRP site. Proposed works for the temporary construction access may be carried out in accordance with the provisions of the Queanbeyan LEP and are subject to assessment consent from QPRC under Part 4 of the EP&A Act.

4.3.2 Palerang Local Environment Plan 2014

No works are proposed within land subject to the Palerang Local Environment Plan 2014.

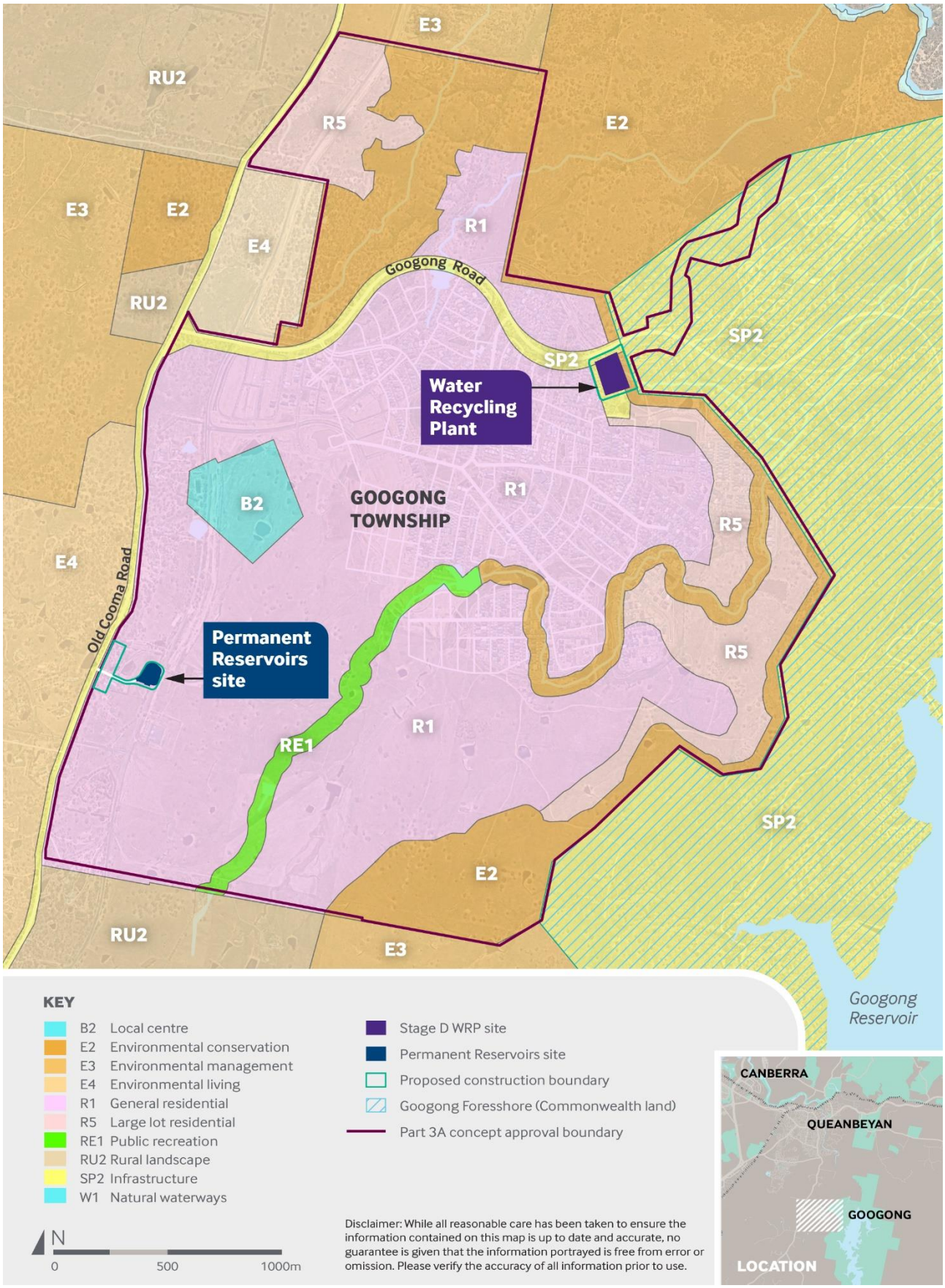

Figure 4.1 Queanbeyan LEP zones for the Proposal

4.4 Other relevant NSW legislation

4.4.1 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) details mechanisms for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities, and areas of outstanding biological value. The Act applies primarily to terrestrial animals and plants and not (unless otherwise provided) to fish and marine vegetation.

The BC Act requires that a species impact statement be prepared under Section 7.10 of the BC Act (terrestrial species) and/or Sections 221J and 221K of the *Fisheries Management Act* (aquatic species) for a proposed activity that:

- Is likely to significant affect threatened species or ecological communities, or their habitats according to the test in Section 7.3 of the BC Act, or
- Is carried out in a declared area of outstanding biodiversity value.

A biodiversity assessment has been undertaken for the Proposal and is outlined in Section 6.4 of this REF. The assessment concluded that no significant impacts are predicted and therefore a species impact statement is not required.

4.4.2 National Parks and Wildlife Act 1974

The Proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act).

The NPW Act provides protection for Aboriginal objects (material evidence of indigenous occupation) and Aboriginal places (areas of cultural significance to the Aboriginal community) across NSW.

It is an offence to harm Aboriginal objects or places without a permit authorised by the Director-General of the NSW Environment, Energy and Science (EES). This permit is issued under Section 90 of the Act to allow the investigation, impact and/or destruction of Aboriginal objects.

An Aboriginal heritage assessment has been undertaken for the Proposal and is outlined in Section 6.10 of this REF. This assessment concluded that no harm to Aboriginal object or places is predicted.

4.4.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. This includes the conservation of threatened species and populations, as well as habitat.

Part 7 of the FM Act outlines legislative provisions to protect fish habitat and Part 7A outlines provisions to conserve threatened species of fish and marine vegetation and their habitat. As described in Section 4.4.1, a species impact statement would be required if the proposed activity is likely to significantly affect threatened species, ecological communities or their habitats.

Additionally, Section 220ZW provides that a licence is required to harm a threatened species, population or ecological community or to damage habitat.

An aquatic ecology assessment has been undertaken for the Proposal and is outlined in Section 6.4.1 of this REF. The assessment concluded that no significant impacts are predicted, and a species impact statement is not required. A licence to harm/pick/damage habitat of a threatened species, population or community will not be required.

4.4.4 Heritage Act 1997

The *Heritage Act 1997* applies to deposits, objects, or material evidence within NSW which either relates to the non-Aboriginal settlement of the area that comprises NSW, or items listed as being of State or local heritage significance. Under this Act it is an offence to harm relics protected by Interim Heritage Orders (IHO) or the State Heritage Register (SHR) unless an exemption (section 57), an approval (section 60), or a permit (section 140) is obtained. Furthermore, the impact to or removal of a relic requires an excavation permit from the NSW Heritage Council.

A non-Aboriginal heritage assessment had been undertaken for the Proposal and is outlined in Section 6.11 of this REF. This assessment concluded that no impacts to non-Aboriginal heritage are predicted.

4.4.5 Protection of the Environment Operations Act 1997

Section 120 of the *Protection of the Environment Operations Act 1997* (PoEO Act) prohibits the pollution of waters. Section 6.2 of this REF identifies the potential impacts to local natural water systems and the management measures to address risk of water pollution.

Part 3.2 of the PoEO Act requires an Environmental Protection Licence (EPL) for scheduled development work and the carrying out of schedule activities. Scheduled activities are listed in Schedule 1 of the Act. Clause 36 of Schedule 1 lists sewage treatment processes with a capacity that exceeds 2,500 equivalent persons (750 kL/day) as a scheduled activity and scheduled development works are defined as the construction of work to undertake a scheduled activity.

As the Proposal forms part of the IWC Project, an EPL would be required for the construction and operation of the recycled water components of the Proposal (i.e. Stage D WRP and recycled water reservoir). It is noted that EPL 20188 is currently held by QPRC for the operation of Stages AB and C of the IWC Project.

Given the complex nature of the licensing regime for the IWC Project, with multiple stages, premises and two licensees, GTPL proposes to discuss and agree the appropriate licensing arrangements with both QPRC and the EPA prior to the commencement of construction. These issues were addressed for the construction of Stage C WRP through the definition of separate premises on the WRP site and the issue of a construction EPL to GTPL separate from QPRC's amended operations EPL.

4.4.6 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* was established to assist in the achievement of the objectives of the PoEO Act. The objectives of this Act are to encourage the most efficient use of resources and to reduce environmental harm; apply resource management through avoidance, resource recovery and appropriate disposal, and provide for the continual reduction in waste generation.

The Proposal is consistent with the objectives of this Act as water is treated for reuse throughout the Googong township. A Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) would be prepared prior to construction activities to ensure that the resource management hierarchy principles, including the appropriate handling and disposal of waste, would be followed in accordance with this Act.

4.4.7 Local Government Act 1993

The *Local Government Act 1993* provides the framework to provide for local government in NSW as well as outline other functions of local government, such as being a consent authority for the approval of development applications.

Section 60 of this Act requires local water utilities to obtain an approval from the Minister for Primary Industries for the construction or modification of water and sewage treatment works. QPRC (as the operator), with the support of GTPL, would be required to seek approval from the Department of Planning, Industry and Environment (DPIE) – Water to construct and operate the Proposal. DPIE – Water would also need to approve the *Recycled Water Quality Management Plan*. These approvals provide an independent assessment of the proposed works to ensure they are fit for purpose and provide a robust, safe, cost-effective, and soundly based solutions that meet public health and environmental requirements. The requirements for the Section 60 approval include:

- Concept design report and environmental assessment
- Detailed design.

Consultation with the Urban Water Unit of the DPIE – Water has continued to occur in relation to the IWC Project. Approval for construction and operation of the Stage D WRP and Permanent Reservoirs would be sought as required by QPRC, with support from GTPL.

QPRC may also require GTPL to submit an application for approval to work on the existing WRP and Permanent Reservoirs sites under Section 64 of the Act. The requirement for this approval and the form of the application are to be determined in consultation with QPRC.

4.4.8 Roads Act 1993

The *Roads Act 1993* outlines the rights of members of the public in regard to access to and usage of public roads and establishes the procedures for the opening and closing of a public road.

Section 138 of this Act requires contractors to obtain an approval from the appropriate roads authority, such as the council or the Road and Maritime Services (RMS), to carry out works on a public road.

As part of this Proposal, no works are planned or required on Googong Road or Old Cooma Road, the closest public roads.

4.4.9 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the integrated and sustainable management of water in NSW. The WM Act is based on the concept of ecologically sustainable development to protect water resources and systems for current and future generations. Major functions of the WM Act include licencing of water extraction and the development of water management plans. It is not anticipated that groundwater would be encountered as part of the proposed works therefore approval under the WM Act would not be required. Furthermore, QPRC are considered a public authority under the WM Act and therefore, under section 38 of the *Water Management (General) Regulation 2011*, are exempt from requiring an approval for all controlled activities carried out in, on or under waterfront land.

4.4.10 Water Act 1912

The *Water Act 1912* historically provided access to water sources via licenses and permits however these provisions are being progressively transitioned to the WM Act. This is to better reflect modern water management practices in line with the principles of ecologically sustainable development. Water extraction is not required for the Proposal therefore approval under the *Water Act 1912* is not required.

4.5 Commonwealth legislation

4.5.1 Airports Act 1996

The *Airports Act 1996* promotes the sound development of civil aviation in Australia and establishes a system for the regulation of airports that considers the interests of airport uses and the general community. The Act and the *Airports (Protection of Airspace) Regulations 1996* also protects prescribed airspace and regulates development that intrudes into a prescribed airspace.

Under Section 182 of the Act, the Proposal is considered a controlled activity as it involves the construction of a structure that intrudes into the prescribed airspace. In July 2015, the Commonwealth Department of Infrastructure and Regional Development (DIRD) granted approval (15/270) for the construction and operation of water supply reservoirs, and associated communications tower at the Permanent Reservoirs site as part of the Stage C IWC Project. The 15/270 approval permits the intrusion of infrastructure into prescribed airspace for Canberra Airport and included conditions related to infrastructure heights.

outlines the approved heights under the 15/270 approval with the actual/proposed heights of the Permanent Reservoirs infrastructure.

Table 4.2 Approved and actual/proposed heights of Permanent Reservoirs infrastructure

Permanent Reservoirs Infrastructure[1]	Approved heights of top of structure (m AHD)	Actual/proposed height of top of structure (m AHD)
Tank 1 (Stage D 9ML tank)	816.30	808.70
Tank 2 (existing 4ML recycled water tank)	817.30	807.20
Tank 3 (existing 1.9ML potable water tank) [1]	805.50	805.75
Communications tower	821	813

1. Tank 2, Tank 3 and the communications tower were constructed as part of Stage C Network West and would not be modified as part of Stage D.

Consultation was undertaken with Canberra Airport and the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications (previously DIRD) for the Proposal and is further discussed in Section 5.3. It was determined that there is no requirement for a reassessment of the proposed heights and the current approval is sufficient for the Proposal.

4.5.2 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Commonwealth for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land.

The potential for the IWC Project to significantly impact a matter of national environment significance or Commonwealth land, and the need to make a referral to DAWE for a decision by the Commonwealth Minister for the Environment was previously completed in parallel with the Part 3A Concept Approval process. An approval for the IWC Project (including Stage D) was granted on 19 May 2011.

The Pink-tailed Worm-lizard (*Aprasia parapulchella*) is a reptile classified as a vulnerable species under the EPBC Act. It has a widespread distribution from the Central and Southern Tablelands and Southern Western Slopes of NSW, and throughout the ACT. As part of the EPBC approval for the Googong township development (EPBC 2011/5829) the former Commonwealth Department of Sustainability, Environment, Water, Population and Communities approved the development subject to a number of conditions.

CoA 1 requires GTPL to prepare and implement a Pink-tailed Worm-lizard Protection and Management Plan, which was subsequently approved on 2 September 2014, and establish a Pink-tailed Worm-lizard Conservation Area. The Pink-tailed Worm-lizard Conservation Area is located along the eastern boundary of the Googong township, as shown in Figure 4.2. The proposed works are not within or close to the Conservation Area and the Pink-tailed Worm lizard is unlikely to be impacted by the works as no habitat for this species would be disturbed.

The Googong Foreshores is located east and south-east to the WRP and Permanent Reservoirs sites, and encompasses a short section of the Queanbeyan River, the Googong Dam, land either side of Googong Dam, and land either side of the Queanbeyan River and Burra Creek downstream. CoA 2 and CoA 3 require GTPL to develop and implement a *Googong Foreshores Interface Management Strategy* (GFIMS), which was prepared and approved on 2 September 2014, and establish a committee to oversee the implementation of the GFIMS. The GFIMS extent is located immediately adjacent to the WRP site and extends along the eastern boundary of the Googong township, as shown in Figure 4.2.

The temporary construction area for the WRP site is located within the GFIMS boundary. No additional clearing of vegetation would be required, and adequate controls would be used to ensure there would be no impacts to the Googong Foreshores. The works would adhere to the GFIMS.

As the approval granted under the EPBC Act covered the IWC Project (including Stage D) no additional approvals are considered to be required under the Act. Nonetheless, the Proposal has been assessed against the matters of environmental significance as described in Appendix A. No impacts on these matters have been identified.

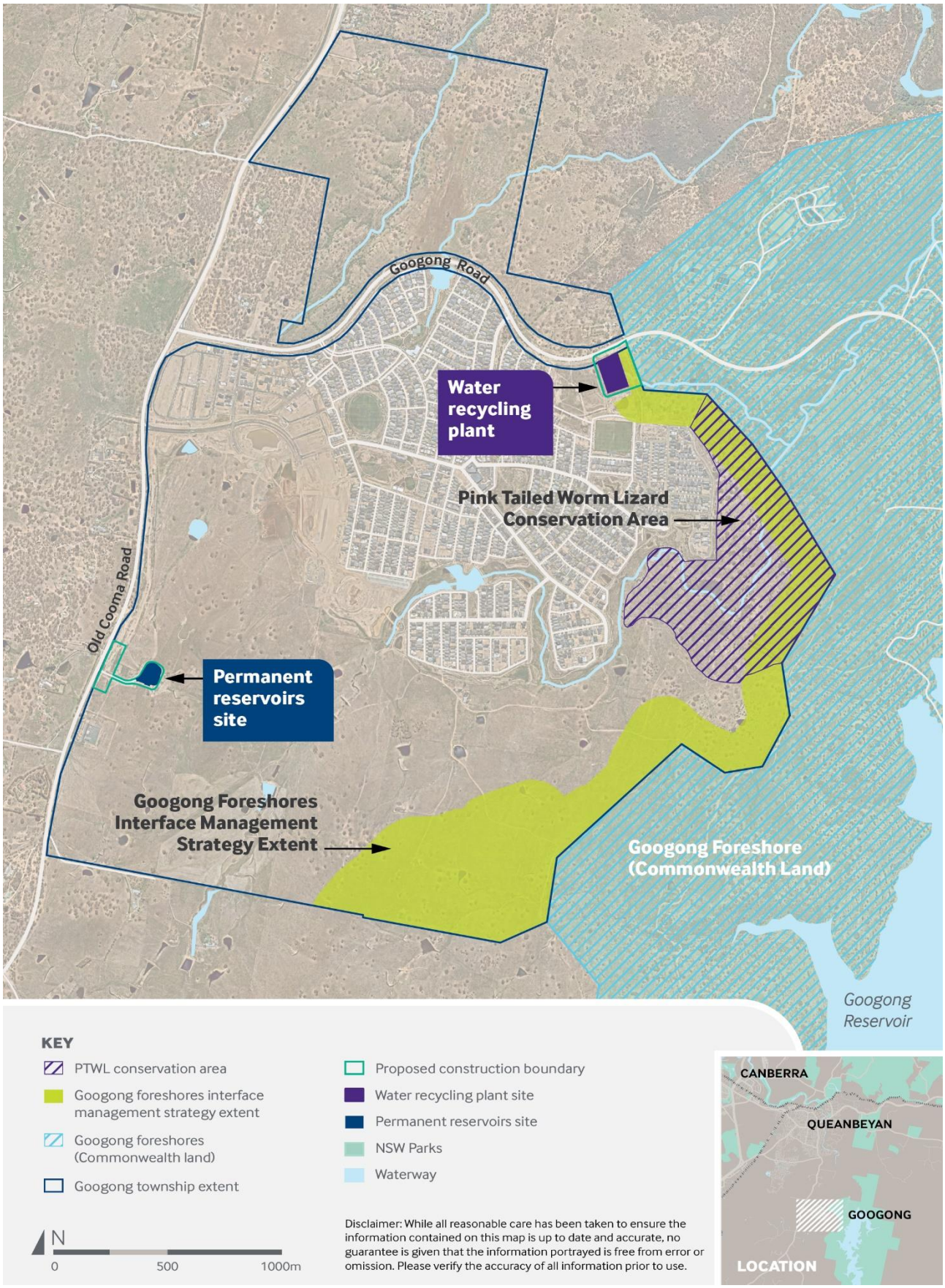

Figure 4.2 Pink-tailed Worm-lizard conservation area and the Googong Foreshores

4.6 Confirmation of statutory position

Clause 106(3A) of the ISEPP permits development for the purpose of a water recycling facility to be carried out by a public authority, such as a council, without consent in a prescribed zone, and Clause 125(1) permits development on any land for the purposes of a water reticulation system to be carried out by or on behalf of a public authority without consent.

The WRP component of the Proposal is classified as a water recycling facility and would be undertaken on land in a prescribed zone (i.e. SP2). The Permanent Reservoirs component of the Proposal is classified as a water reticulation system. Both these components would be carried out by GTPL as the proponent of the Proposal, acting for on behalf of QPRC, who would own and operate the IWC Project. As such, the Proposal is permissible without consent and the environmental impacts would be assessed by QPRC and determined under Part 5 of the EP&A Act.

The Queanbeyan LEP permits development for the purpose of “environmental protection works” to be carried out without consent and development for the purpose of “roads” to be carried out with consent in zone E2. The temporary construction access immediately east of the WRP site is located within the E2 zone and is permissible with consent under the provisions of the Queanbeyan LEP. As such, these construction works are subject to assessment and development consent from QPRC under Part 4 of the EP&A Act.

Other approvals licences and permits would also be required as part of the construction and operation of the Proposal and include an EPL under the *Protection of the Environment Operations Act 1997* for construction and operation of the Stage D WRP and Permanent Reservoirs sites.

5 STAKEHOLDER AND COMMUNITY CONSULTATION

5.1 Background

Community consultation regarding the Proposal for a Googong township commenced in the preliminary development stages in early 2000s. The stakeholder consultation process for the Part 3A Concept Approval assessment for the Googong IWC Project formally commenced in May 2007.

Consultation regarding the IWC Project was undertaken during the preparation of concept designs and the environmental assessment throughout 2009–10. The results of this consultation are outlined in Chapter 16 of the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010).

In 2010 the then NSW Department of Planning placed the *Googong Township Water Cycle Project Environmental Assessment* (Manidis Roberts, 2010) on public exhibition from 17 November to 20 December 2010. As a result of the public display of the environmental assessment, 12 submissions were received from residents, government agencies and QCC (now QPRC).

A Submissions Report was prepared in May 2011 considering and responding to the issues raised in the submissions received and additional meetings were held with a number of residents and government agencies, including QCC, to discuss their concerns with the Proposal.

The Concept Approval requires community consultation, which has been consistently undertaken throughout the IWC Project. Consultation was undertaken for previous stages of the IWC Project including Stage AB, Stage C Network West, Stage C Network East and Stage C WRP.

GTPL and QPRC have collaborated in the development and delivery of a program of community education activities. These commenced in 2015, prior to the anticipated availability of recycled water for use in the Googong township in late 2016 and have continued since that time. The key messages delivered by the program have included:

- Recycled water is conditional to property ownership.
- Property owners and residents have an ongoing responsibility to inform visitors about recycled water and to maintain their recycled water system appropriately.
- Use of the recycled water in Googong would lead to a 60 per cent reduction in potable water use when compared to a regular township.
- Recycled Water should not be used for: drinking, bidet flushing, or filling the pool or washing machine.
- All recycled water fittings are purple.
- Use of rainwater in the IWC system – washing machine with potable water backup.

Key education activities have included:

- Survey of Googong residents to establish a baseline of their knowledge about recycled water and its use. This survey was undertaken in November 2015 and would be repeated in the future by QPRC to gauge the success of the community education program.
- Holding two drop-in information sessions in Googong township.
- Insertion of flyers with QPRC rates notices providing information about the use of recycled water in Googong.
- Recycled water updates included in the Googong township and QPRC community newsletters
- Fact sheet mail outs to Googong residents.
- Posting fact sheets and other information on GTPL and QPRC websites.

5.2 Community consultation

Since construction commenced on the Stage 1 and Stage 2 works, regular updates have been provided to the community to keep them informed about the progress of the IWC Project. A community hotline (1800 838 438) has been established to provide an avenue for residents to raise any issues that they may have with

construction activities. A log has been kept of all communication with the community in response to construction activities and the actions/responses provided.

Community consultation was undertaken between 1 April and 17 April 2020 to inform stakeholders and residents of the Googong township of the Proposal and provide an opportunity for engagement. The key engagement activities undertaken during this period include:

- A notification and link to a flyer published on the Googong.net website
- An electronic distribute mail (email) sent to Googong township subscribers
- A community letter delivered to community members residing near the Permanent Reservoirs site
- A notification published in the Googongian Gazette location newsletter (refer Appendix L)
- Links to the digital version of the Googongian Gazette posted on the Googong township's social media accounts.

The letters and publications provided a brief outline of the Proposal and provided an opportunity for members of the community to raise any issues or concerns that they may have. The letter also identified that a REF for the Proposal was being prepared and that the public display was scheduled for Quarter 3 2020.

By the end of the community consultation period, five stakeholders had responded to the engagement activities. Two community members requested further information and three organisations acknowledged receipt of the notification.

It is noted that this consultation was undertaken during the period when restrictions were in place to limit the COVID-19 pandemic in NSW. Some planned consultation activities (i.e. community drop-in sessions) were unable to be undertaken due to these restrictions.

5.3 Stakeholder consultation

5.3.1 QPRC

In depth consultation is ongoing with QPRC as the operator of the IWC Project, including Stage D. This includes regular design and project co-ordination meetings.

5.3.2 Federal and State agencies

From January to April 2020, key State and Federal agencies (as identified in the Part 3A Conditions of Approval) were consulted about the Proposal. A letter was sent providing a brief outline of the proposed Stage D works to the following agencies:

- Commonwealth Department of Agriculture, Water and the Environment
- NSW Department of Planning, Industry and Environment (DPIE)
- NSW DPIE – Water (previously NSW Office of Water)
- NSW Environment Protection Authority
- NSW Environment, Energy and Science Division (previously Office of Environment and Heritage)
- NSW Transport for NSW
- NSW Roads and Maritime Services
- NSW Health
- ACT Icon Water
- Canberra Airport.

Responses received from the above agencies are outlined in Table 5.1.

Table 5.1 Issues raised through agency consultation

Agency	Issues/comments raised	GTPL Response
NSW Public Health	No objections or issues with the Proposal.	-
Environment Protection Authority	No objections or issues with the Proposal.	-
Transport for NSW	Transport for NSW request that a traffic assessment be undertaken to identify the implications of the Proposal on traffic counts on key road and intersections within the locality of the Googong township.	Noted – A qualitative traffic assessment was undertaken for the Proposal based on current and previous traffic studies and information. A road noise assessment was also undertaken as part of the Noise and Vibration Assessment. Traffic mitigation and management measures are detailed in Section 6.9.
Canberra Airport	Canberra Airport consulted with the Department of Infrastructure, Transport, Regional Development and Communication for the Proposal. There is no requirement for a reassessment and the current approval remains in place. Canberra Airport agrees and approves the proposed works for Googong IWC Stage D.	Noted – proposed infrastructure heights are provided in Section 4.5.1.

5.3.3 Aboriginal stakeholder consultation

Consultation with Aboriginal stakeholders regarding the Googong township has been ongoing since 2003 when rezoning of the area for the Googong township was first proposed. Aboriginal stakeholders have been engaged throughout the development process including participating in archaeological surveys of the site in 2009 (Manidis Roberts, 2010).

Eleven Aboriginal stakeholders have interest in the country in which Stage D works are located:

- Buru Ngunawal Aboriginal Corporation
- King Brown's Tribal Group
- Little Gudgenby River Tribal Council
- Ngambri Local Aboriginal Land Council
- Gunjeewong Cultural Heritage Aboriginal Corporation
- Gulgunya Ngunawal Heritage Aboriginal Consultancy
- Arnold Williams
- Thunderstone Aboriginal Cultural & Land Management Services
- Murra Bidgee Mullangari Aboriginal Corporation
- Murgadi Heritage Indigenous Corporation.

A consultation letter was issued to the above listed stakeholders on 30 January 2020 and letter providing additional information regarding the Proposal was issued on 24 March 2020. The letters provided a brief outline of the Proposal and provided an opportunity for members of the community to raise any issues or concerns that they may have. The letters also identified that a REF for the Proposal was being prepared.

By 15 May 2020, no Aboriginal stakeholders had provided responses to the consultation letter.

5.4 Ongoing consultation

During and immediately following public display of the REF, QPRC would receive and consider all submissions received prior to making a determination to proceed (or otherwise) with the Proposal.

A Consultation Plan, as part of the CEMP would be prepared prior to the construction of Stage D in accordance with the Concept Approval CoA 3.2 and any additional CoAs. The Plan would outline how and when consultation would be undertaken with the local community and other stakeholders throughout the construction period and how information about the project would be communicated.

The existing Googong IWC Project website (www.compliance.goongong.net) and hotline (1800 838 438) would be maintained throughout the Stage D construction period and kept up-to-date to provide the community with, as a minimum the following information (as per the requirements of the Concept Approval):

- The status of the project.
- A copy of each relevant environmental approval, licence or permit required and obtained in relation to the project.
- A copy of each approved plan, report, or monitoring program required by this approval and associated project approvals.
- A summary of the monitoring result of the project, which have been reported in accordance with the various plans and programs approved under this approval and associated project approvals.
- Details of the outcomes of compliance reviews and audits of the project, to the satisfaction of the Secretary.

A community complaints register would continue to be kept and maintained throughout construction to document any issues raised by the community and how these issues were addressed. In operation, QPRC would be responsible for logging and responding to complaints.

6 ENVIRONMENTAL ASSESSMENT

6.1 Risk assessment

An environmental risk assessment is considered to be an important step in the environmental impact assessment process. A risk assessment was undertaken to identify the potential environmental, operational and construction risks associated with the Proposal. The risks identified guide the environmental impact assessment in order to mitigate aspects of risk.

6.1.1 Risk assessment process

The environmental risk assessment has been undertaken in accordance with the principles of AS/NZS ISO 31000:2009. The risk assessment process is outlined below in Figure 6.1.

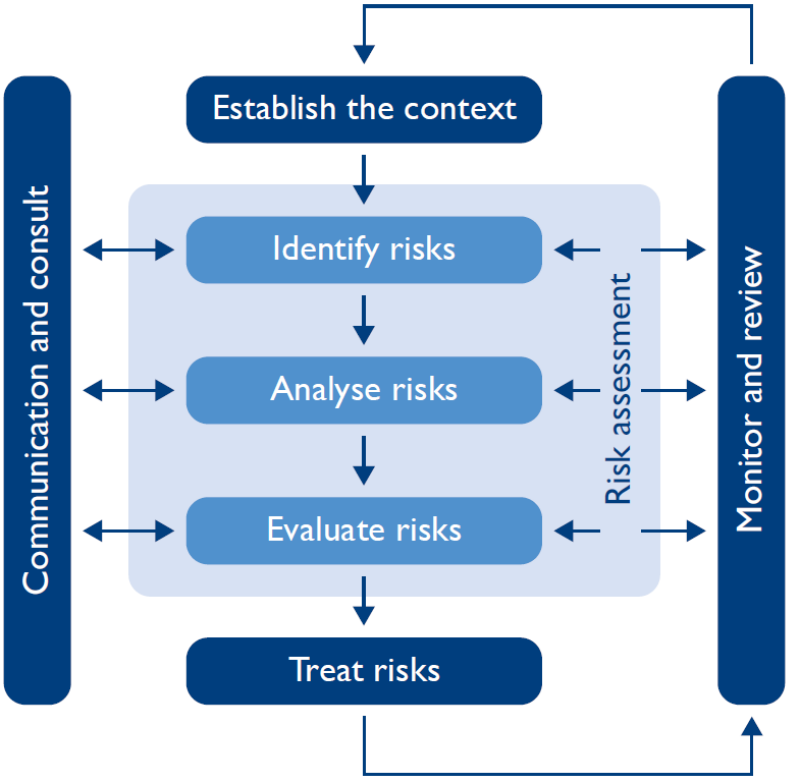

Figure 6.1 Risk assessment process

Establish the context

Establishing the context defines the scope for the risk management process and sets parameters against which risk can be assessed and managed within. The risk context for the assessment is the associated potential environmental impacts of the Proposal. The risk assessment has focused on the following issues:

- Water quality
- Hydrology
- Biodiversity
- Soils and landscape
- Noise and vibration
- Air quality
- Visual amenity

- Traffic and access
- Aboriginal and non-Aboriginal heritage
- Waste
- Hazards and risks
- Human health
- Socio-economic.

Identify risks

The identification of risks was based on previous experience from earlier stages of the IWC Project and experience on other projects.

In addition, a Construction Hazard Assessment Implications Review (CHAIR) workshop was held on 2 March 2020 to identify, eliminate, or minimise construction, repair and maintenance risks in the design phase. Further CHAIR and Hazard and Operability Study workshops would be undertaken in Q2 and Q3 2020.

Analyse risks

A risk assessment for the project involves determining the potential level of risk for each of the identified impacts.

The first descriptor of risk defines the consequence level for each potential impact. The definitions for each consequence level are outlined in Table 6.1

Table 6.1 Risk assessment consequence definitions

Consequence level	Definition
Extreme	Would result in a major prosecution under relevant environmental legislation. Would cause long-term and irreversible impacts.
High	Would result in a fine or equivalent under relevant environmental legislation. Would cause medium-long-term, potentially irreversible impacts.
Medium	Would result in a medium-term, reversible impact.
Low	Would result in short-term, reversible impact.
Negligible	Would not result in any perceptible impacts.

The second descriptor of risk identifies the frequency of activities that may cause the impact and the probability of the impact occurring during that activity, the likelihood level is outlined in Table 6.2

Table 6.2 Risk assessment likelihood definitions

Likelihood level	Definition
Extremely	The impact is expected to occur in most circumstances.
Highly	The impact will probably occur in most circumstances.
Medium	The impact will probably occur at some time.
Low	The impact could occur at some time.
Negligible	The impact may only occur in exceptional circumstances.

When both the descriptors of risk have been identified for each potential impact the level of risk is determined using the risk matrix in Figure 6.2.

		Consequences				
		Negligible	Low	Medium	High	Extreme
Likelihood	Extremely	Medium	High	Extreme	Extreme	Extreme
	Highly	Low	Medium	High	Extreme	Extreme
	Medium	Negligible	Low	Medium	High	Extreme
	Low	Negligible	Negligible	Low	Medium	High
	Negligible	Negligible	Negligible	Negligible	Low	Medium

Figure 6.2 Risk matrix

Evaluate risks

Identified risks are evaluated in further detail and mitigation measures proposed throughout this chapter.

Treat risks

Treating risks involves identifying options to mitigate risks as well as developing plans to manage and monitor risks during construction and operation. Stage 1 and the first sub-stage of Stage 2 (Stage C) of the IWC Project has an existing WMP as well as other environmental management plans (see Section 7.1) which would be updated and adapted for Stage D as required.

A range of mitigation measures are proposed for both construction and operation of Stage D throughout Section 6 and in the Statement of Commitments in Section 7.2.

The results of the environmental risk assessment are included as Appendix J.

Monitor and review

Ongoing review of the risk assessment process ensures that it remains both relevant and adaptive. This review should account for any factors that may change the likelihood, consequence, mitigation or ongoing monitoring needs of an impact. The risk assessment cycle should be repeated regularly to maintain appropriate and current environmental management plans.

Communicate and consult

Ongoing communication and consultation with government agencies and relevant stakeholders allows issues that arise to be addressed through the environmental risk assessment process.

6.2 Surface water

A surface water assessment has been prepared by SMEC to assess the potential impacts of the Proposal (SMEC, 2020). Their assessment included a desktop review of background information, data and management plans. The findings of the assessment are summarised in this section and the full report is included in Appendix D.

6.2.1 Existing environment

Googong region

The Googong township is being developed on former rural farmland. Drainage in the area consists of a number of small ephemeral and semi-permanent creeks, farm dams and depressions. The nearest surface water body is Googong Dam, located 600 m east of the Googong township and is the primary potable water source for Queanbeyan.

The nearest major river is the Queanbeyan River which flows in a north-westerly direction. Googong Creek located north-east of the site flows north-east into the Queanbeyan River. North Creek flows north into the Queanbeyan River, west of Googong Creek. East of the Googong township is Montgomery Creek which

flows east into the Queanbeyan River. South Creek flows through the eastern portion of the Googong township into Montgomery Creek.

Surface water catchments

Part of the Googong township is located within the Googong Reservoir Water supply catchment. The catchment area is characterised by the ongoing Googong Township development of low-intensity grazing land, natural bushland, and rural residential land uses. There are three water courses within the Googong township catchment:

- South Creek / Montgomery Creek
- North Creek
- Googong Creek.

Each watercourse joins with the Queanbeyan River downstream of the Googong township and their catchment boundaries are shown in Figure 6.3, with the Stage AC and C surface water monitoring locations.

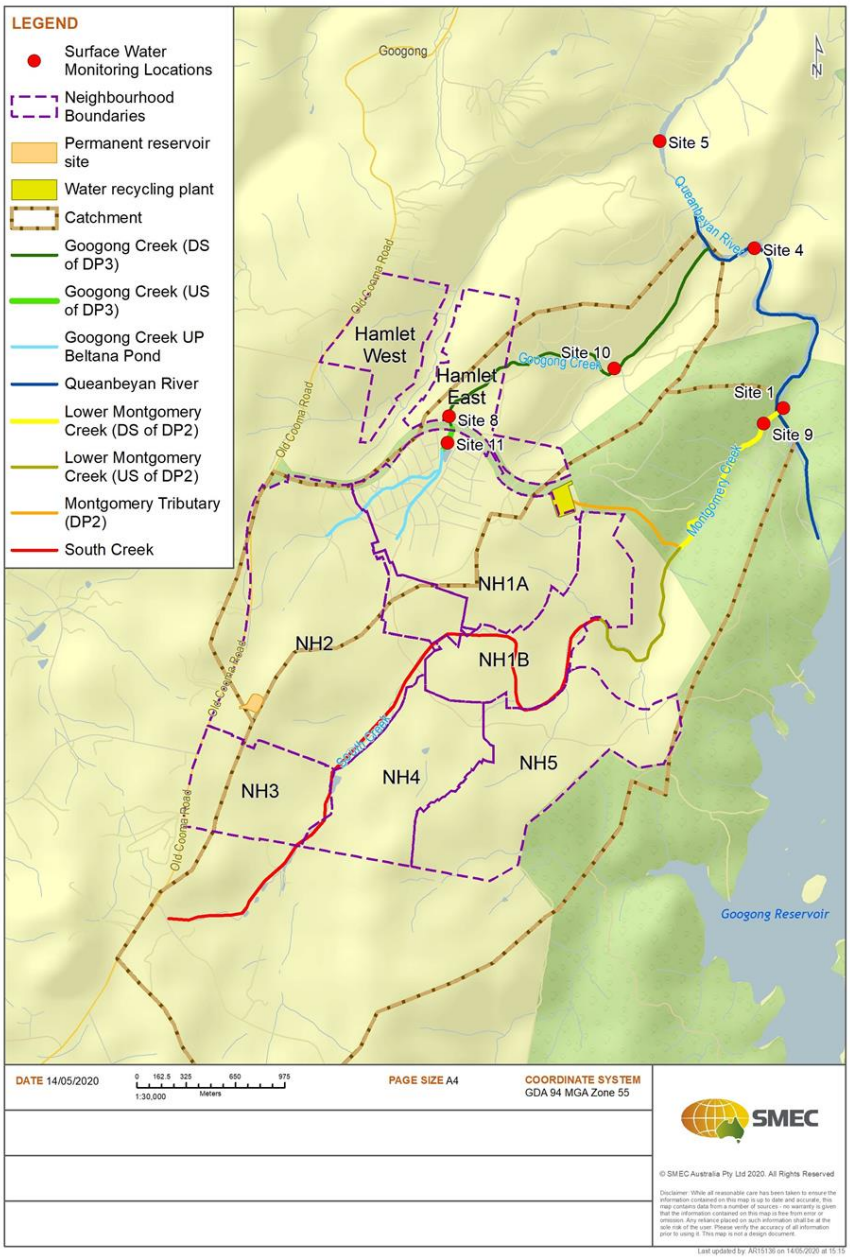

Figure 6.3 The Googong township neighbourhood boundaries with surface water catchment boundaries and monitoring locations (SMEC, 2020)

Stage C WRP development saw the commissioning of the WRP and the start of discharge of excess recycled water to Googong Creek. To date, there has been no recycled water irrigation or domestic use of recycled water, and no emergency discharges of recycled water down Montgomery Creek.

Googong Creek

Googong Creek is a small ephemeral system that flows in a north-easterly direction. Googong Creek is divided into two different reaches:

- The upper reach now forms part of the stormwater system of Googong Township to Beltana Pond
- The lower reach that connections to the Queanbeyan River.

The upper reach previously comprised of moderately sloped grassy swales with poorly define bed and bands and a number of farm dams. The system now comprises of a series of farm dams between Old Cooma Road and NH1A and terminates with a large dam that will be transformed into the Town Lake. The creek then runs through the stormwater system beneath Rockley Oval and flows north through vegetated bio-swales into Beltana Pond.

The lower reaches of Googong Creek are unaltered by the Googong township development. Googong Creek passes through open farmland, eventually joining with the Queanbeyan River. This section of the creek is narrow and shallow, characterised by a rock base. The riparian vegetation is generally good providing stability to channel margins, with isolated erosion likely due to livestock access.

Googong Creek has two surface water monitoring locations, Site 8 and Site 10. Continuous recycled water recharge to Googong Creek commenced in July 2016, after the initial trial of discharge in December 2015.

North Creek

North Creek runs almost parallel to Googong Creek and has its headwaters at Googong Road, approximately 440 m west of Old Cooma Road. The channel is steeply incised and vegetated with outcrops of rock observed in the hill slopes. The surface catchment for North Creek encompasses Hamlet East and West.

South Creek

South Creek forms the upper reaches of Montgomery Creek and is mainly a drainage line as opposed to a defined channel. South Creek is characterised by a small discontinuous channel set within a wide and flat floodplain with moderately sloped sides and a series of dams. The channel slope reduces, before becoming narrower and constrained towards the eastern boundary of the Googong township, where South Creek becomes Montgomery Creek.

Montgomery Creek

Montgomery Creek is characterised by a steep channel and valley slopes. The creek is ephemeral with several small rock pools and sparsely vegetated banks and valley sides. The development of NH1A has increased the amount of impervious areas to the north of Montgomery Creek.

At the WRP two small drainage lines, which appear spring feed, flow to the east and converge into a dam in the Googong Foreshore Protected Zone. From this dam a small creek joins Montgomery Creek and provides constant discharge to this creek, which is more vegetated than the upper reaches of Montgomery Creek. This ‘spring’ creek line is the location of the emergency discharge point for for the emergency discharge of recycled water. Montgomery Creek joins the Queanbeyan River approximately 570 metres downstream of Googong Dam.

Queanbeyan River

The Queanbeyan River downstream of Googong Dam receives surface water from Googong Creek and Montgomery Creek. Its catchment area covers around 873 km^2 and primarily consists of rural land uses. The river perennially flows in a northerly direction towards Queanbeyan and the Molonglo River. The river has been previously modified upstream by Googong Dam for water supply, altering the flow regime and quantity. The river is confined to a high valley with narrow gorges, bedrock and coarse bank material. The river banks and slopes are continuously well vegetated.

The commencement of recycled water discharge to Googong Creek occurred in July 2016, and the volume of recycled water being discharged is slowly increasing, with the volume in 2019 approaching 0.01 m^3/s.

The Queanbeyan River flow at the Wickerslack Gauge, downstream of the junction with Googong Creek, is presented in Figure 6.4.

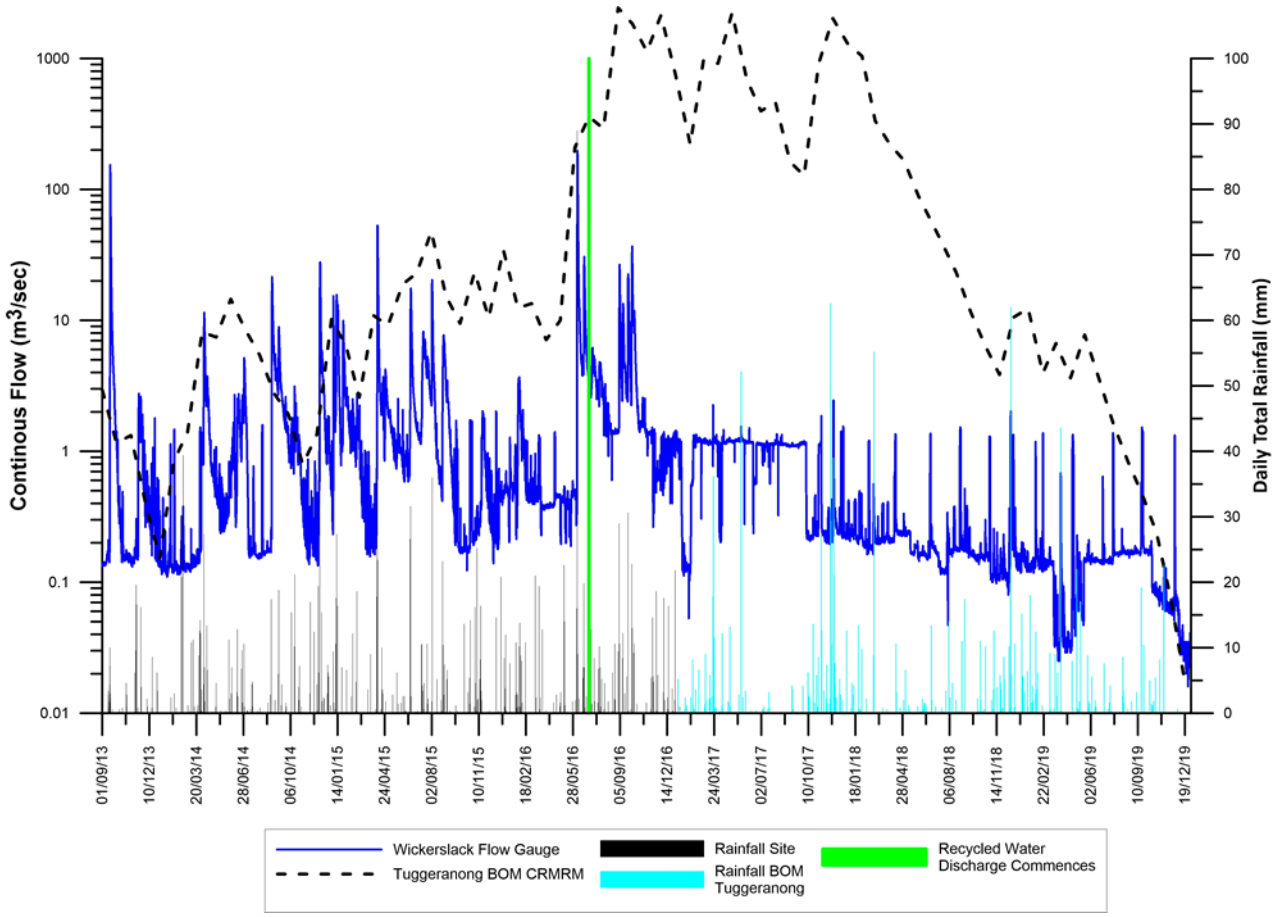

Figure 6.4 Queanbeyan River flow at Wickerslack Gauge September 2013 to December 2019 (SMEC, 2020)

Surface water monitoring

There are nine surface water monitoring locations within Googong township as required by Stage AB and C project approvals. Baseline surface water quality monitoring was undertaken between November 2013 and December 2014, and monitoring activities are prescribed by the Water Management Plan (WMP) (RPS, 2018). Since the baseline monitoring, QPRC have elected to make changes to the monitoring locations, which were approved by NSW under the approved WMP change protocols. These changes are as follows:

- Site 2 and Site 3, both located on the Queanbeyan river, were removed due to access difficulties
- Site 8, on Googong Creek, was moved upstream towards Beltana Pond due to low flows being observed
- Site 10, near the former Site 8 location, was added following the Stage C WRP hydrogeological assessment recommendations in 2016
- Site 11, in Beltana Pond, was added to assess the quality of surface water entering Googong Creek upstream of the excess recycled water Discharge Point 3.

The original baseline surface water monitoring locations are shown in Figure 6.5 , and the updated monitoring locations are shown in Figure 6.3.

The private bore survey identified two bores along Googong Creek, north of the Googong township, which are potential groundwater beneficial users. GTPL also indicated there are some potential surface water users who draw water directly from the Queanbeyan River which have been observed by SMEC.

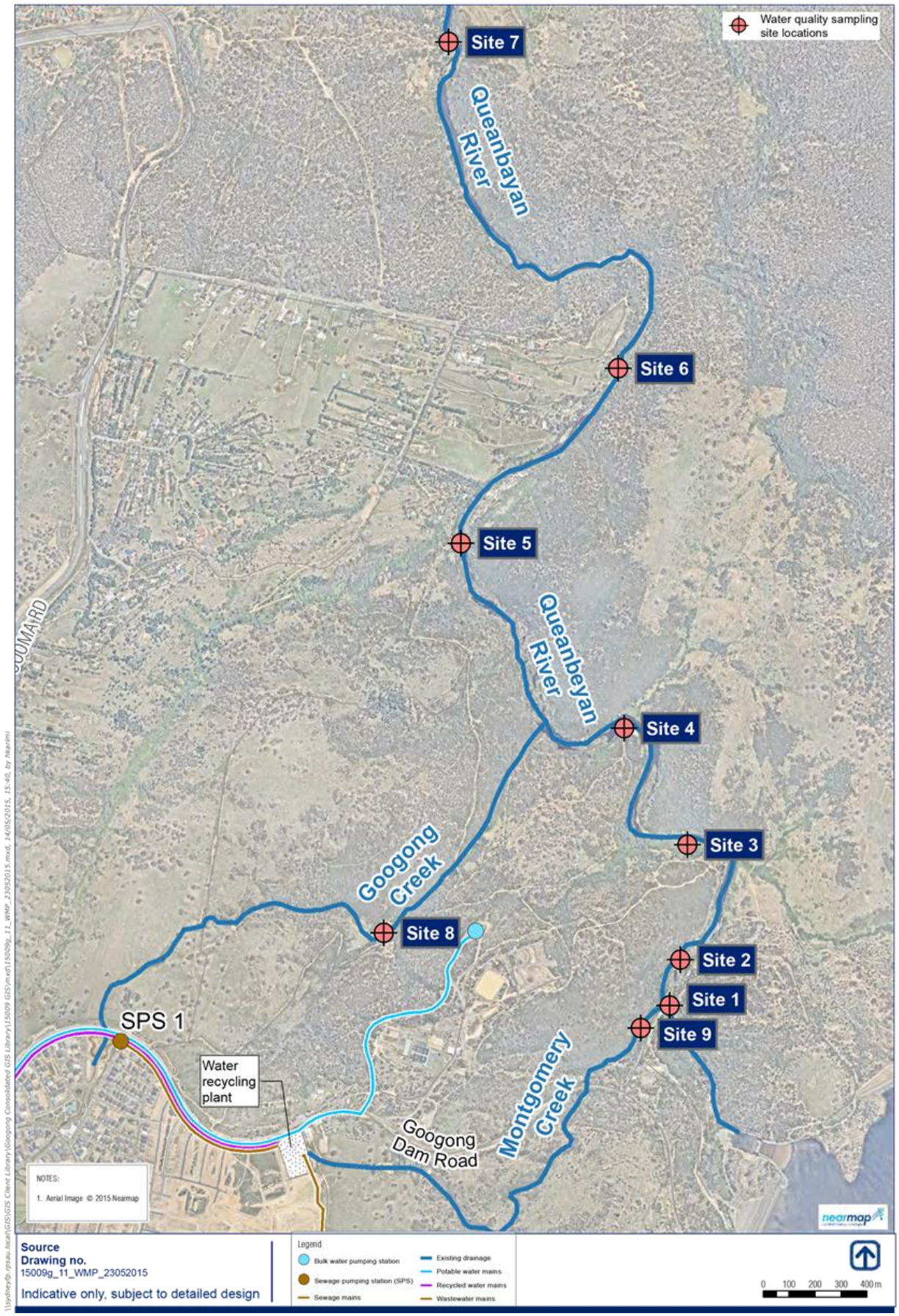

Figure 6.5 Original baseline surface water monitoring locations (Source: WMP)

Climate

The Googong climate is temperate and characterised by warm dry summers and cold winters. Rainfall is distributed fairly evenly throughout the year with the winter months generally being slightly drier. Average annual rainfall at the Googong Township is approximately 590 mm, compared to the 595 mm annual average for the region. Climate data is shown below in Figure 6.6 and Figure 6.7.

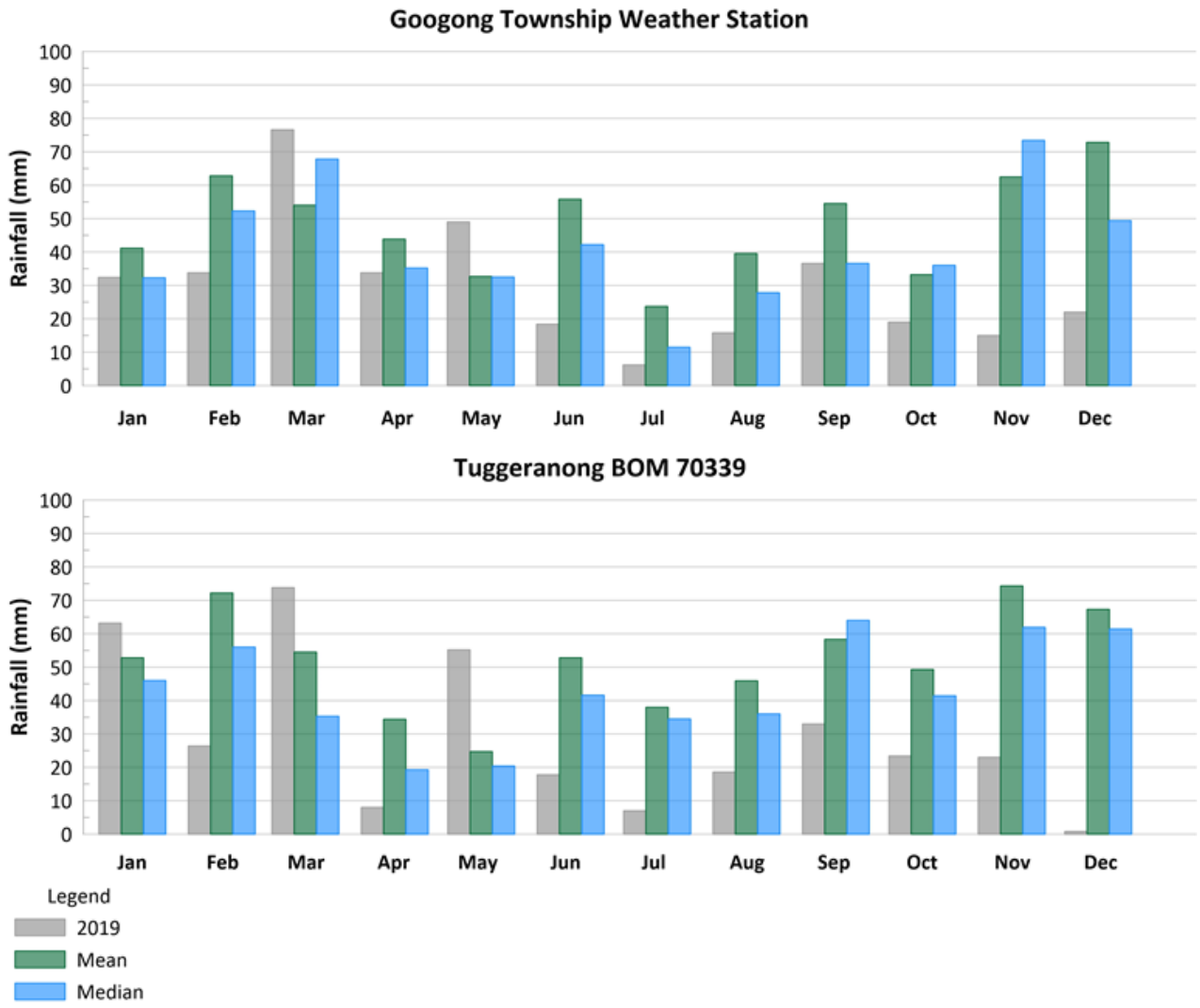

Figure 6.6 Googong township weather station and BOM weather station Tuggeranong monthly rainfall summary (SMEC, 2020)

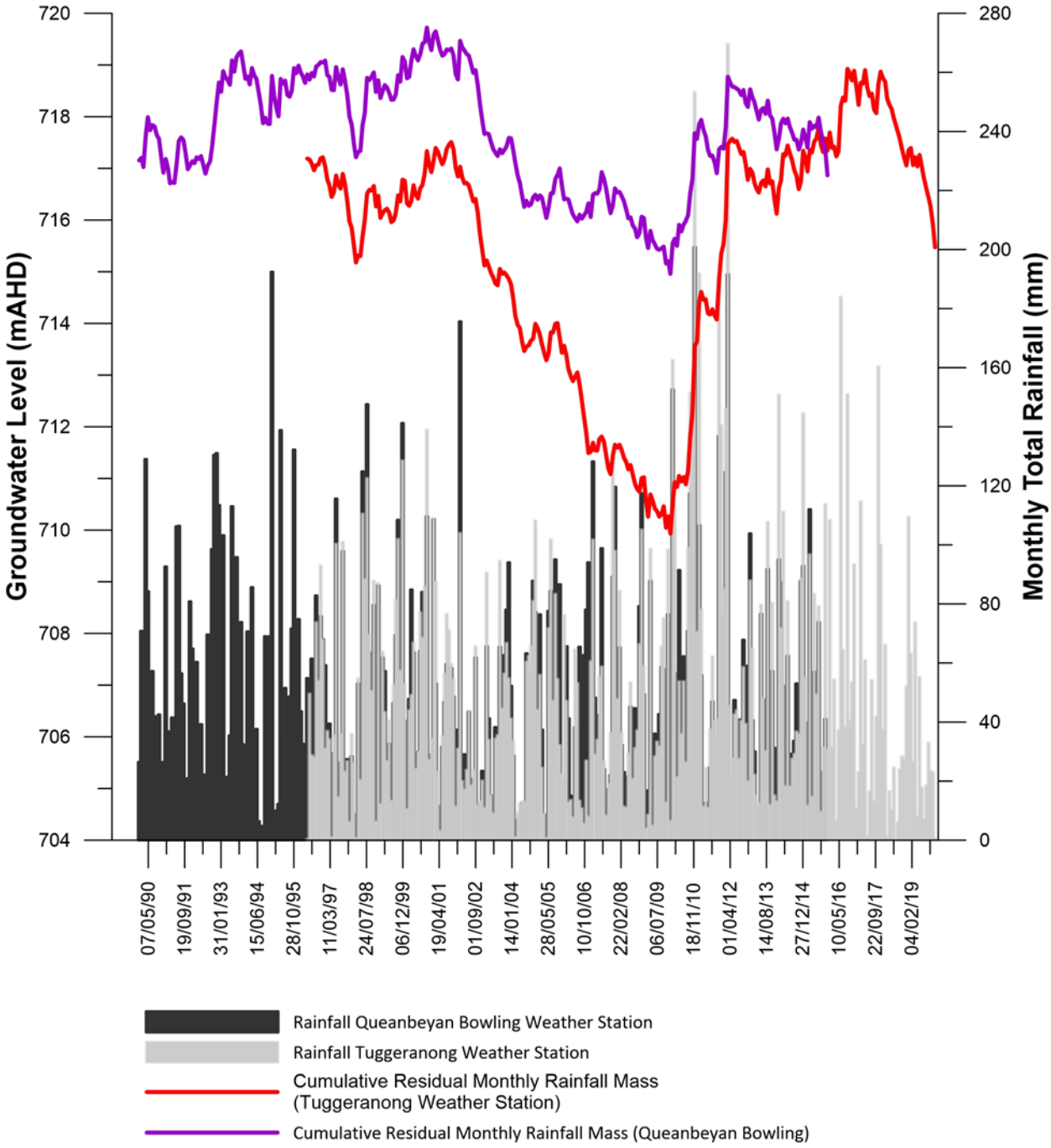

Figure 6.7 Monthly rainfall and cumulative residual rainfall mass from 1990 to 2019 (SMEC, 2020)

WRP

The WRP is located within the north-eastern boundary of the Googong township off Googong Road. To the west of the WRP are residential houses; to the south is Duncan Fields; to the north is Googong Road and farmland; and to the east is the Googong Foreshores protection area surrounding Googong Dam. The nearest surface water body is the ephemeral Montgomery Creek which flows into the Queanbeyan River, followed by the reservoir of Googong Dam.

There are three recycled water discharge locations for Stage D of the IWC Project, described in Section 3.7 and shown in Figure 3.8, which include:

- Discharge Point 1 – an EPA-licenced discharge point where recycled water in excess of Googong township demand may then discharge via a series of overland flow stormwater ponds in NH2 and the

NH2 stormwater management system and flow into Beltana Pond. This discharge point is anticipated to come online in Q3 2020.

- Discharge Point 3 – an EPA-licenced discharge point where either excess recycled water or recycled water that does not meet the Essential Sewage and Recycled Water Quality Management Plan (RWQMP) criteria but meets discharge criteria detailed in an operational Environmental Protection Licence is discharged. Discharge has been occurring at this location since 2016.
- An emergency discharge point at the WRP – an unlicensed discharge point where emergency only discharge would flow into Montgomery Creek.

Surface drainage

Surface water drainage in the vicinity of the WRP is predominantly east to south-east towards the foreshore boundary and drainage lines which feed into Montgomery Creek (refer to Figure 6.8). Within the WRP compound surface drainage is contained within the site.

The WRP is designed with three types of surface water drainage systems:

1. First Flush – all the areas which are considered 'dirty' and likely to have had raw sewage/dirty water contact the surface drains to a first flush tank. This has been designed to capture the first 10 mm rainfall across all of the dirty areas – this water is put back to the head of works as soon as possible.
2. Chemical drainage – all areas that could be contaminated with chemicals drain to the neutralisation pit which is then treated and put back to head of works.
3. Stormwater – all other areas drain to stormwater and are discharged directly to the Montgomery creek outlet.

Surface water quality

Montgomery Creek is the nearest surface water body to the WRP and receives any emergency discharge water. To date there have been no emergency discharges of water from the WRP. Montgomery Creek surface water Site 9 (of the WMP surface water monitoring program) is ephemeral and at times is dry. The field pH ranges from 6.5 to 8.5 and the field EC ranges from 94 µS/cm to 790 µS/cm. TDS ranges from 95 mg/L to 530 mg/L with total suspended solids (TSS) ranging from < 5 mg/L to 170 mg/L. When above the laboratory limit of detection TDS is generally higher than the other surface water monitoring sites.

Permanent Reservoirs

The Stage D Permanent Reservoirs are located in NH2 in the south-west of the site, approximately 200 m from Old Cooma Road. The existing site consists of a 4.0 ML reservoir within a hardstand compound, with two storage tanks already constructed as part of the Stage AB works. The site is located in the saddle of the hill.

The area surrounding the Permanent Reservoirs site is currently farmland but would be developed as open space and residential areas within NH2 and NH3. Approximately 3.5 km to the east is the Googong Foreshores protection area surrounding Googong Dam. The nearest surface water body is the ephemeral South Creek, located approximately 650 metres to the east.

Surface drainage

The majority of surface water within the compound is collected and managed within the site. Around the compound, with the exception of the chemical storage areas, surface water drainage follows the topography and the land and is generally to the north-west and west (refer to Figure 6.8). Discharge Point 1 is located north-west of the reservoir and forms the start of the overland flow system for excess recycled water. On the eastern side of the Permanent Reservoir sites surface water may also flow east towards South Creek.

Currently, there are no water quality monitoring sites in South Creek.

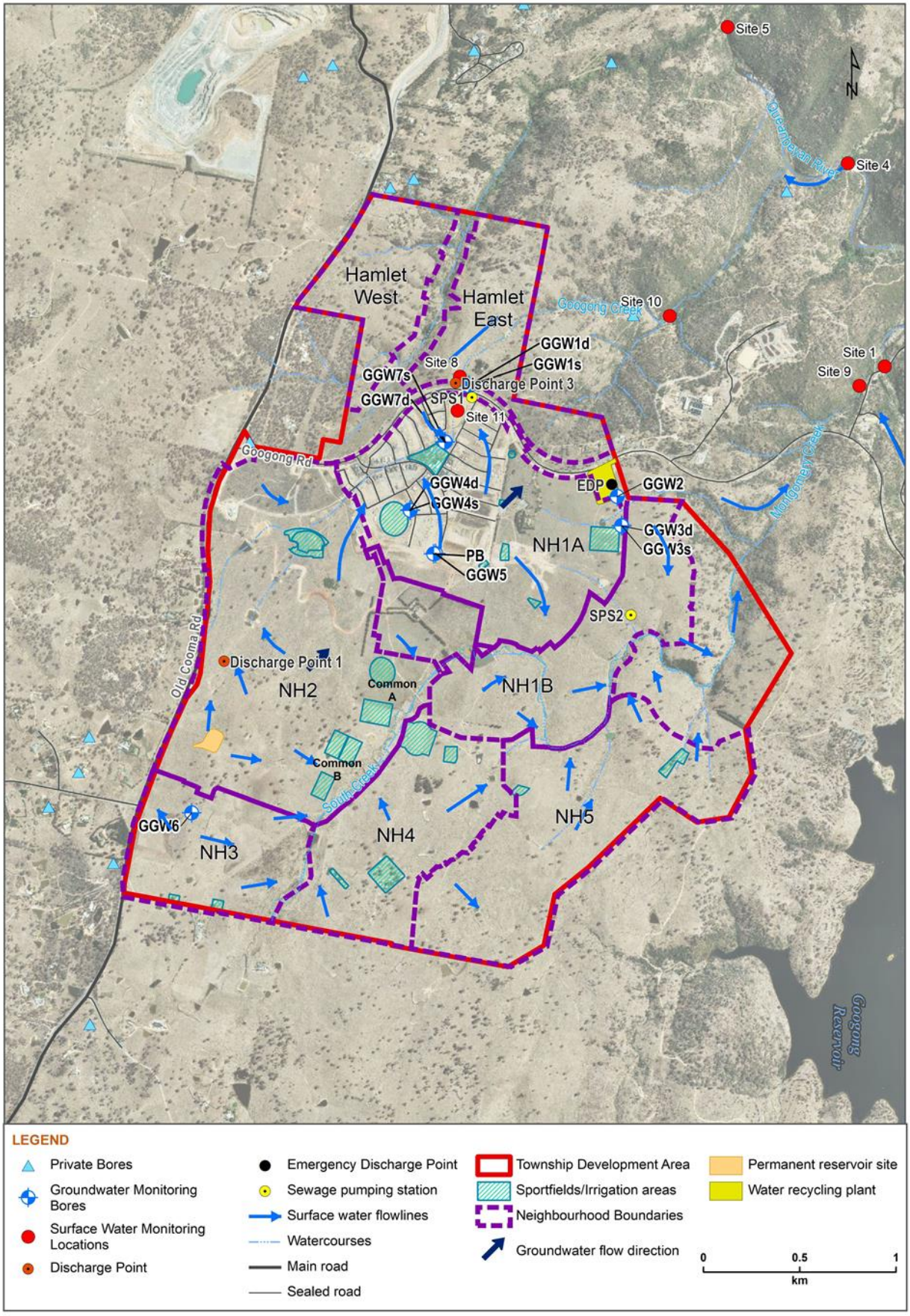

Figure 6.8 Location of the current recycled water discharge locations with inferred surface water drainage

6.2.2 Potential impacts

Construction

The surface water assessment determined that construction related impacts to the surface water are likely to be minor and would be contained within the existing IWC infrastructure. Earthworks would disturb the soil profile and may cause additional sediment load to surface water. Any impacts are likely short lived and are not anticipated to have significant long-term impacts on the water quality of the Queanbeyan River and are not anticipated to impact on the water quality of the Googong Reservoir.

It is noted mobilisation of sediment may increase the presence of heavy metals within the surface water which are not currently assessed in the surface water monitoring analysis suite.

WRP

The Stage C WRP site layout included provisions for Stage D infrastructure and therefore extensive earthworks would not be required for Proposal. Any earthworks for the foundations of new infrastructure has to potential to expose the shallow rock profile and any placed material. Additionally, the use of the temporary construction access has the potential to result in topsoil stripping, placement and compaction of materials. However, the temporary construction access would be used within the existing footprint and rehabilitated following construction.

Construction of the Proposal at the WRP has the potential to result in the following temporary and minor impacts:

- Degradation and erosion of the temporary construction access
- Sediment discharge to the drainage line from the road construction
- Spills of chemicals from decommissioned and disassembled plant
- Contaminated surface run off.

Permanent Reservoirs

The Stage C Permanent Reservoirs site layout included provided for Stage D infrastructure and therefore extensive earthworks would also not be required. The main access to the Permanent Reservoir site is from Old Cooma Road via a sealed access road and no further access ways would be required.

Construction of the Proposal at the Permanent Reservoirs has the potential to result in the following temporary and minor impacts:

- Sediment discharge during the removal of the earth bund
- Spills of chemicals from decommissioned and disassembled plant
- Contaminated surface run off.

Operation

The potential operational impacts of the WRP and Permanent Reservoirs relate to spills of dosing chemicals, leaking pipes and tanks and emergency discharges releases. These operational impacts are considered relatively unlikely and would be contained within the IWC system, with the exception of the emergency discharges.

Impacts of the emergency discharge of partially treated wastewater down Montgomery Creek would be rare and short-lived, and are not proposed to be mitigated any further than the current WRP design allows. Since the operation of the WRP commenced in 2016, there have been no reported emergency discharge events from the WRP. Massive failure of Permanent Reservoirs is also considered unlikely and any discharge would likely be contained with flows directed to Discharge Point 1, the overland flow system and into the NH2 stormwater system.

The potential operational impacts of open space irrigation with recycled water include:

- Over-application of water leading to surface ponding or run-off

- Spray drift
- Pipe failure resulting to a flow of excess water.

As the irrigated areas are considered unlikely to contribute significant volumes of water to the surface water system these impacts are considered to be unlikely. Furthermore, proposed volumes and irrigation schedules are managed by the Irrigation Management Plan (RPS, 2018). Run-off from these irrigated areas would be managed within the stormwater management system.

Operational impacts of excess recycled water discharge

During operation of Stages AB and C of the IWC, excess recycled water has been discharged from Discharge Point 3 on Googong Creek, just below Beltana Pond, while the ultimate discharge location of Discharge Point 1 in Neighbourhood 2 was being constructed and approval for use of recycled water in the Googong township was sought.

The retention of Discharge Point 3 as the main location for excess recycled water and off-spec recycled water discharge is now proposed. As such, this change would mean that the bio-retention basins, vegetated swales, and wetland element of the Googong township stormwater management systems would not typically receive excess recycled water. These elements of the Googong township stormwater management system are designed to capture, reduce, and in some instances, remove excess nitrogen and phosphorous. Beltana Pond has been designed with passive water flow to ensure water is regularly passed through the wetland and a recirculation pump to provide increased oxygenation. As less water would pass through the system, the operation of Stage D would also result in less recycled water recharging the shallow groundwater system and more surface flow reaching the Queanbeyan River.

Stantec have estimated for the total project at completion the average excess recycled water to discharge to the environment is 1029 kL/day to a maximum of 5477 kL/day. This equates to around 0.01 m3/s to 0.06 m3/sec of discharge to Googong Creek compared to the 2019 discharge which was around 700 kL/day which equates to around 0.008m3/s.

The potential impacts of increased recycled water discharge include:

- Waterlogging of soils, erosion of creek bed and banks, and elevated nutrient load to the Queanbeyan River
- Increased surface flow in Googong Creek reporting to the Queanbeyan River during wet periods
- Increased total suspended solids/TDS, nutrient and metals load to surface water
- Erosion in Googong Creek from increased flow.

Discharge of excess recycled water must meet the EPL conditions and is not considered likely to have a significant impact on the quality of surface water. Monitoring results to date show the receiving waters of the Queanbeyan River do not appear to be adversely impacted by the recycled water discharge.

Current discharges have resulted in a more constant flow of water through Googong Creek. The surface water assessment and discharge modelling identified that it is likely to be minimal to no excess recycled water discharged as an environmental flow to Googong Creek in the summer months and higher volumes in the winter months. This would be a significant change from the current conditions, returning Googong Creek to a more ephemeral state. This would also lead to a shift in macroinvertebrate and diatom aquatic characteristics, potentially similar to those observed in the baseline studies.

6.2.3 Mitigation measures

Construction

Construction activities for the Proposal are not anticipated to require extensive earthworks and as such potential impacts are anticipated to be minimal. Any impact of flows into receiving waterways resulting from construction of the Proposal are likely to be negligible and measures in place within the CEMP are considered sufficient.

The following measures would be implemented as part of the CEMP:

- Surface water run-off would be captured and directed away from exposed areas and managed within the existing stormwater management system
- Bunding would be establishing during the upgrade or replacement of plant containing chemicals or biosolids to minimise the risks of spills
- Sediment and erosion controls would be installed on the drainage line near the WRP to reduce sediment transport and TDS
- Sediment trap fencing would be installed to reduce sediment transport and TDS during the removal of the existing bund at the Permanent Reservoirs and establishment of the temporary construction access at the WRP.

It is also recommended that an additional surface water monitoring location be established on South Creek, downgradient of Common A and Sporting Field 7, to monitor surface water near Hill 800 not contained with the IWC system.

Operation

A Water Management Plan (WMP) (RPS, 2018) has been prepared for the IWC Project, which outlines the procedures and practices to manage potential impacts on surface water and groundwater systems during operation of the IWC Project. The WMP and associated sub-plans would be revised and amended to reflect the increased operational capacity of the WRP and Permanent Reservoirs, and additional mitigation and management requirements. The sub-plans that would be revised include:

- Surface Water and Aquatic Ecology Monitoring Program
- Surface and Groundwater Response Plan
- Groundwater Monitoring Program
- Recycled Water Flow Release Protocol
- Irrigation Management Plan.

Surface water monitoring for the operational impacts of the WRP and Permanent Reservoirs is unlikely to be necessary. In the event of spills that are not captured by the IWC system, an event-based surface water monitoring of the nearest receiving waterbody may be considered and would target relevant parameters. Further, monitoring is recommended in the proposed NH2 Town Lake as water from this lake flows to Beltana Pond via the stormwater system. NH2 Town Lake receives discharge from Discharge Point 1.

Monitoring of the potential operational impacts of excess recycled water discharge under the Surface Water (Aquatic Ecology) Monitoring Program (SWAEMP) would continue for at least the first year of irrigation with recycled water with the removal of Site 6 and Site 7 from the program and the addition of heavy metals testing at all sites. Monitoring at Site 11 would continue to compare the quality of the water in Beltana Pond with the recycled water discharge. The SWAEMP trigger levels for total nitrogen at Site 8 would continue to exceed with the discharge of recycled water and should be revised to the EPL limit.

Other mitigation measures to reduce potential impacts to surface water include:

- The temporary sediment fence at Site 8 would be replaced with a more permanent series of gabion walls and smaller bio-swales/wetlands within the aim of minimising pooled water areas while also improving water quality.
- A series of gabion walls would be installed in the lower reaches of Googong Creek to reduce flow velocity and minimise erosion in the plateau area between Beltana Pond and the existing dam on Googong Creek (located approximately 200 m downstream of Discharge Point 3)
- Heavy metals analysis would be added to the surface water monitoring program, including monitoring for metals with a bio-accumulated toxicity
- Diatoms and macroinvertebrates surveys would be reviewed after two years of irrigation with recycled water.

In addition, the frequency and locations of surface water monitoring would be reviewed after the first year of irrigation with recycled water. Site 7 would only be considered if significant impacts were observed at Site 5 that may be attributed to the discharge of excess recycled water.

6.3 Groundwater

A groundwater assessment has been prepared by SMEC to assess the potential impacts of the Proposal (SMEC, 2020). Their assessment included a review of existing hydrogeological information for the WRP. Permanent Reservoirs and public space irrigation sites, and an update of the existing groundwater model to predict potential impacts associated with the Proposal. The findings of the assessment are summarised in this section and the full report is included in Appendix E.

6.3.1 Existing environment

Overview

Groundwater within the Googong area is hosted in a regionally extensive fractured-rock aquifer. Minor alluvial aquifers are located along the alignment of locally significant waters, but these are expected to have minimal storage and not be of significant to this assessment. The depth to bedrock is expected to be between one to two metres, with fresh bedrock encountered at shallower depths at higher elevations and marked changes of slope. Shallow groundwater is expected to migrate along the interface between the soil horizons and relatively fresh bedrock, and to discharge to surface water drainage lines and creeks (SMEC, 2015a).

Aquifer type

Groundwater is hosted in a regionally extensive, unconfined to semi-confined fractured rock aquifer. Structural features thought to be significant to groundwater flow at the Googong township include local and regional faults, joints, fractures, and cleavage.

Groundwater recharge

Rainfall recharge of fractured-rock aquifers occurs through areas of open fracturing, either at the surface or through superficial unconsolidated material. In some cases, there may be a delay between a rainfall event and the entry of water into the aquifer, due to storage in the unconsolidated material of the recharge zone.

Recharge of the aquifers would occur mainly via infiltration of rainfall, infiltration of slope runoff, and outflow from the Queanbeyan River and Jerrabomberra Creek (and other watercourses) during periods of high flow and flooding events. Overall, recharge in the area is expected to be limited by the generally low rainfall, particularly during winter months.

Groundwater discharge

Discharge from the aquifer is primarily through natural flow from springs, both perennial and ephemeral, and from baseflow into perennial watercourses. Other discharges from the aquifer include bore pumping for domestic and stock purposes, whilst some localised irrigation is also possible. A potential spring was observed at the site in the vicinity of the WRP during the baseline groundwater monitoring program. The original assessment for Stage 1 works did not note any springs or ‘soaks’ but it is noted that the assessment was carried out in a relatively dry period. Commonly in rural farmland springs are often converted into dams as was the case with the original farm dams located at the WRP.

Monitoring bore network

A dedicated groundwater monitoring network was established within Googong in August 2013 and consists of 11 monitoring bores across seven different locations. Regional groundwater flow direction is north-east towards the Queanbeyan River and located shallow groundwater flows towards the main drainage lines i.e. north towards Googong Creek or east towards Googong Reservoir. Since August 2013, the following changes to the groundwater bores have been made:

- PB was decommissioned after the pumping test was completed in 2013
- GGW2 was decommissioned in August 2015 and preplaced in October 2015 to make way for WRP construction
- GGW5 was raised between December 2013 and March 2014 as part of the road construction; and
- GGW3S and GGW3D were raised as part of the development of Duncan Sporting Fields between September and October 2014.

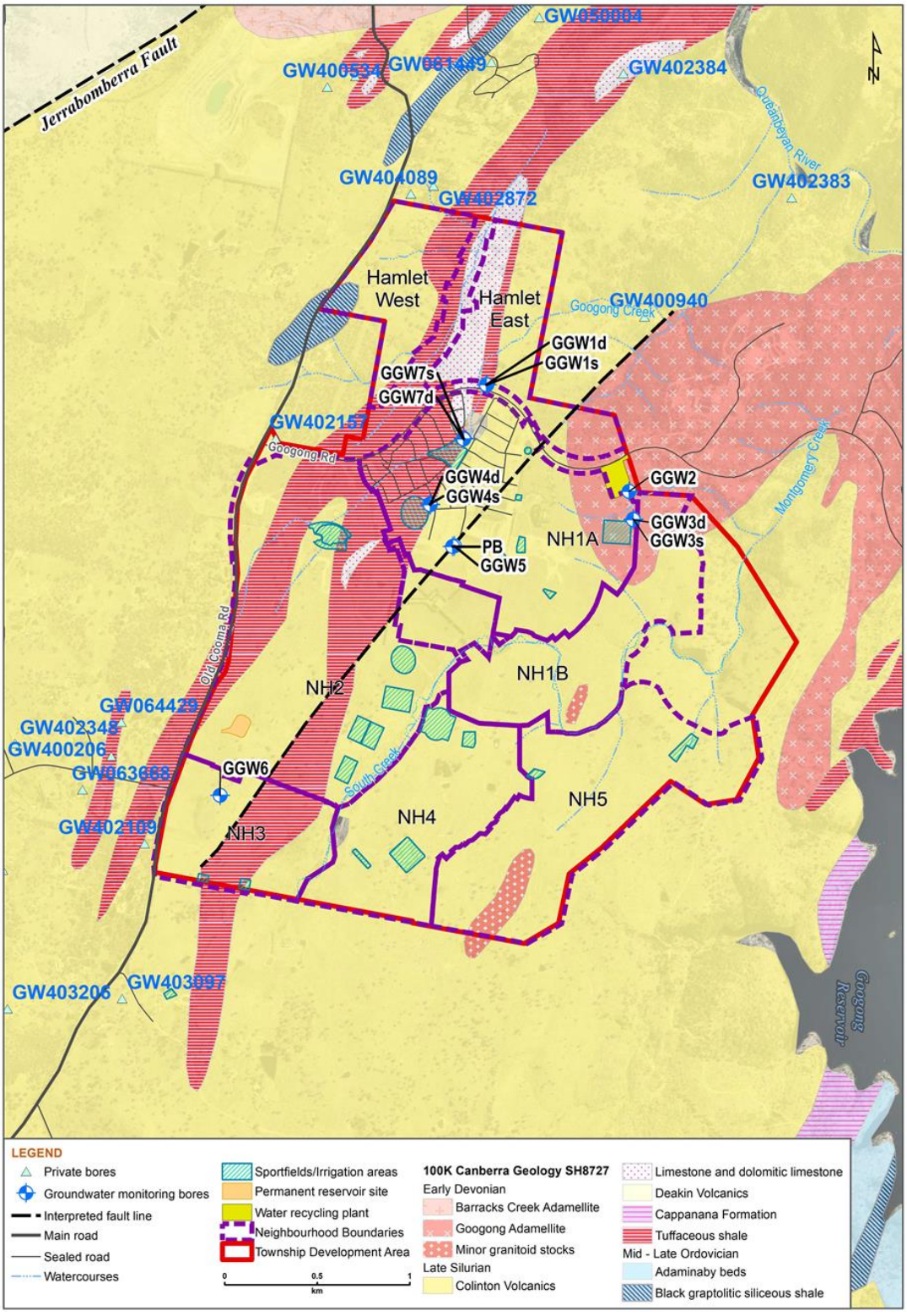

Figure 6.9 Googong township geological map and monitoring bore locations (SMEC, 2020)

Table 6.3 Summary of groundwater monitoring bore network details

Bore ID	Total depth drilled (m)	Final airlift yield (L/sec)	Screened lithology	Description of location
GGW1S	10.5	NA	Limestone / shale	Immediately north of Googong Road and Beltana Pond irrigation area
GGW1D	19.0	0.14	Shale / limestone	Immediately north of Googong Road and Beltana Pond irrigation area
GGW2[1]	8.0	NA	Adamellite / dacite	South-eastern corner of WRP, within future drainage reserve
GGW2A	19.2	<0.1	Adamellite / dacite	South-eastern corner of WRP, within future drainage reserve
GGW3S	7.0	NA	Adamellite	North-eastern corner of second sports field and irrigation area
GGW3D	25.6	0.03	Dacite	North-eastern corner of second sports field and irrigation area
GGW4S	7.0	NA	Shale / phyllite	North-eastern corner of second sports field and irrigation area
GGW4D	55.0	0.05	Shale / phyllite	North-eastern edge of first recreational reserve and irrigation area
GGW5	43.0	0.02	Dacite	Near top of ridge between Googong and Montgomery creeks
GGW6	43.0	0.16	Dacite	Accessible location near top of hill between Jerrabomberra and Montgomery Creeks (control site)
GGW7S	3.0	NA	Fill – sandy clay	Within Beltana Park, close to Club Googong and an irrigated area
GGW7D	19.0	NS	Shale / phyllite	Within Beltana Park, close to Club Googong and an irrigated area
PB	66.0	0.07	Dacite	Near top of ridge between Googong and Montgomery creeks

(1) GGW2 was decommissioned in 2015 and replaced by GGW2A.

Bore yields and aquifer hydraulic properties

Yields for the boreholes drilled in the Late Silurian aged Colinton Volcanics throughout the Googong district vary from less than 0.1 L/s to up to about 10 L/s, including some into the margins of the Barracks Creek Adamellite. Most of the private bores are in the Colinton Volcanics where yields are more modest and typically range between 0.5 L/s and 1.0 L/s.

The higher-yielding bores were drilled in the ignimbrite and metasedimentary units of the Colinton Volcanics, although a few higher-yielding bores have also been drilled along the southern margin of the Barracks Creek Adamellite where natural fracturing and deeper weathering profiles are thought to exist. Boreholes that have encountered multiple water-bearing zones appear to have markedly higher yields, and in most instances yields appear to increase with depth. The highest-yielding water-bearing zones throughout the area were typically identified at depths of between 20 and 50 metres, beyond which the degree of fracturing is thought to decline markedly, particularly in the Silurian intrusions.

Groundwater utilisation/abstraction

Groundwater is anticipated to be of sufficient quality for general water supply purposes, and it may be suitable for potable use. Groundwater in the area is predominantly used for a combination of domestic and stock purposes. Of the 272 bores located within a 5 km buffer of the Googong township, all but a few are registered for such use, and only a few appear to have achieved yields that would satisfy all the water requirements of a property without some form of reliance on surface water supplies. There are no private bores located within the Googong township. There are five private bores located north of the Googong

township (within 1.5 km of the boundary) and three located to the west (within 500 m of the boundary) (refer to Figure 6.10).

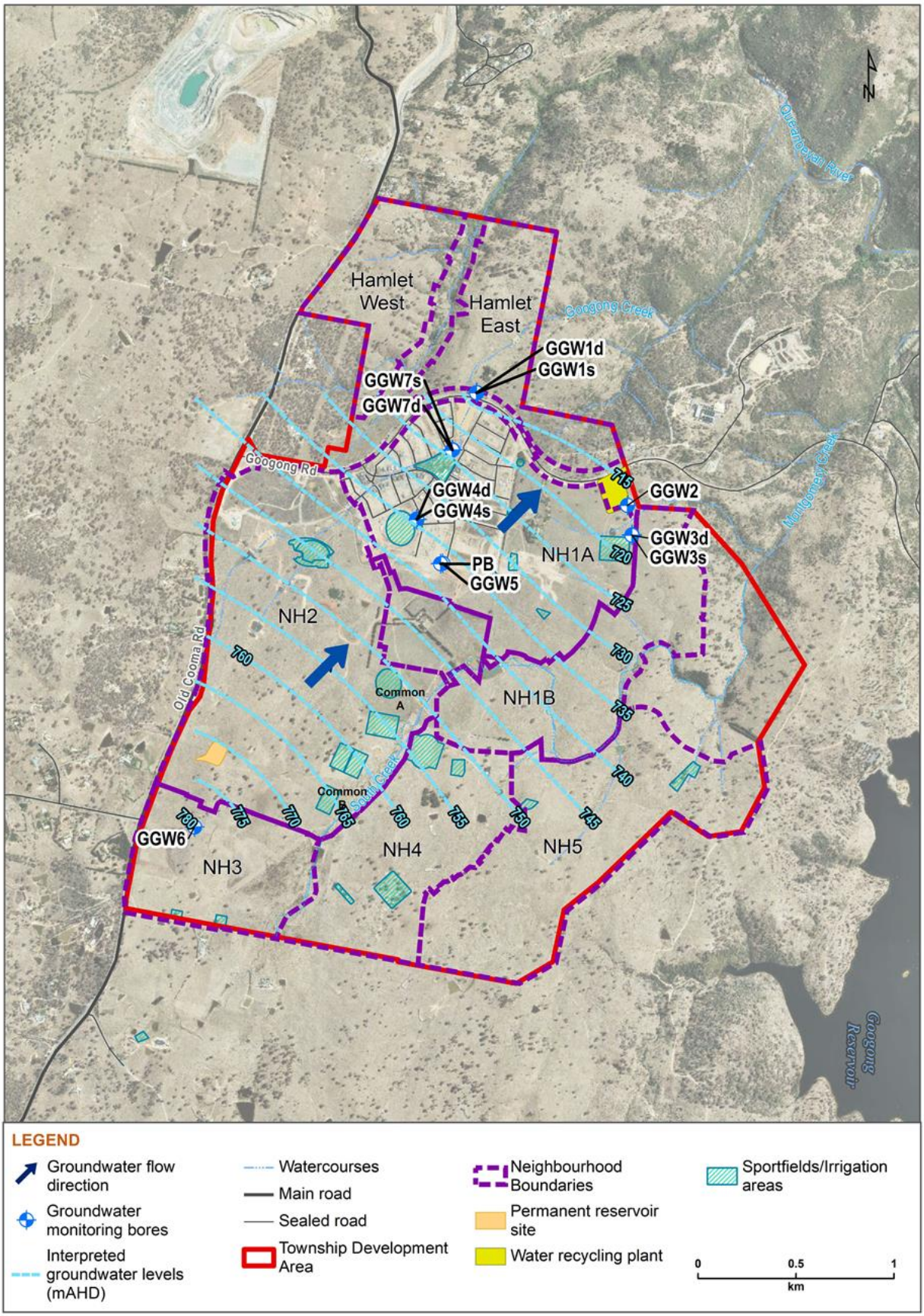

Figure 6.10 Regional groundwater contours and flow directions (SMEC, 2020)

Groundwater dependent ecosystems

The EA (Manidis Roberts, 2010) and SMEC (2020) did not identify the presence of groundwater-dependent ecosystems within the vicinity of the Googong township area. Accordingly, it was determined that impacts on groundwater dependent ecosystems resulting from operation of the IWC Project are unlikely.

Groundwater quality

Groundwater monitoring has been undertaken at 11 locations as part of the pre-operational phase of the IWC Project Stage 1. The background monitoring observed the following field groundwater quality ranges:

- Field electrical conductivity (EC) (shallow): 425 µS/cm to 2166 µS/cm
- Field EC (deep): 425 µS/cm to 2887 µS/cm
- Field pH (shallow): 6.5 to 8.8; and
- Field pH (deep): 5.8 to 8.3.

The installation of EC data loggers in late 2014 in selected monitoring bores was to assess fluctuations in EC with rainfall and recycled water irrigation, as shown on Figure 6.11. Figure 6.11 also presents the EC logger data from monitoring bores with irrigation volume at Rockley Oval and Duncan Sport Fields and does not show any clear correlation of increases in EC with irrigation compared to trends observed in other bores. It should also be noted that irrigation is currently with potable water, and recycled water irrigation is planned to commence in Q3 2020.

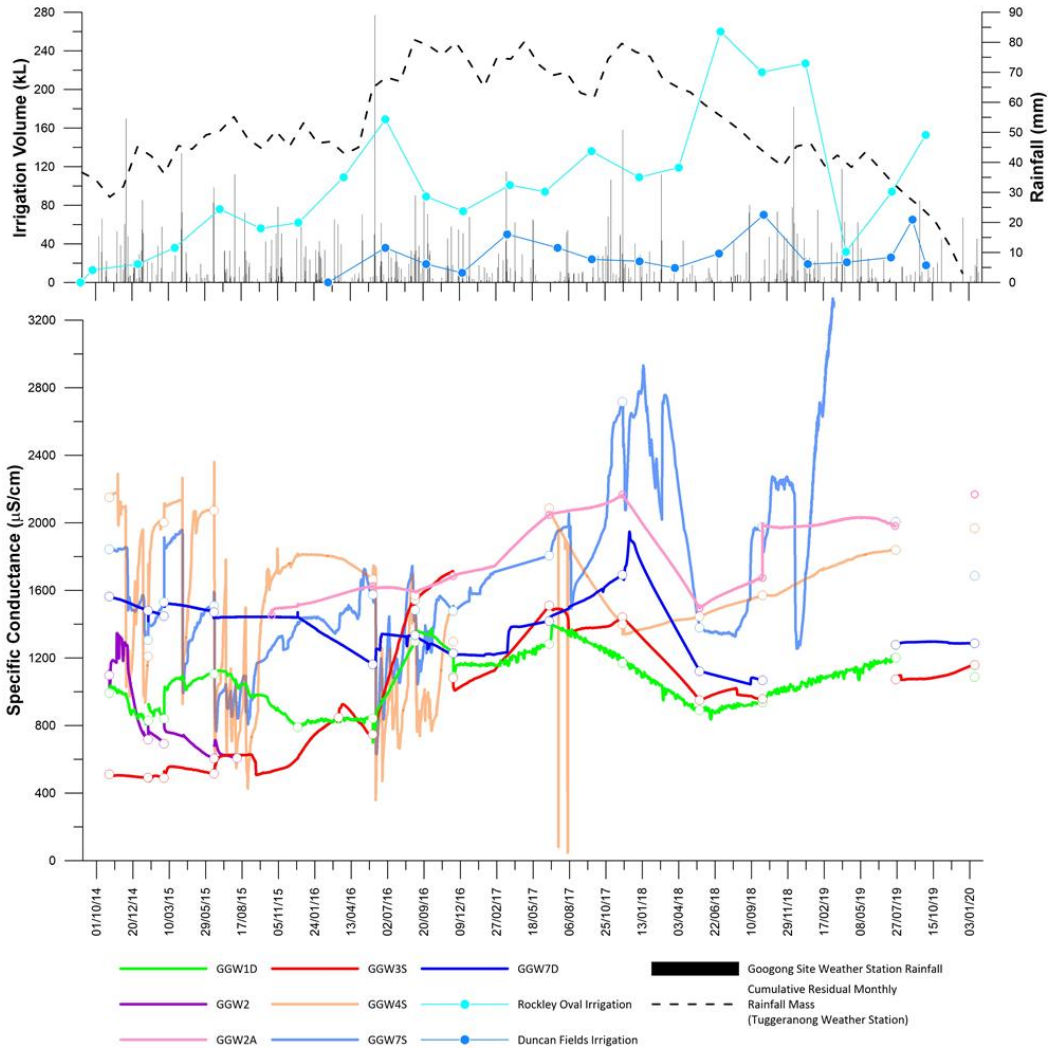

Figure 6.11 EC data logger results October 2014 to January 2020 with rainfall, cumulative residual monthly rainfall mass (CRMRM) and potable irrigation volume (SMEC, 2020)

The groundwater chemistry results indicate the water type is generally bicarbonate dominate, sulphate type with variable metals. Figure 6.12 presents a piper diagram of the monitoring results from 2013 to 2019. The results show groundwater clusters into generally two distinctive groupings. GGW3S and GGW2 are distinctly different from the other groundwater bores, reflecting screening within the Googong adamellite. GGW1S is slightly distinct from the main cluster, reflecting the limestone lithology due to the increased calcium component. GGW2A is distinctly different from the main sample groups, with increased sodium and chloride, and may reflect influence from potable irrigation water due to the presence of fluoride and free chlorine. GGW4S and GGW4D are two distinct clusters of points, reflecting the difference between the weathered shale and fresh shale.

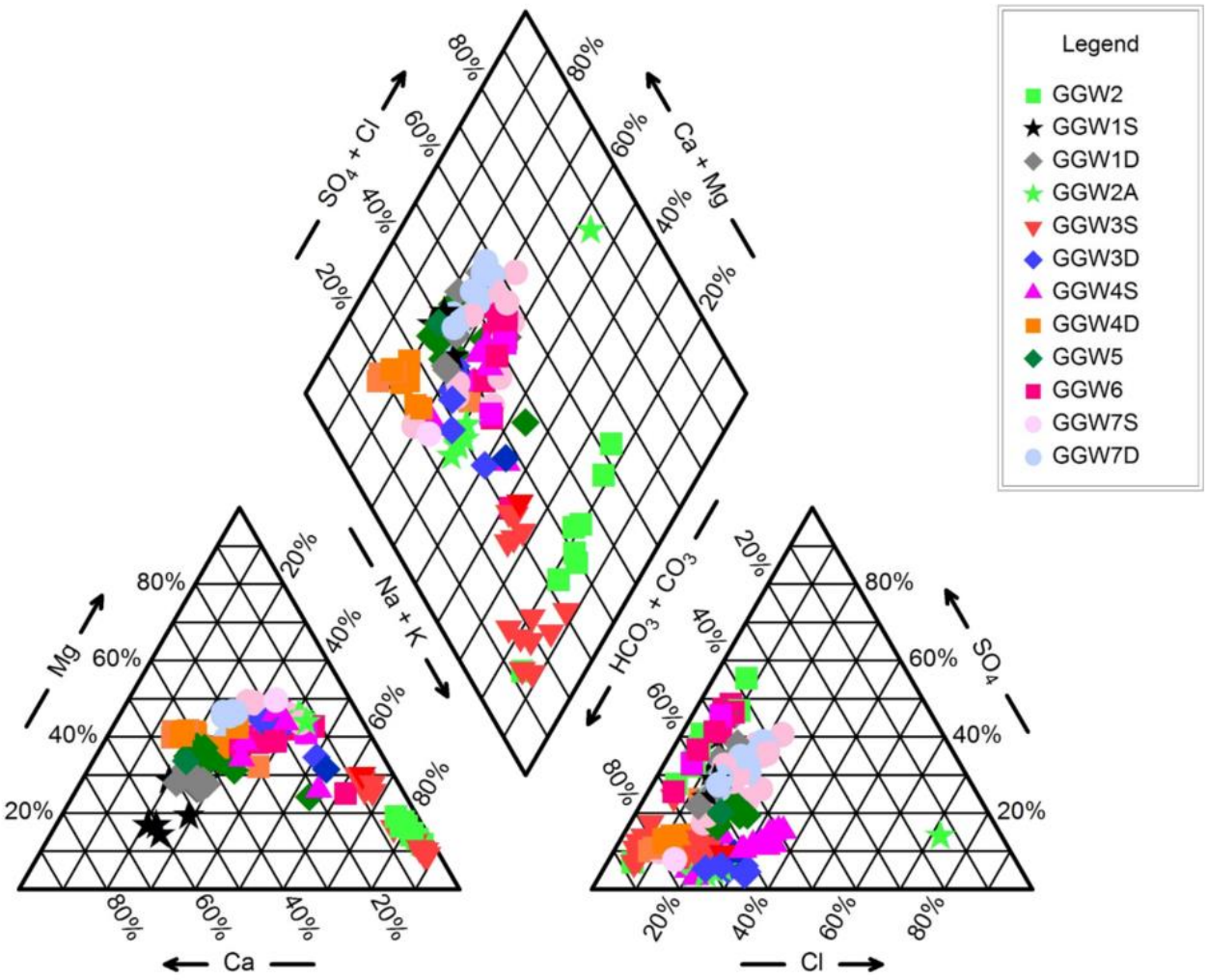

Figure 6.12 Piper diagram of groundwater chemistry 2013 to 2019 (SMEC, 2020)

Nutrients observed in the groundwater likely reflect the rural land use history of the site and disturbances caused during previous stages of construction. Figure 6.13 shows the TDS in groundwater from 2013 to 2019. Most monitoring bores show short durations of increase which are likely related to excavation activities within the Googong township development.

Increases in TDS concentrations at GGW3S and GGW3D may indicate potential impacts to the groundwater from construction activities or may also be as a result of flooding of the boreholes, which was observed following a significant rain event in June 2014. Increased TDS observed in GGW1D in January 2015 is also thought to be related to rainfall events prior, localised earthworks, and increased discharge from Beltana Pond into Googong Creek. From August 2016, increased TDS may be related to the discharge of recycled water to Googong Creek (refer to Figure 6.13).

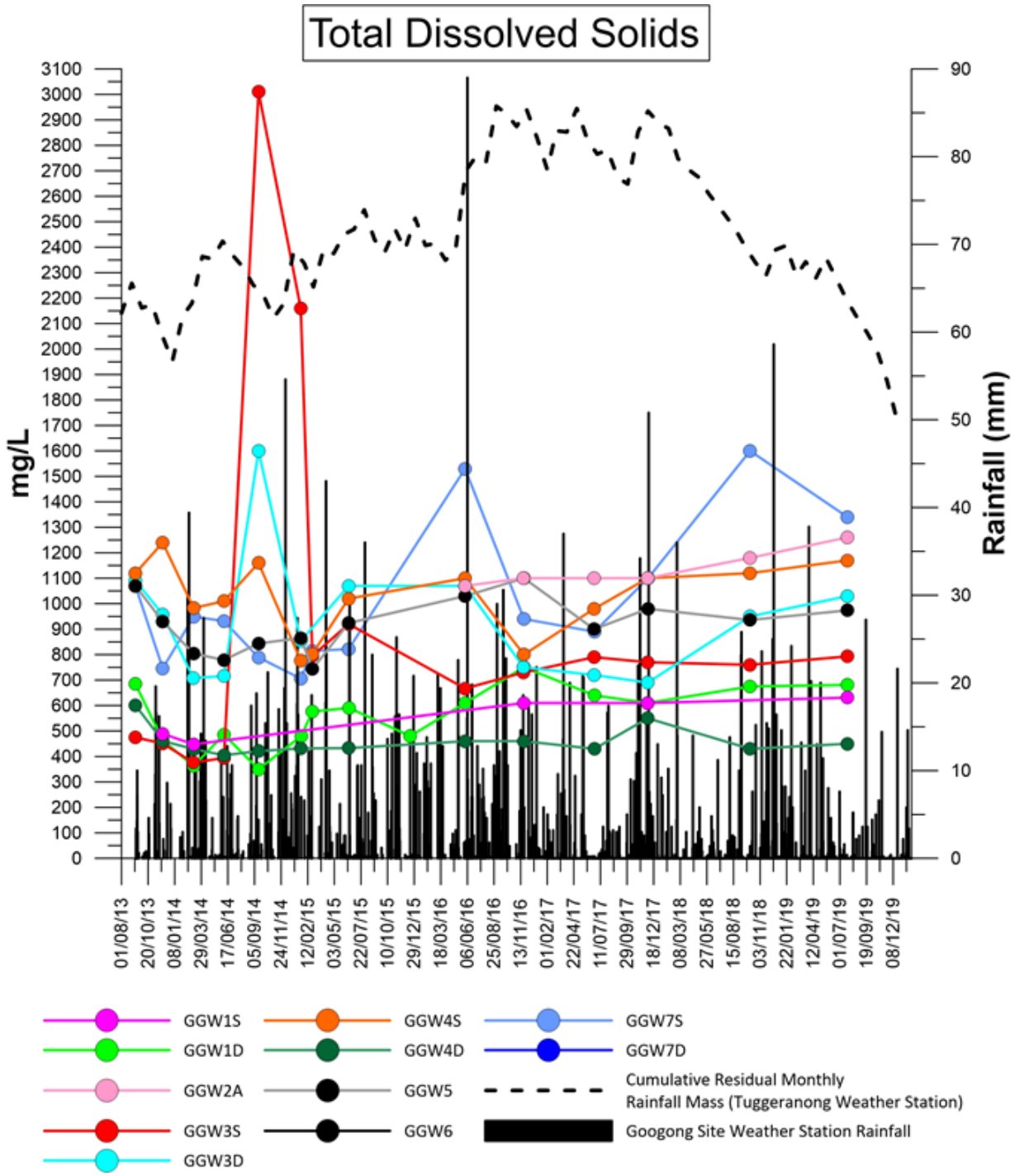

Figure 6.13 Time series plot of Total Dissolved Solids in groundwater 2013 to 2019 (SMEC, 2020)

Dissolved heavy metals were analysed at ultra-trace levels (e.g. detection down to very low levels of 0.05 µg/L to 0.01 µg/L) with most results either below the limits of detection. No significant contamination of heavy metals was observed, and the dissolved heavy metals detected are considered representative of the natural geology.

WRP

The WRP site is located within the contact aureole zone of the Googong Adamellite which has intruded the dacite of the Coliton Volcanics. The adamellite outcrops north of Googong Road and beneath the WRP is approximately five to eight metres deep, below a highly weathered rock and soil horizon.

Shallow groundwater is present approximately four metres below the surface within the weathered bedrock, and the flow direction is easterly towards Montgomery Creek, the nearest drainage line.

Monitoring bore GGW2 was located at the south-eastern corner of the WRP. Pre-construction monitoring showed field pH generally ranged from 6.8 to 7.6 and a field EC ranging from 760 µS/cm to 1000 µS/cm. This bore showed impacts from the construction of the WRP and pipework trenches. In August 2015 it was decommissioned (for construction of the rising main pipeline) and replaced with a new bore (GGW2A) 48 metres down gradient to the east. GGW2A shows a field pH ranging from 6.6 to 8.1 and a field EC ranging from 1452 µS/cm to 2168 µS/cm.

Permanent Reservoirs

The geology of Hill 800 is anticipated to be dominated by Silurian Shale and dacitic Colinton Volcanics. Groundwater is hosted within a localised shallow unconfined aquifer which sits on top of the regionally semi-confined to confined fractured rock aquifer. The groundwater flow within the shallow aquifer is controlled by local topography and the direction is generally towards the nearest discharge point, i.e. creek or drainage line. Groundwater is present within the rock at around three to nine metres below ground surface.

Approximately 640 metres to the west of the Permanent Reservoirs site are four registered private bores, with yields of 0.76 L/s at GW400206, a stock and domestic bore in shale (total depth 39 metres), and 12.5 L/s at GW402109, a stock a domestic bore in volcanics (total depth 23 metres). These bores are up-gradient of the site and higher yields may be from influence of the nearby granitic intrusion.

Monitoring bore GGW6 is located 320 metres south of the Permanent Reservoirs. Field pH generally ranges from 6.4 to 8.3 and a field EC ranging from 517 µS/cm to 1340 µS/cm. Construction for the electricity substation may have impacted some water quality results with increased recharge and disturbance from earthworks resulting in leaching of metals, nutrients, and salts. This monitoring bore does not have an EC logger installed.

Stage D irrigation areas

Once Stage D is completed, recycled water from the WRP would be used on public spaces (including sports fields) and residential and other properties across all neighbourhoods within the Googong Township. These include both current and future public spaces and properties. Figure 2.1 presents the ultimate Googong township development plan with neighbourhood layout and open spaces consisting of parks, sporting fields and protected areas. NH1A and NH1B have been constructed, NH2 has commenced development in the northern portion. Residential development would be ongoing over the next 25 years.

There are currently six existing open spaces available for irrigation and 21 planned open spaces within the Googong township, listed in Table 6.4 and shown in Figure 6.14.

Table 6.4 Existing and planned open spaces within the Googong township

Existing open spaces	Planned open spaces
• Beltana Pond • NH1 Local parks 2 and 3 • Sportsfield 1 (Rockley Oval) • Sportsfield 2 (Duncan Sporting Fields) • NH1 Local park 4 (dog walking park) • NH1 Local parks 5, 6 and 7	• NH2 Park 2 • NH2 Town Centre • NH2 Local park 8 • NH3 Local park 3 • NH3 Civic space • NH3 Local park 10 • Common A: Sportsfield 3 • Common A: Sportsfield 4 • Common B: Sportsfield 5 • Common B: Indoor Sport Centre • Neighbourhood 4 Civic space • NH4 Local park 11 • NH4 Local park 12 • NH5 Local park 5 • Neighbourhood 5 Civic space • NH5 Local park 13

- Common B: Sportsfield 6
- NH4 Sportsfield 7
- Googong Common Drainage Reserve
- NH5 Dam Foreshore protection reserve
- NH5 Pink tailed worm lizard conservation area

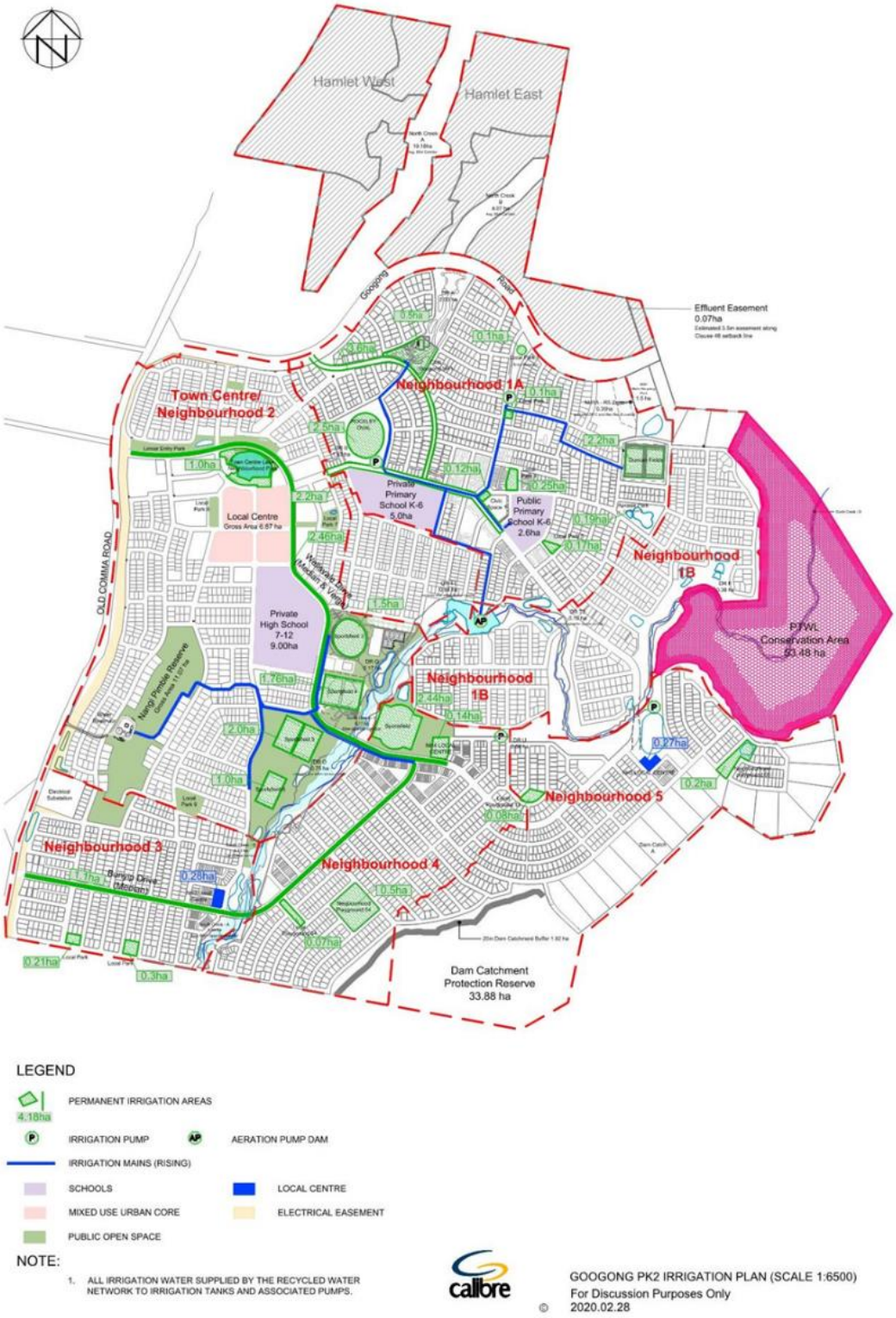

Figure 6.14 Googong Township Master Plan with neighbourhood developments, open spaces and sporting fields

NH1AB and NH2 have been discussed in the Stage C WRP Hydrogeological Assessment (SMEC, 2016), although it is noted that there has been a change to the final design of NH2 with respect to the location of some open spaces for irrigation. The land for NH2 to NH5 is predominantly rural grazing land with sparse trees and several dams. Irrigation with potable water occurs in NH1A, with recycled water irrigation expected to commence in May 2020.

6.3.2 Potential impacts

Construction

Construction activities for the Proposal are not anticipated to require extensive earthworks and potential impacts on groundwater are considered to be minimal. Potential construction impacts on groundwater may include:

- Excavation and trenching into the weathered bedrock zone providing direct pathways for recharge and contamination to the groundwater table
- Variation in groundwater recharge with localised increases in recharge to groundwater when significant rainfall is experienced
- Drainage systems redirect surface water recharge and may cause minor reductions in groundwater recharge for some parts of the site
- Backfilled trenches may provide increase recharge to the shallow groundwater table and act like conduits for shallow groundwater movement
- Spills of chemicals or wastes during plant equipment upgrade impacting the shallow groundwater table
- Imported fill material bringing potential contamination
- Fill areas changing the rainfall recharge rate
- Over-application of fertilisers for the establishment of vegetation impacting groundwater quality.

Minor earthworks would be required for foundation works which have the potential to disturb the soil profile, allow increased recharge to the shallow groundwater and result in dissolution of additional ions from the disturbed ground. With increased recharge there is also potential for increased TDS, nutrients and salts. Any impacts are also considered minimal and short lived.

Operation

WRP and Permanent Reservoirs

The potential operational impacts of the WRP and Permanent Reservoirs relate to spills of dosing chemicals, leaking pipes and tanks and emergency discharge releases. At the WRP, GGW2A is positioned for down-gradient monitoring. There is no monitoring down-gradient of the Permanent Reservoirs and a groundwater monitoring bore is required. The risk of operational impacts is considered low and are expected to be contained within the site.

The groundwater assessment identified spring seepage under the WRP site, though it is not clear if the spring flows underneath the foundations of the WRP. Further geophysical and geotechnical investigation may be required to identity potential impacts to the WRP site.

Impacts that would be short lived are considered the emergency discharge of water down Montgomery Creek which cannot be mitigated any further than is currently possible within the WRP site.

Irrigation of public spaces and gardens

Operation of Stage D includes the application of recycled water on public spaces (including sports fields) and gardens for the whole of the Googong township. The Googong township consists of a total of 767 ha, of which 460 ha are hardstand and 307 ha are open space. A total of 7.6 ha of open space for irrigation has already been constructed and currently uses potable water for irrigation. At complete development, recycled water would be used for the irrigation of public spaces and on residential gardens. Recycled water will also

be used for toilet flushing in residences and other buildings, however this water is returned to the WRP via the sewage reticulation system.

The total irrigation and predicted excess discharge volumes for the Googong township at completion of the township is provided in Table 6.5.

Table 6.5 Summary of Stage D IWC monthly and peak irrigation and domestic consumption volumes and predicted excess recycled water discharge

Month	Irrigation and domestic consumption volume (ML)		Predicted excess recycled water for discharge (ML)	
	Average	Peak	Average	Peak
Jan	3	5.8	0.3	4.3
Feb	2.8	6.1	0.4	3.5
Mar	2.3	5.1	0.5	5.5
Apr	1.5	4.2	0.9	3.4
May	0.9	3.8	1.4	3.9
Jun	0.5	2.7	1.8	3.8
Jul	0.4	0.9	1.9	3.6
Aug	0.5	1.9	1.8	4.8
Sep	0.8	3.3	1.5	3.3
Oct	1.6	4.2	0.9	4.5
Nov	2	5.2	0.7	4.4
Dec	2.9	5.5	0.3	3.2

The predicted excess recycled water to be discharged to the environment shows seasonal variability, with the winter months generating the most excess. Googong township consumption of recycled water also has a slight seasonal variability, likely related to garden watering.

Currently, irrigation of Rockley Oval and Duncan Sporting Fields with potable water is approximately 0.048 ML/month. In 2019 a total of 2,000 ML of treated recycled water was discharged Googong Creek (around 16.5 ML/month).

The long-term irrigation of public spaces, including sports fields, and gardens has the potential to impact groundwater and may include:

- Localised groundwater mounding
- Increased localised recharge to the shallow groundwater table and may increase recharge to the deeper groundwater system
- Mobilisation of salts
- Increased nutrients from fertilisers that have been used on gardens and sporting fields
- Increased nutrients and other parameters from recycled water
- Water logging of soils
- Down-gradient accumulation of salinity.

In order to assess the potential impact of the additional irrigation on the groundwater system, the existing Googong township groundwater model was updated. Refer to Appendix E for a detailed explanation of the groundwater model set up, calibration and results.

The groundwater modelling identified the flow paths from the irrigation areas to assess potential salinity migration pathways, shown in Figure 6.15. While some changes to the groundwater system are expected, the flow path lines do not show interaction with water stored in the Googong Dam. The expected groundwater flow directions beneath much of the proposed development area would see any impacted

groundwater migrate to the north and north-east of the site, ultimately draining to the Queanbeyan River below Googong Dam.

Under natural conditions groundwater may be shallow enough to discharge to the surface and would be subject to evapotranspiration. There is also potential for shallow groundwater to discharge and result in accumulated salts. The areas for potential shallow groundwater discharge are shown in Figure 6.15.

Overall. the flow paths are not expected to change significantly with the addition of additional irrigated areas within the Googong township for Stage D, though the potential concentrations at the discharge locations may change. The potential consequences of the use of recycled water is the slight decrease in groundwater quality, regardless of whether recharge increases (e.g. infiltration of recycled water into the aquifer) or decreases (e.g. stormwater capture across the developed parts of the site). Reducing the recharge from the development of the Googong township through NH3 to NH5 is not likely to change the flow paths, though the concentration of salts at the discharge points may increase.

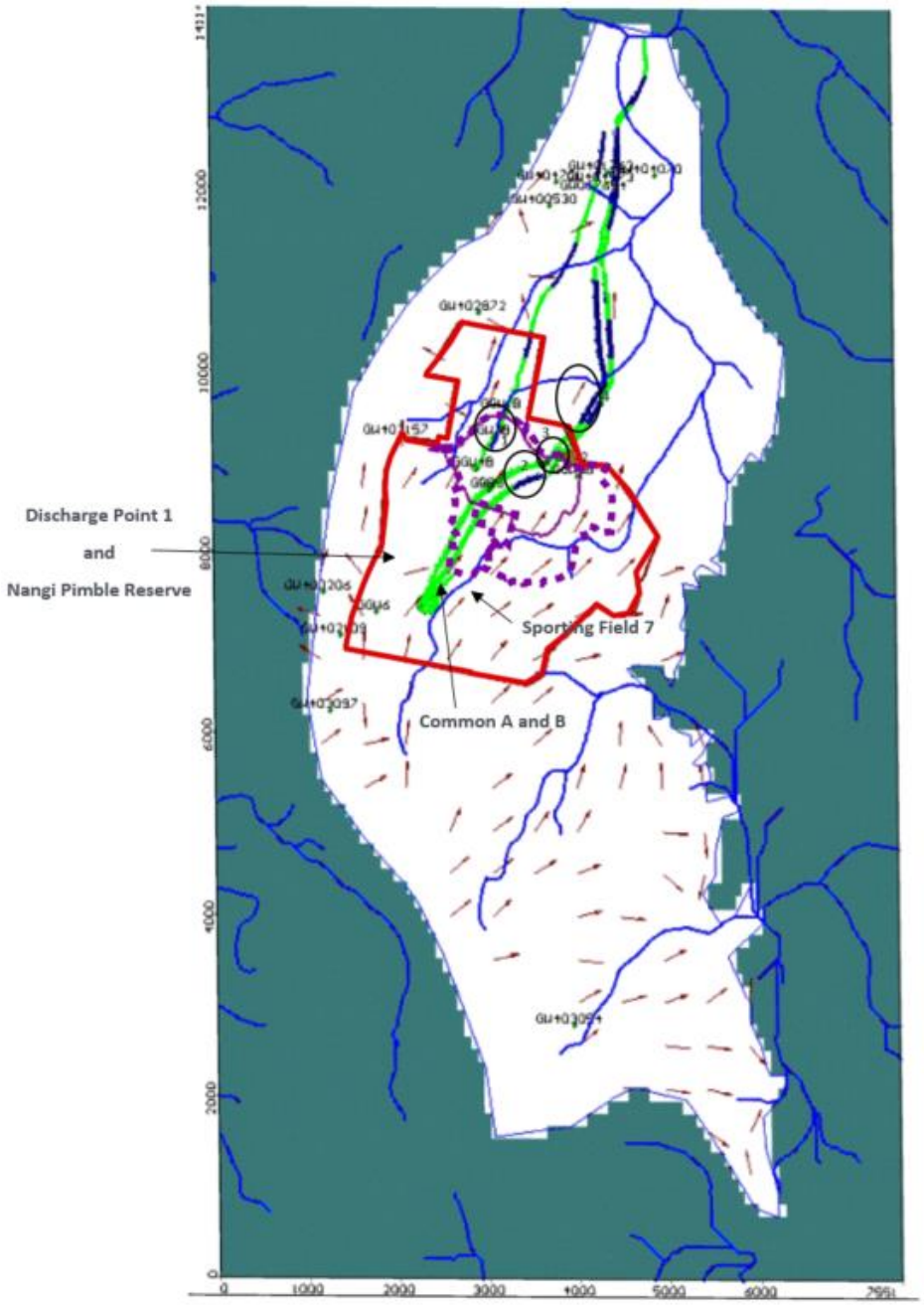

Figure 6.15 Flow paths lines from the irrigation areas. The Googong township boundary is shown in red, Stage C boundary shown in dashed purple, the WRP is shown in brown and potential discharge zones are shown with black circles (SMEC, 2020)

Discharge of excess recycled water

The potential groundwater impacts of increased excess recycled water discharge to the environment may include:

- Localised point source recharge of the shallow groundwater system during drier periods
- Increased TSS/TDS and nutrient load to recharging shallow groundwater
- Water logging around the discharge point. This can lead to increased evapotranspiration, which may lead to increased salinity
- Increased contaminants to recharging shallow groundwater.

Discharge of excess recycled water to Googong Creek commenced in 2016, and the discharge volumes from July 2016 to December 2019 are shown in Figure 6.16. The volume of excess recycled water discharge increased from 0.2 ML/day in July 2017 to 0.7 ML/day by December 2019. Several peak discharge events of 1.3 ML/day and 1.9 ML/day occurred in November 2017 and December 2018, respectively.

In 2019 the total excess recycled water discharge was 200 ML. When reticulation of recycled water commences the volume of excess discharge to Googong Creek may initially reduce, however as the Googong township development increases with greater EP the volume of excess discharge is also expected to increase. At ultimate development the Googong township is estimated to have on average a monthly excess of 66.7 ML, noting that discharge is generally higher in the winter and spring months.

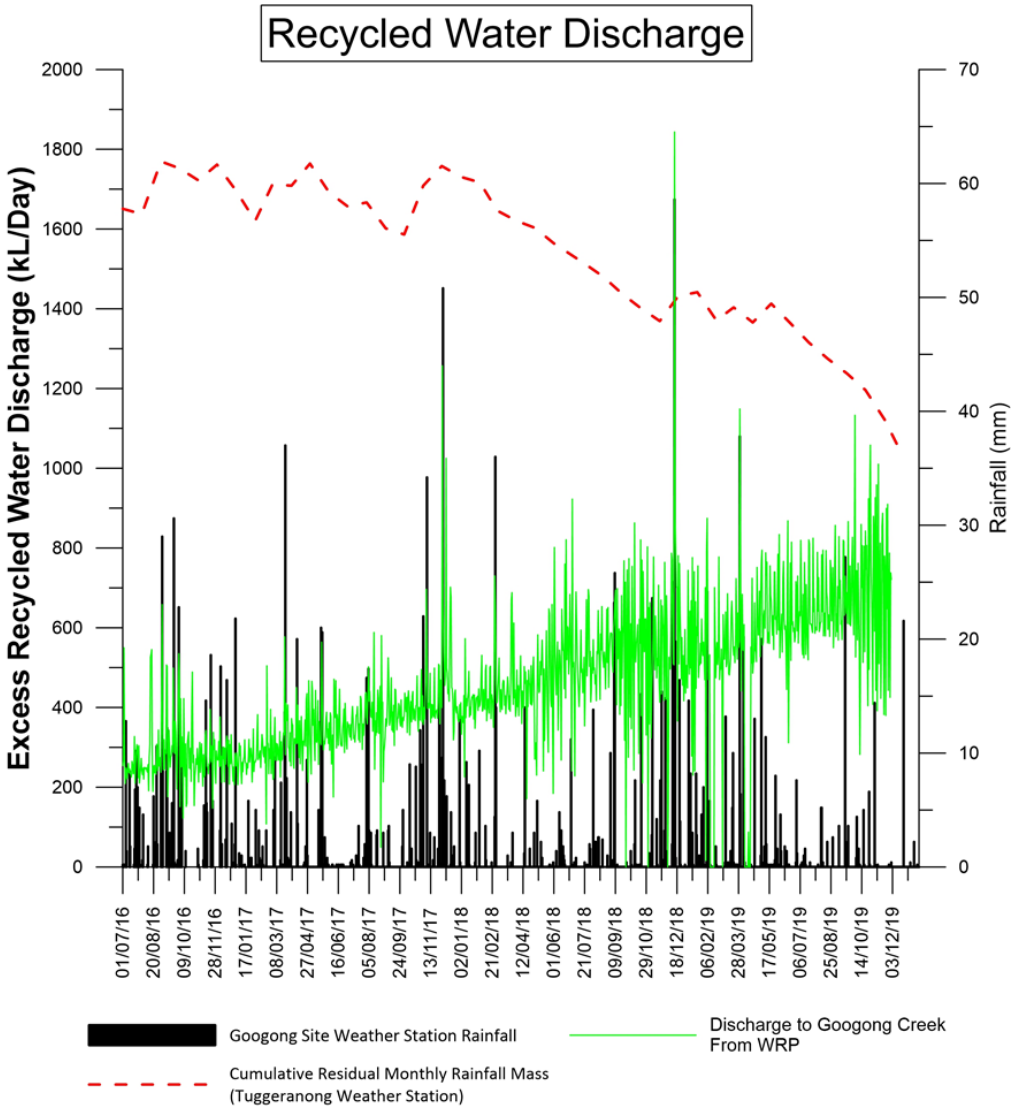

Figure 6.16 Excess recycled water discharge to Googong Creek from July 2016 to December 2019 (SMEC, 2020)

The water quality of discharged water is monitored as any water that is discharged must meet the effluent criteria listed in the Recycled Water Quality Management Plan and be in accordance with the conditions of the relevant EPA licence. Water quality monitoring results are shown in Figure 6.17, and the following observations have been made:

- pH has generally remained consistent, along with the concentrations of major ions, ammonia, and total phosphorus
- There is some variability of sulphate concentrations, which may be related to seasonal variability
- There was a significant increase in total nitrogen concentration from May to September 2017
- The TDS of the monitored water ranges from 288 mg/L to 586 mg/L.

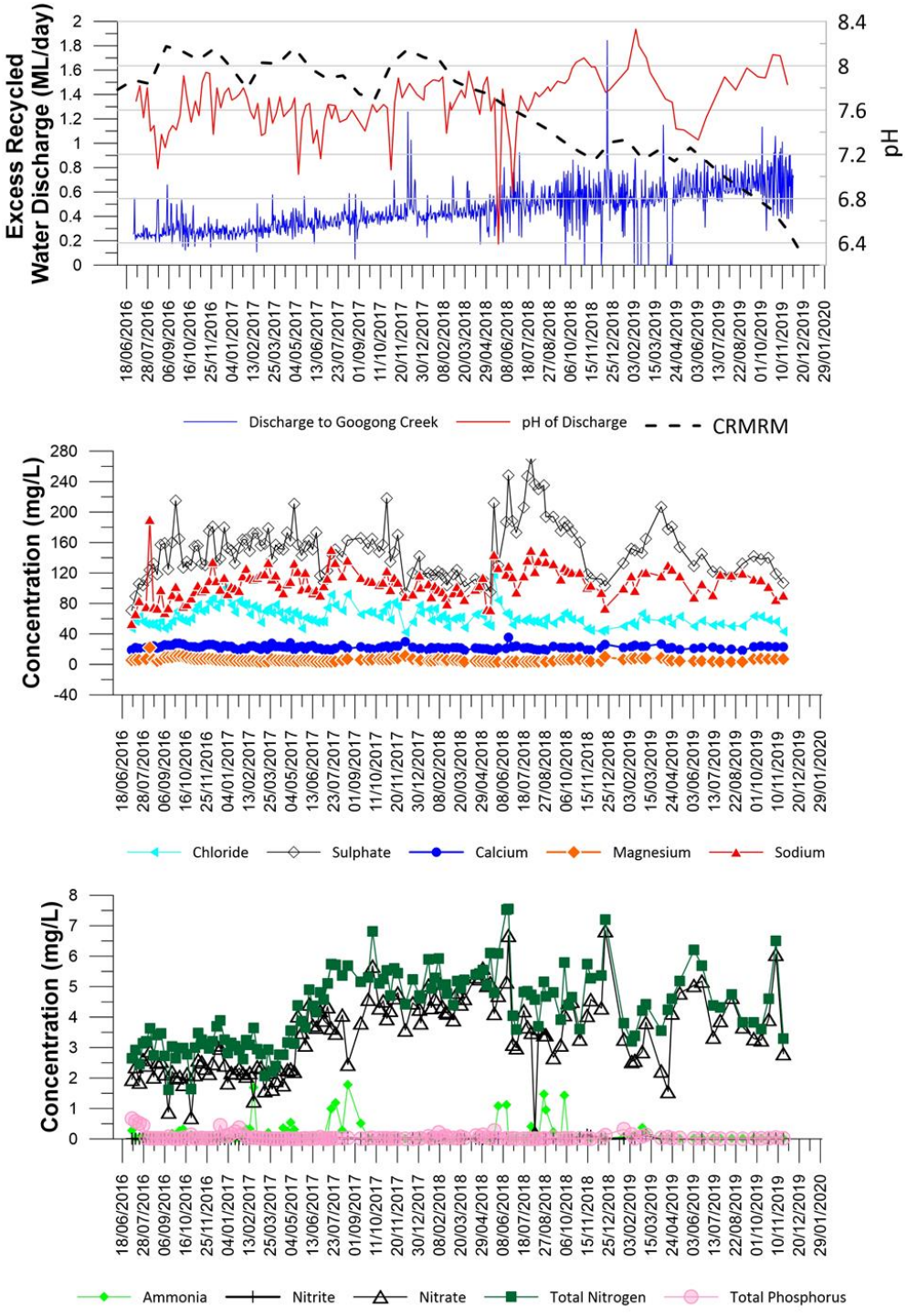

Figure 6.17 Time series plot of recycled water quality (SMEC, 2020)

Residential and other use of recycled water

The use of recycled water on residential, commercial, and other (e.g. educational) properties in Googong would include:

- Toilet flushing
- Garden use
- Car washing
- Firefighting.

These uses would continue in the future neighbourhoods of the Googong township. Operational impacts to groundwater resulting from residential and other uses of recycled water are considered to be minimal. The potential impacts to groundwater from long term recycled water usage may include the following:

- Uneven distribution of recharge due to variable residential water use practices
- Potential increased contamination (including nutrients) to groundwater from car washing, fertilizers, and household chemicals
- Increased recharge from leaking recycled water and potable pipes.

6.3.3 Mitigation measures

Construction

Mitigation of impacts to groundwater from construction activities would include the following:

- Surface water runoff would be captured and directed away from exposed area and managed within the current IWC sites
- Bunding would be established during the upgrade or replacement of plant containing chemicals or biosolids to minimise the risk of spills
- Sediment and erosion controls would be installed where appropriate to reduce sediment transport and TDS in nearby waterways or recharge to the shallow groundwater system
- Sediment trap fencing to reduce sediment transport and TDS during the Permanent Reservoirs bund removal
- Minimising the period water may pond on disturbed ground
- Limiting the application of fertilisers for vegetation establishment in revegetated areas, if required
- Installation of a down-gradient groundwater monitoring bore at Hill 800 to capture construction impacts.

Operation

Ongoing monitoring would be useful to provide suitable data with which to compare the predicted versus actual impacts of the IWC Project on groundwater. It is recommended that groundwater monitoring is increased from six-monthly to quarterly during the first two years of recycled water irrigation to sufficiently capture the seasonal variations of both the natural climate and recycled water consumption trends, while also capturing construction-related impacts.

An IMP has been developed as part of a Water Management Plan (RPS, 2018) which outlines the procedures and practices related to the sustainable management of irrigation of public spaces for Stage 1 and Stage C of the IWC Project. The IMP includes standard operating procedures that would assist in reducing the movement of salt through soil and into the groundwater system. It also provides a mechanism by which the operations can be monitored and continually assessed. The IMP would be updated to incorporate the public spaces irrigated for Stage D of the IWC Project and the monitoring requirements for Stage D of the IWC Project.

Furthermore, a Groundwater Monitoring Program (GWMP) has also been developed as part of the Water Management Plan. The GWMP outlines the ongoing groundwater monitoring requirements, including location, methodology and frequency for Stage 1 and Stage C of the IWC Project.

Updates to the management plans would incorporate the following:

- The installation of six groundwater monitoring bores in NH2 (1), Common A (1), NH4 (2) and NH5 (2)
- The updated groundwater model for the whole of the Googong township development after one year of recycled water irrigation (i.e. 2021)
- The updated groundwater monitoring program during the first two years of recycled water irrigation
- A revision of geophysical electromagnetic survey
- The addition of the groundwater spring at the WRP into the groundwater monitoring program, including quality and flow rate
- A revision of Discharge Point 1 to be considered as an occasional release point.

6.4 Biodiversity

6.4.1 Aquatic ecology

An aquatic ecology assessment has been prepared by SMEC to assess the potential impacts of the Proposal (SMEC, 2020). Their assessment included a review of existing aquatic ecology, surface water and hydrogeological information for the WRP. Permanent Reservoirs and public space irrigation sites, and data from previous field surveys between 2016 and 2018 to predict potential impacts associated with the Proposal. The findings of the assessment are summarised in this section and the full report is included in Appendix F.

Existing environment

Aquatic environment

The headwaters of Googong Creek lie within a wide valley typifying past agricultural uses including modification of landforms through farm dams. The upper catchment is also subject to urbanisation from Googong township, with part of the creek piped underground to accommodate development. Stream banks, channels and beds are poorly defined due to the ephemeral nature of the upper catchment with limited connectivity. Bank stability is likely to be impacted by stock access, human access, unsealed roadways, cleared vegetation and modified stream flow. The bed matrix is tightly packed and vegetated with exotic agricultural grasses.

The valley north of Googong Road becomes increasingly steep with the Googong Creek channel deepening. Substrate consists of finer sediments including silt and clay due to run off from surrounding agricultural uses. Vegetation surrounding the creek is highly disturbed with little native vegetation present. Introduced species such as Briar Rose and Blackberry are found, as well as exotic grasses associated with agricultural uses.

The reach steepens to a gorge towards Queanbeyan River with vegetation quality and density improving. Flow is characterised by riffles, pools, small vegetated side bars and mid-channel bars. Bedrock and boulders form the substrate of the channel, which has a high gradient. Vegetation is moderately disturbed, although native species are dominant on the steep flanks. Macrophytes are in excellent condition, however there are introduced species present such as Watercress. This reach is considered to have good habitat for aquatic fauna.

The Queanbeyan River has been modified by the construction of the Googong Reservoir, with flow from the dam wall being a combination of discharge from the reservoir, shallow groundwater discharge and local catchment run-off. The Queanbeyan River is a shallow valley at the confluence with Googong Creek. Substrate is highly variable, with sections of braided channel, deeper pools, vegetated side bars and mid-channel bars. Vegetation is predominantly native including regenerated areas, although there are minor intrusions of exotic species. Bank stability is considered to be impacted by human access, vehicular access, and flow releases from Googong Dam.

South Creek, which forms the headwaters of Montgomery Creek, has also been altered with the development of the Googong township. The creek is a broad valley typified by agricultural pastures with livestock grazing, scattered trees and farm dams. Introduced species and herbs dominate the upper catchment with large populations of Saffron Thistle, Purple Top and St Johns Wort. Macrophyte cover in the creek is minimal.

Montgomery Creek is an ephemeral watercourse that is characterised by steep banks and valley sides. The creek line has been modified with flow attenuation structures to protect the creek from excessive flow velocity. Isolated pools are present with steep banks and small vegetated side bars. Moderate erosion is evident. Disturbed native vegetation is present on both banks, with exotic species intruding and a moderately impacted canopy. The upper catchment is predominantly agricultural pasture; however, vegetation quality improves towards the Queanbeyan River.

Riparian and aquatic vegetation

The primary vegetation communities within the study area are South Eastern Tablelands Dry Shrub-Grass-Herb Forest, Tablelands Dry Shrub-Tussock Grass Forest, and South Eastern Tablelands Dry Shrub-Grass-Herb Forest. South Eastern Tablelands Dry Shrub-Grass-Herb Forest is present in the upper reaches of Googong Creek, transitioning to Tablelands Dry Shrub-Tussock Grass Forest closer to the Queanbeyan River. The vegetation along the assessed area of the Queanbeyan River is primarily Tablelands Dry Shrub-tussock Grass Forest.

A review of the site photography undertaken as part of the SWAEMP shows no significant changes in riparian and aquatic vegetation to date. Seasonal variance was noted to be consistent across the 2017 to 2019 period between the spring/summer growth of riparian vegetation and the autumn/winter herbaceous nature of the riparian species. A slight change in composition of species due to drought conditions was noted towards the end of 2019.

Macroinvertebrates

In May and August 2016, macroinvertebrate surveys were undertaken at two locations on Googong Creek (GC 1 and GC2) and one site on the Queanbeyan River (QR1) (Biosis, 2016). The survey noted that the riparian and aquatic vegetation surrounding QR1 (which coincides with Site 8, refer to Figure 6.3) was highly disturbed with very little native vegetation present and both banks severely modified by grazing. The 2016 survey determined a Band ‘A’ score with a SIGNAL score of 3.22 and 16 taxa present, suggesting any impacts present were not of a type that results in a loss of taxa. However, sensitive taxa have been moderately impacted and mild nutrient enrichment may be compensating for their loss through increased primary productivity.

Macroinvertebrate surveys were again undertaken in Spring 2016 and Spring 2018. 46 and 56 invertebrate taxa were collected during the Spring 2016 and Spring 2018 surveys, respectively. The following observations were made during the Spring 2016 survey:

- Site 1 had the highest richness with 27 taxa. All sites had between 20 to 27 taxa, except for Site 8 which had 13
- *Dipteria* (fly larvae) numerically dominated all sites. *Ephemeroptera* (mayfly larvae) were common in Sites 1, 4, 5 and 6 while *Gastropoda* (snails and slugs) were abundant at Sites 7, 8, 9 and 10
- In the Queanbeyan River, average SIGNAL scores were higher in riffle habitats compared to edge habitats. Riffle habitats at Sites 1, 5 and 6 indicated mild pollution while edge habitats had moderate to severe pollution. Both riffle and edge habitats at site 7 indicate moderate pollution
- In the tributary sites, the SIGNAL scores indicated severe pollution for both habitats, with the exception of the edge habitat at Site 10.

Macroinvertebrate surveys were undertaken in Spring 2018 and showed an improvement in SIGNAL score for edge habitat at Sites 1, 4, 6 and 8, while other site SIGNAL scores were worse than the 2016 results. Riffle habitats at Sites 7, 8 and 10 had also improved, while the other sites were worse or not comparable.

Of the nine sites sampled, the riffle habitat of Site 7 recorded the highest average SIGNAL score, indicating moderate disturbance levels. SIGNAL scores indicated moderate disturbance at both habitats of Sites 1, 4, and 6, and for the riffle habitats at Sites 5 and 7. The edge habitats at Sites 5 and 7 were severely disturbed, as were both habitats at Sites 8, 9, 10, and 11.

The three subfamilies of Chironomidae were the most widespread taxa present; they occurred at all sites and in both riffle and edge habitats. Ceratopogonidae were also present at all sites, though preferred edge habitats to riffles. Another midge family, Simuliidae, occurred at all sites except Site 11, and preferred riffle habitat. Caenidae mayflies occurred at all sites except Site 10. The more sensitive families (those with SIGNAL scores of 8 or higher), were less common. These were represented by Telephlebiidae, Calocidae,

Gripiterygidae, Hydrobiosidae, and Philopotamidae. Of these, Gripopterygidae stoneflies were the most widespread, being collected at all sites except Site 8 and Site 11 and were more abundant in riffles than edges.

Macroinvertebrate families such as Culicidae, Lymnaeidae, Physidae and Notonectidae have a SIGNAL score of 1, meaning they are very tolerant to pollution. Site 10 and Site 11 had the highest number of Culicidae collected, which may indicate that these sites were affected by pollution. Both these sites also had high levels of turbidity and relatively high levels of total dissolved solids and electrical conductivity.

Diatoms

Diatoms are a major group of algae which represent an important component of freshwater ecosystems and respond quickly to environmental changes. Diatom sampling at each of the nine surface water sampling sites was undertaken as part of the baseline monitoring.

The baseline monitoring identified that the diatoms sampled had a range of pH preferences with the majority being circum-neutral and alkaliphilic and a range of oxygen requirement classifications. The majority recorded required higher oxygen levels. Diatom total abundance and richness varied between sites over time with no clear distinction between seasons but a distinction between the Queanbeyan River sites and the ephemeral creeks.

The total diatom abundance has been monitoring over time, with the results from the monitoring data presented in Figure 6.18. The total diatom abundance varies between sites over time, with clear peaks in spring/early summer and late summer/early autumn.

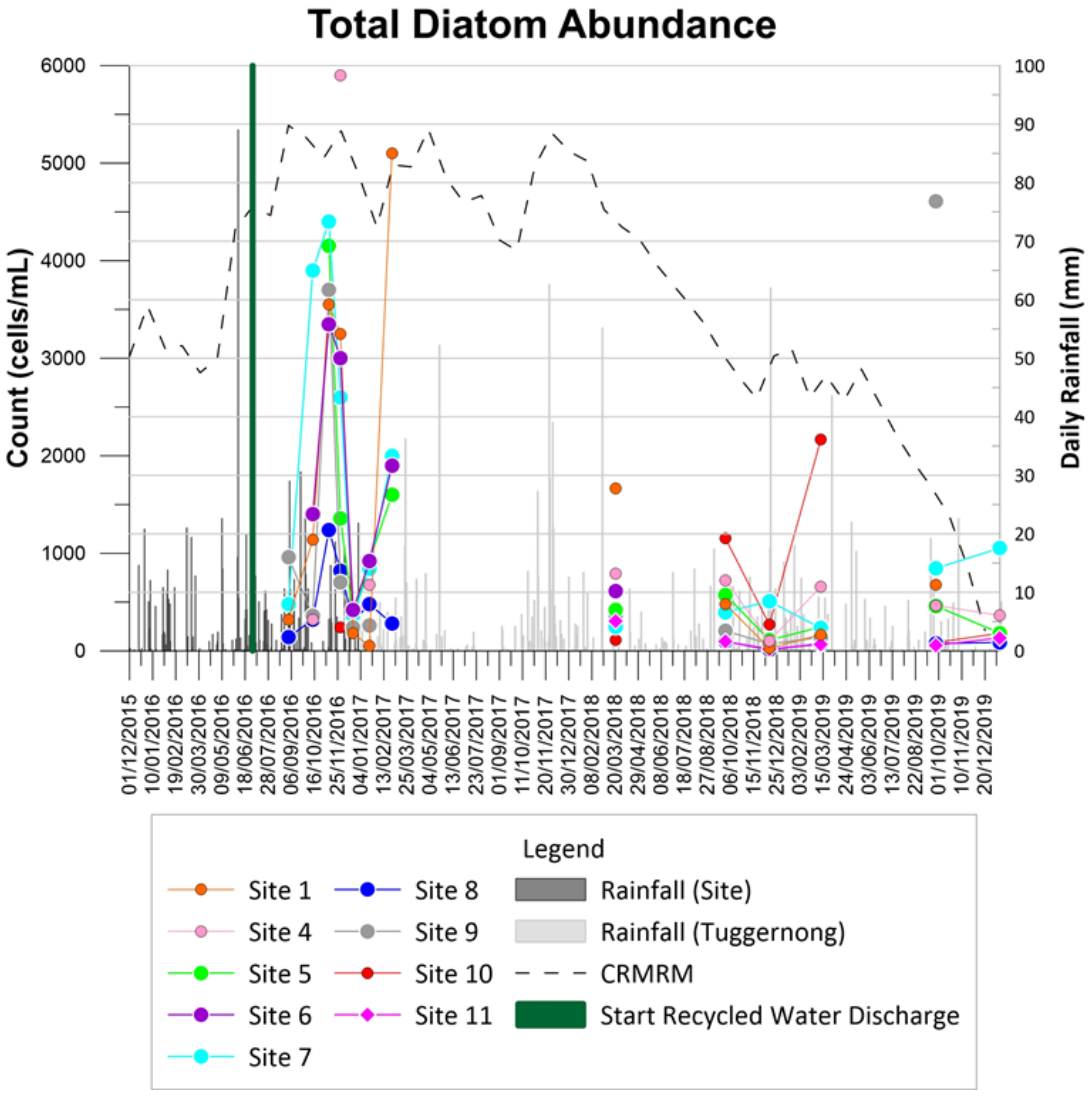

Figure 6.18 Total diatom abundance at each surface water monitoring site

Fish

Fish surveys were undertaken for the baseline surveys and also between 2016-2017. These surveys noted the sites along the Queanbeyan River, and not the tributary creeks, returned results. A clear dominance of introduced species to native species has been observed, with fish numbers generally peaking in summer months. The combined spring and autumn results of the 2016-2017 fish survey results for the Queanbeyan River sites are shown in Table 6.6.

Table 6.6 Fish observations in the 2016-2017 surveys along Queanbeyan River (SMEC, 2017)

Common name	Scientific name	Site 1	Site 4	Site 5	Site 6	Site 7
Carp gudgeon	*Hypseleotris* sp.					33
Redfin perch	*Perca fluviatilis*	11	11	11	42	3
Rainbow trout	*Oncorhynchus mykiss*			5		
Brown trout	*Salmo trutta*	5	2			
Oriental weatherloach	*Misgurnus anguillicaudatus*				1	2
Mosquitofish	*Gambusia holbrooki*	19	91	11	19	

The only native species observed in the Queanbeyan River sites was Carp gudgeon (*Hypseleotris sp.*), which were only collected at Site 7 in spring. Brown trout and rainbow trout occurred at three sites, although not in the same season and not at the same sites.

Additional aquatic fauna was recorded along the Queanbeyan River, such as yabbies, turtles, and platypus.

Surface water quality

The surface water quality was recorded at sites surveyed for macroinvertebrates or fish communities. Surface water quality of the Queanbeyan River, Googong Creek, Montgomery Creek, and Beltana Pond is monitored by QPRC under the WMP and SWAEMP.

The Spring 2016, Autumn 2017, and Spring 2018 surveys identified exceedances of pH, EC, turbidity and dissolved oxygen, while the Autumn 2016 survey noted that measured electrical conductivity exceeded the ANZECC (2000) guidelines.

Elevated nutrients have been confirmed within the wider catchment. Nutrient levels in the groundwater and surface water were observed to be elevated, with concentrations of the discharged recycled water exceeding the ANZECC (2000) 95 per cent species protection for total nitrogen. However, the discharged recycled water does not exceed the WRP EPL limit of 10 mg/L.

Existing surface water and groundwater quality are discussed in Section 6.2 and Section 6.3, respectively.

Potential impacts

Threatened species

The EPBC Approval for the Googong township (and IWC Project) remains valid and includes a condition of approval relating to the prevention of impacts on listed threatened species and ecological communities associated with the development and occupation of the Googong township (CoA 2).

SMEC (2020) has undertaken an assessment against the significant impact criteria for the relevant Matters of National Environmental Significance (MNES) for the Proposal (refer to Table 6.7). On the basis of criteria outlined in the relevant Significant Impact Guidelines (DEWHA, 2009) it is considered unlikely that a significant impact on these matters would result from the Proposal (not already addressed in the current EPBC Approval), and it is noted that the conditions of the EPBC approval would continue to be implemented.

Table 6.7 Assessment of the Proposal against the Matters of National Environmental Significance relevant to aquatic ecology

MNES	Project specifics	Significant Impact Criteria assessment findings
Threatened species (flora and fauna)	Protected Matters Search Tool predicts the occurrence of three listed species of aquatic fauna: • Silver Perch (*Bidyanus bidyanus*) • Macquarie Perch (*Macquaria australasica*) • Murray Cod (*Maccullochella peelii*)	Not likely to occur within the study area and unlikely to constitute significant impact
Threatened ecological communities	None within the study area	Not required
Wetlands of International Importance	Hattah-kulkyne Lakes, located more than 600km away	Unlikely to be impacted

Additional assessments and approvals are required under certain State legislation where a significant impact is expected as a result of a project or development. SMEC (2020) has undertaken an assessment of the Proposal against the key State legislative policies to determine whether further assessment or approvals are required, with triggers and assessment outcomes summarised in Table 6.8. No further assessment or approvals related to aquatic ecology are required for the Proposal.

Table 6.8 Summary of State legislation against the Proposal

Legislation / policy	Trigger	Assessment
Environmental Planning and Assessment Act 1979	An assessment of significant for three threatened fish species: • Silver Perch (*Bidyanus bidyanus*) • Macquarie Perch (*Macquaria australasica*) • Murray Cod (*Maccullochella peelii*)	These fish are not considered to have a medium or higher likelihood of occurrence within the study area – no further consideration under the act is required
Fisheries Management Act 1994	Googong Creek and Montgomery Creek are both defined as first and second order streams with a Class 3 waterway.	Not considered key fish habitat.
	Queanbeyan River is a Type 1 Key Fish Habitat and Class 1 waterway	Fish survey identifies exotic species dominance. Stage D works are within the footprint of Stage C. Unlikely to be impacted.
Water Management Act 2000	Works within 40 metres of a designated waterway	Stage D works are within the Stage C footprint. No additional works are proposed within 40 metres of waterways. Discharge Points are already constructed.
Biosecurity Act 2015	Study area includes priority weeds within the South East region: • Serrated Tussock (*Nassella trichotoma*) • Blackberry (*Rubus fruticosus sp. agg.*) • Willow (*Salix sp.*)	Priority weeds occurring in the riparian zone within the Googong township development to be managed in accordance with the relevant duties specified under the Act.
Biodiversity Conservation Act 2016	No Threatened Ecological communities within the study area	Not likely to occur within the study area and unlikely to constitute significant impact

Construction

Construction activities for the Proposal are not anticipated to have extensive earthworks. Excavation works for foundations of new structures would be required and are likely to expose the shallow rock profile and any placed material. All works would be contained within the existing footprint of both sites and as such, potential impacts on downstream aquatic ecology are expected to be minimal. However, potential construction impacts may include:

- Degradation and erosion of the temporary construction access at the WRP
- Sediment discharge to the drainage line from the road construction
- Sediment discharge from foundation works and the removal of the earth bund
- Spill of chemicals from decommissioned and disassembled plant
- Contaminated surface run-off.

Constructed related impacts to aquatic ecology are likely to be minor and short term and are likely to be through indirect impacts such as water quality, quantity or sedimentation issues, however management and mitigation measures will be employed to reduce the impact of the Proposal on aquatic ecology. It should also be noted that most major earthworks took place during earlier stages thus limiting the amount of earthworks required and lessening the potential ground disturbance impacts.

Operation

The operation of the Proposal may result in the following impacts:

- Spills of dosing chemicals, leaking pipes and tanks and emergency discharge releases
- Overall reduction of surface water flow due to development of Googong township.

Operational impacts are considered relatively unlikely and would be contained within the sites, excluding emergency discharge releases. Emergency discharge of water down Montgomery Creek may be visually unsightly but short lived. Potential impacts may include erosion of the upper creek channel and a potential decrease in water quality.

Within the Googong township the headwaters of Googong Creek have been significantly altered and the headwaters of Montgomery Creek would be significantly altered as the Googong township development progresses. The Googong township development has likely reduced both baseflow and surface flows to Googong Creek and Montgomery Creek which are both ephemeral with some natural baseflow from groundwater discharge, particularly in the lower reaches. This would have an impact on aquatic ecology and riparian vegetation communities, though some of these impacts in Googong Creek may have been offset by the start of discharge of recycled water.

Since the discharge of excess recycled water commenced in 2016, Googong Creek has transitioned from an ephemeral creek to a creek with continuous flow The aquatic survey results reflect the changed environment and elevated nutrient component of the water, particularly as SIGNAL scores for some sites improved or deteriorated. The commencement of reticulation of recycled water and the associated reduction in the volume of excess recycled water for discharge is likely to again impact the creek flow, shifting aquatic communities to those more representative of ephemeral waterways. Over time as the Googong township grows and flows increase or become permanent again in Googong Creek it is likely the aquatic ecology would reflect the changing conditions.

The operational impacts of the Proposal and open space irrigation on surface water are further described in Section 6.2.2 and Section 6.3.2.

Mitigation measures

Mitigation of impacts to aquatic ecology from construction activities would include those outlined in Section 6.2.3 for the reduction of potential impacts to surface water.

A Surface Water and Aquatic Ecology Monitoring Program has been developed as part of the approved Water Management Plan (RPS, 2018) and would continue to be implemented during the operation of Stage D. Additional mitigation of impacts to aquatic ecology from operational activities would include:

- Ensuring ongoing monitoring in accordance the Surface Water (Aquatic Ecology) Monitoring Program and adherence to adaptive management measures to managing potential impacts.
- Ongoing restoration and remediation of Googong Creek where required (if erosion is identified through monitoring of drainage lines and creeks) to further reduce the likelihood of alterations to the structure of beds, banks and riparian vegetation

- Aquatic monitoring through diatom and macroinvertebrate surveys would be undertaken for the first two years of open space irrigation with recycled water. Macroinvertebrate surveys would be undertaken in Spring 2020 in line with the AUSRIVAS protocols and the commencement of recycled water irrigation
- Removal of Site 6 and Site 7 from the aquatic ecology monitoring program.

6.4.2 Terrestrial ecology

Existing environment

The Googong township area is highly modified, having been previously largely cleared for pastoral use and grazed intensively for many years. This intensive and prolonged grazing has resulted in the removal of all but the most resilient native flora species and prevented the establishment and regeneration of native trees and shrubs.

The results of database searches indicate that the following threatened species, as defined under the *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), have previously recorded or are predicted to occur in the locality of the Proposal (up to a ten-kilometre radius):

- 5 threatened ecological communities listed under the BC Act/EPBC Act
- 12 threatened flora species listed under the BC Act/EPBC Act
- 30 threatened fauna species listed under the BC Act, FM Act and/or EPBC Act
- 13 migratory species listed under the EPBC Act.

WRP

The construction footprint area at the WRP site comprises of cleared, developed land with no trees or other notable habitat features. There is a stand of trees located on the northern road verge and also recently planted trees along the berm that extends on the western and southern boundaries of the WRP. These areas are outside the construction footprint. It is possible that some weeds may also be present in the construction footprint area.

Land to the east of the WRP site would be utilised during construction for temporary access to the WRP site from the site compound located to the north along Googong Dam. This land has been previously disturbed during the construction of the existing WRP. This land is subject to the Googong Foreshores Interface Management Strategy as it borders on the Googong Foreshores, an area protected to ensure the quality of raw water for the supply of potable water.

Permanent Reservoirs

The construction footprint area at the Permanent Reservoirs site comprises of cleared, developed land with no trees or other notable habitat features. There are numerous scattered trees on the eastern boundary of the Permanent Reservoirs site, however these areas are outside of the construction footprint. It is also possible that some weeds may be present in the construction footprint area.

Land to the west of the Permanent Reservoirs site would be utilised during construction for storage, stockpiling, and site offices. This land has also been previously disturbed during the construction of the existing infrastructure at the Permanent Reservoirs site and has since been resurfaced with grass and landscaping along the outside of the perimeter roadway to tie in with the future open space parkland to be established on Hill 800.

Potential impacts

Construction

Construction of the Proposal is proposed within the existing site boundaries and therefore direct biodiversity impacts of the Proposal are predicted to be negligible due to the disturbed nature of the existing and proposed construction areas. Vegetation clearance is not proposed for proposed works within the site boundaries or the temporary construction access, and there would be no impacts to native vegetation or high quality fauna habitat. There is a minor risk that native fauna may be trapped in trenches or plant/equipment if not checked during start up activities.

Furthermore, the construction of the Proposal is not anticipated to involve major earthworks. Proposed earthworks for the Proposal involves minor earthworks related to the preparation and excavation for the foundations for the new infrastructure element, as most major earthworks have taken place during earlier stages of construction.

Without appropriate management strategies, construction activities also have the potential to disperse weeds and may include species listed as noxious under the *Noxious Weeds Act 1993*. Construction activities also have the potential to import new weed species into the area.

Operation

As the Proposal areas have previously been cleared and contain existing IWC infrastructure, no operational impacts on terrestrial ecology are expected.

Mitigation measures

Construction

The following measures would be implemented during construction to avoid impacts to terrestrial ecology:

- Areas cleared of ground cover for construction works would be restored to previous condition to stabilise soils and approve visual amenity. Any additional landscaping undertaken during the restoration of the site would use native species.
- Where feasible, the landscaping plans should provide for replanting of local species, in particular tree species that provide habitat and foraging opportunities (such as Yellow Box and Red Box).
- The measures outlined in the Googong Foreshores Interface Management Strategy would be implemented for the land to the east of the WRP including weed removal and restoration with native vegetation.

Operation

As the area has previously been cleared, no operational impacts on terrestrial ecology are expected.

The management actions outlined in the Googong Foreshores Interface Management Strategy for the land to the east of the WRP and northeast of the Permanent Reservoirs site would be implemented as part of the ongoing compliance with the Concept Approval.

6.5 Soils and landscape

6.5.1 Existing environment

Landform

Googong township comprises approximately 780 ha of undulating terrain bordered by a series of relatively steep gullies. Land elevations vary from approximately 600 metres Australian Height Datum (AHD) along the Queanbeyan River to 816 metres at Swan Hill, which forms part of a low series of ridges that run northwest to southeast through the centre of the wider Googong project area.

The WRP site is located at approximately 730 metres AHD, on an upper slope in the vicinity of an ephemeral drainage line that flows into Montgomery Creek. The Permanent Reservoirs site is located at approximately 800 AHD, on a drainage line and the slopes and crest of Hill 800.

Geology and soils

The soils are typically shallow and contain large quantities of bedrock gravels and cobbles, with bedrock also frequently exposed at ground level on crests and ridge slopes, or as outcrops along the creek lines and steeper ridge slopes. However, on the low gradient basal slopes and creek flats deposits tend towards deeper sandy or loamy soils.

Soils extend to depth of approximately 0.2 to 1.1 metres until bedrock is encountered. Erosion is apparent on spur crests where bedrock is exposed, this is however uneven across these landforms and pockets of deeper soil do exist. Soils are deeper and relatively stable closer to creek lines, though some bank erosion is evident within creek lines.

The majority of the Googong township, including the Permanent Reservoirs site, is located within the Burra soil landscape, while the WRP site is located within the Anembo soil landscape. The soil landscape characteristics for these soil types are detailed in Table 6.2.

Table 6.9 Soil landscape characteristics

Soil landscape	Characteristics	Erosion potential
Burra	This landscape is characterised by undulating to rolling hills and alluvial fans associated with the weathering of the underlying Silurian volcanic units, with the ground surface almost completely cleared of woodland. The soils are described as strongly acidic with low fertility and low available water-holding capability. Subsoils also have low permeability.	• Concentrated flows – moderate erosion potential • Moderate risk of mass movement caused by damage to surface vegetation by the movement of stock on slopes.
Anembo	This landscape is characterised by undulating rises and flats over granitic material. The ground surface typically exhibits extensively cleared, open to tall open forest with woodland and low woodland in frost hollows. The area of Anembo soil landscape has been extensively cleared. Soils are of gravely low fertility and low water-holding capacity and are prone to water logging. Some subsoils have very low permeability.	• Non-concentrated flows – moderate erosion potential. • Concentrated flows – high to very high erosion potential.

Source: Manidis Roberts, Googong Township Water Cycle Project Environmental Assessment, 2009

Douglas Partners have undertaken various geotechnical investigations for previous stages of development at the WRP and Permanent Reservoirs sites (Douglas Partners, 2009 and 2013).

The following observations on soil profiles were made at the Permanent Reservoirs site (Douglas Partners, 2009):

- Topsoil: silty sand with rootlets to 0.05 to 0.2 metres depth.
- Clay, sand, silt, and gravel: stiff to hard and dense soil to 0.2 to 3.4 metres depth but generally 0.5 to 3.4 metres. The soil comprised a mixture of clay, sand, silt, and gravel.
- Bedrock: extremely low to medium strength, extremely to highly weathered dacite and quartzite bedrock below 0.2 to 3.4 metres depth continuing to the limit of investigation at 0.4 to 5.5 metres depth.

The following observations on soil profiles were made at the WRP site (Douglas Partners, 2013):

- Topsoil: loose, dark brown silty clayey sand to 0.1 to 0.25 metres depth; fine to coarse grained, low plasticity, moist, plant roots.
- Slope-wash soil: loose to medium dense, pale grey clayey silty sand to 0.2 to 0.5 metres depth; fine to coarse sand, some dacite gravel and cobbles, slight plasticity, dry.
- Residual soil: hard, yellow-brown, and/or red-brown sandy clay to 0.2 to 1.5 metres depth, but mostly less than 0.5 metres depth, varying low to high plasticity, fine to coarse sand, moist. This soil type is also expected to have a moderate-high swell-shrink potential.
- Bedrock: foliated dacite, variably weathered though typically extremely/highly weathered and highly weathered and of very low to medium strength to 0.75 to 2.5 metres depth, transitioning to moderately weathered and slightly weathered and of high and very high strength at typically 0.75 to 5.0 metres depth.

Acid sulphate soils have an Extremely Low Probability of Occurrence according to the Australian Soil Resource Information System.

Contamination

Coffey Geosciences undertook an initial contamination investigation (Stage 1 investigation) in 2004 to identify Areas of Environmental Concern (AECs) for the Googong Township Water Cycle Project Environmental Assessment. No AECs were identified in proximity to the WRP or Permanent Reservoirs site boundaries.

A site survey to confirm the presence of any actual or potential contamination sites was carried out in July 2012. No additional areas of potential or actual contamination were identified.

A search of NSW EPA's record of notices under Section 58 of the *Contaminated Land Management Act 1997* was undertaken on the 23 March 2020. No recorded contaminated sites were present in the vicinity of the Googong township.

No incidents that have caused soil contamination have been recorded during the construction and operation at the WRP and Permanent Reservoirs sites.

6.5.2 Potential impacts

Construction

Construction activities that may affect soil include:

- Topsoil stripping and soil disturbance
- Earthworks
- Soil contamination.

Topsoil stripping and soil disturbance

Topsoil stripping may result in the exposure of soil horizons and construction materials that are susceptible to erosion. This can lead to erosion of exposed areas and stockpiles; deposition of eroded sediment in waterways increasing turbidity and smothering benthic habitat and organisms; and carriage of nutrients to waterways causing algal growth and eutrophication.

Earthworks

Earthworks may result in exposure of soils that are susceptible to erosion. Soil erosion is most likely to occur during excavation works and use of the proposed temporary construction access. Erosion can be from water (creating inter-rill erosion, rill and gully erosion and tunnel erosion) and wind. Potential impacts include the erosion of exposed areas, damage to retained vegetation due to eroded soils, sedimentation of waterways increasing turbidity and smothering benthic habitat and organisms and the carriage of nutrients to waterways causing algal growth and eutrophication.

The erosion potential and excavation constraints of soil would be considered during construction planning. As noted above, the Proposal is situated on the Burra soil landscape, which has moderate erosion potential and the Anembo soil landscape, which has moderate to very high erosion potential.

Soil contamination

As previously noted, no AECs were identified in proximity to the WRP and Permanent Reservoirs sites, however there is always the potential for earthworks to disturb unidentified contaminated land and adversely impact existing soil characteristics if not managed appropriately. In addition, there is the potential during construction to contaminate soils through fuel or chemical spills. Risks include contamination of soil profiles, adverse impacts on human health and consequential effects on the groundwater quality.

Operation

The operation of the Stage D components at the WRP and Permanent Reservoirs sites would be similar to the existing operations, and as such the Proposal is not expected to result in additional operational impacts on soil and landscape. The potential operational impacts are as existing and are described below.

Discharges to the environment

Discharge of excess recycled water and off-specification recycled water to Googong Creek below Beltana Pond (Discharge Point 3), discharge of excess recycled water or emergency discharges from the Permanent Reservoirs (Discharge Point 1), or emergency discharge of untreated or partially treated wastewater from the WRP to Montgomery Creek (Discharge Point 2) have the potential to impact on the existing soil landscape, particularly in terms of soil erosion.

The most common discharge during normal operation would occur as a result of excess recycled water being released from Discharge Point 3 to Googong Creek. Excess recycled water and emergency discharges of potable water and recycled water in the event of a malfunction of telemetry and controls within the IWC system would discharge from Discharge Point 1 downstream of Hill 800 through the excess recycled water discharge pipeline.

The excess recycled water discharge pipeline traverses underground for approximately 300 metres to the northwest of the permanent reservoirs site. The excess recycled water would then be discharged via a headwall and an energy dissipation structure and would follow the natural drainage line to a series of existing farm dams and a construction sediment basin. From here, excess recycled water would flow into the existing stormwater management system operating within the Googong township to Beltana Pond and onto to Googong Creek. When Neighbourhood 2 is developed, excess recycled water would be carried through the township-wide stormwater management system from the reservoir site to Beltana Pond.

The excess recycled water discharged into the environment must meet the water quality requirements of the Project Approval for Stage 1 and Stage C and the requirements that are expected to be included in the EPL for the operation of the Stage D components of the IWC Project, based on the existing EPL requirements for Stage C. Modelling has been undertaken to predict the volumes of excess recycled water that would be discharged into Googong Creek. The results of this modelling are outlined in Section 6.3, but in summary:

- Up to a maximum of 5,477 kL of excess recycled water may be discharged in a day, but on some days no excess recycled water may be discharged. The average daily discharge is predicted to be about 1,029 kL.
- On a monthly basis, December is predicted to have the lowest average volume of excess recycled water discharged (295 kL/day), as demand is predicted to exceed supply on most days during the hottest months. July is predicted to have the highest average volume of excess recycled water discharged (1923 kL/day), as demand in the colder months is predicted to be lower than supply.

Discharge of excess recycled water at these volumes has the potential to cause erosion and scouring of the waterways downstream of the Googong township's stormwater management system.

The impact of any erosion or scouring of the drainage lines would be minimised by:

- The presence of the existing farm dams and sediment basins that would capture sediment washed down the drainage line in the excess recycled water flows.
- The existing stormwater management system operating within the Googong township would capture prior to discharge of water to Googong Creek. This system has been designed to cater for stormwater generated from the catchment as well as the predicted excess recycled water discharges.

Given these factors, as well as the measures outlined in Section 6.2, it is considered that the impacts on the drainage lines would be low.

Irrigation of public spaces

The EA (Manidis Roberts, 2010) and appended studies identified that the potential off-site risks associated with using recycled water primarily relate to the introduction of salt into the landscape and receiving waters as a result of garden and landscape irrigation and discharges from the WRP. More salt would be added to the soil (and potentially the groundwater) from recycled water irrigation than is currently the case, or if conventional potable water supplies were used.

During prolonged rainfall events, salt accumulated from recycled water irrigation has the potential to leach below the plant root zone and start to move to lower lying parts of the landscape. Soil salt levels downhill could increase, harming the growth of existing or future vegetation. At worst, salt scalds could develop in lower lying areas and soil erosion may subsequently occur where plant growth is impaired.

Salt stored in the landscape may also find its way via interflow or groundwater to streams in the catchment of the Queanbeyan River. However, discharges from these sources are likely to be generated in pulses following heavy and/or prolonged rain and/or erosion events. During high rainfall events the flow rate in perched groundwater tables, creeks and rivers is likely to be greater, consequently minimising the risk of adverse impacts.

A lesser risk is accumulation of other pollutants such as nitrogen that is also present in the recycled water. To minimise risks to the Googong Dam catchment a section of the south-east corner of the Googong township (39.9 ha) would not be developed. It is zoned for environmental protection to avoid direct impact on the Googong Foreshores.

6.5.3 Mitigation measures

Construction

Soil erosion

Erosion potential for the Proposal would be managed using a Soil and Water Management Plan implemented under the CEMP. The Plan would include measures outlined in Section 6.2.3 as well as those below:

- Measures to ensure limited tracking of dirt off site would be implemented at access points. Where required the controls may include exit rumble grids at all points of egress onto public (sealed) roads, and/or stabilisation of site roads/tracks with aggregate where appropriate.
- Stockpiles would be checked for stability weekly and after heavy rainfall.
- Topsoil would be conserved, where reasonable and feasible, for use in site rehabilitation/revegetation.

Furthermore, during the restoration and clean-up of construction sites, the following measures would be applied to stabilise the soils:

- The sites would be re-profiled to achieve soil stability and congruity with the surrounding landscape. This would be done in consideration of the landscape and open space strategy for the Googong township development.
- Re-seeding would be undertaken, and geotextile materials used as required.
- Trenches would be backfilled and compacted in layers.
- Access to the sites would be managed (including site restrictions) to assist with site recovery.
- There would be progressive revegetation, stabilisation and restoration works of earthworks areas in accordance with the ‘Blue Book’ *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004).

Soil contamination

To avoid soil contamination during construction activities, and to manage contamination if it is found during construction, the following measures would be implemented as well as those included in Section 6.2.3:

- Chemical transport, storage, handling, and disposal procedures would be implemented in accordance with the requirements of dangerous goods and environmental legislation, and industry standards.
- Stop all work in the area if potential or actual contamination is found during earthworks, until a suitably qualified person has inspected the site, the hazard has been assessed and appropriate action has been taken (including delineating areas of concern as required until earthworks can resume safely).

Operation

Soil erosion

The impacts from the potential erosion risks would be addressed by soil and water management measures in the OEMP and Irrigation Management Plan (IMP).

To mitigate potential impacts of the discharge of excess recycled water in Googong Creek, the OEMP will include the following measures:

- Inspect drainage lines and watercourses for evidence of erosion and scouring impacts.
- In the event that impacts are identified, additional measures would be considered. These would include the provision of:
  - Additional energy dissipation structures along drainage lines.
  - Diversion structures around the farm dams or strengthening these structures.
  - Additional sediment basins or the modification of the existing basin.

Additional management measures for erosion control would be similar to those detailed for construction, and include bank restoration techniques, where required (if erosion is identified through monitoring of drainage lines and creeks). Techniques include:

- Stabilising where required by establishing rocks, sandbags, and/or matting to prevent scouring, ensuring that they are placed to conform as far as possible with existing contours.
- Re-spreading topsoil over the area from where it was removed.
- Installing matting that is infused with seedlings to keep the soils stable while it settles.
- Protecting buffer and riparian vegetation zones, and restoring these zones where required.

Soil salinity

The potential for salinity impacts on soils is a primary concern when recycled water is used for irrigation. One way to detect salinity is by measuring how much salt is in a solution. This measurement is called TDS.

In response to workshops conducted with DPI Water (formerly the NSW Office of Water), the level of TDS that would be in recycled water from the IWC Project has been significantly reduced, compared to earlier design proposals, primarily through the use of biological phosphorus removal processes in the treatment system at the WRP. In addition, GTPL and QPRC are committed to reducing salt levels where practical during operation by focussing on mechanisms that would control salt levels in different areas throughout the water recycling system. Three areas are the focus of the salt reduction strategy:

- At the WRP:
  - The treatment process has been optimised to produce recycled water with low salinity, thereby minimising potential adverse salinity impacts.
  - Control mechanisms have been incorporated to ensure salinity of the recycled water can be further reduced if required, either through mandating the specific types of chemicals used in the treatment process and/or reducing the quantity of chemicals used. There is a trade-off between management of phosphorus and management of salinity. If salinity is required to be reduced, changes to the way phosphorus is managed in the treatment process are possible.
  - Management of salt can be adapted as the staging of the WRP and the Googong township progresses. Completing the WRP in stages allows for any lessons learnt in the initial stages to be incorporated and for salt reduction processes to be adopted progressively.
- The system (reticulation infrastructure) – The reticulation infrastructure (e.g. reservoirs, pipe work and sewage pumping stations) has been considered as a further way to influence salt levels. This includes controlling the amounts of chemicals used for odour control and chlorination.
- Users – A Community Education Strategy has been developed to help minimise the environmental and human health risk associated with the use of recycled water within the Googong township. This strategy includes the development of education programs for residents as another method to reduce salt levels during operation. These programs would aim to inform residents about the risks involved with salinity, especially in relation to impacts on plant growth and foliage damage (as these would be of most concern for residents). Residents would be offered advice and alternative ways to reduce this risk. GTPL/QPRC would run programs to:

- Encourage (and, if possible, mandate) residents to use detergents low in phosphorus, sodium, and salt. Education would take place at the time of sale and through structured education sessions planned by QPRC.
- Encourage residents to use appropriate organic fertilisers rather than high potency chemical fertilisers on home gardens and lawns.
- Educate residents to grow species that are tolerant of soil salinity, particularly in areas that are considered to be at a high risk of salinity impacts.
- Educate residents about the potential for vegetation damage from salt, which can be reduced through practices such as minimising leaf wetting, especially during hot weather and during daylight.
- Educate residents about appropriate soil mixes for use in garden landscaping to ameliorate the potential impacts of saline water on garden plants.

Furthermore, an IMP has been developed as part of a Water Management Plan (RPS, 2018) which outlines the procedures and practices related to the sustainable management of irrigation of public spaces for Stages 1 and 2 of the IWC Project. The IMP includes standard operating procedures that would assist in reducing the movement of salt through soil. It also provides a mechanism by which the operations can be monitored and continually assessed. The IMP would be expanded to incorporate the public spaces irrigated for Stage D of the IWC Project.

The existing soil landscape is characterised by well-drained non-sodic soils with no evidence of existing salinity hotspots. Therefore, it is likely natural rainfall would sufficiently dilute any salinity moving down slope. As a result, due to the existing landscape conditions and complemented by the above measures, it is expected that there would be minor salinity issues within and surrounding the WRP site.

Although the predicted levels of TDS would be suitable for irrigation within the Googong township, management measures are suggested as precautionary measures. These include constructing all buildings in accordance with the relevant building codes for salt-affected landscapes as outlined in Building in a Saline Environment (part of the Local Government Salinity Initiative) (DECC, 2007).

Even though unlikely, if monitoring indicates that salt is accumulating in down slope areas such that a negative impact is likely, the stormwater system could be retrofitted with subsoil drains within recycled water irrigation areas. In this way, the stormwater system could direct saline subsoil flows (interflows) into the surface stormwater system. While this measure would address soil salinity impacts, it may have the following impacts:

- A reduction in the groundwater recharge. (This reduction must be considered in the context of overall recharge reduction as a result of the Googong township. Refer to Section 6.5 regarding groundwater recharge).
- An increase in potential surface water salt.

These impacts are generally considered minor in the context of the Proposal and would be weighed up against not implementing the stormwater changes.

As the Googong township is being progressively built over a 25 year period, this would allow for management measures to be adaptively implemented throughout the staging. Therefore, during Stage 1 of the IWC Project, piezometers have been established to monitor the movement and salinity within and below the NH1A development.

Ongoing monitoring of the piezometers, irrigated soils, groundwater, and surface water is necessary and recommended as potential salt impacts are considered long term and ongoing, and impacts may not start to arise for decades and/or would be affected by changing climatic patterns. This ongoing monitoring is outlined in the Water Management Plan and sub-plans, which would be amended to incorporate this ultimate stage of the IWC Project.

6.6 Noise and vibration

A noise and vibration assessment has been prepared by WSP to assess the potential impacts of the Proposal (WSP, 2020). This assessment included a desktop review of background data, attended noise monitoring in February and March 2018 and June 2019 to determine the actual operational noise levels associated with the operational Stage C WRP and Permanent Reservoirs sites and modelling of construction and operational noise associated with Stage D using SoundPLAN software. The findings of the assessment are summarised in this section and the full report is included in Appendix C.

6.6.1 Existing environment

The existing landscape around the WRP site is open grasslands and land already under construction as part of the Googong township development. Residential properties are built in the areas to the west and south of the WRP with an open space buffer zone between the WRP and these properties (refer to Figure 3.1).

The existing landscape around the Permanent Reservoirs site is primarily open grasslands that has previously been used as agricultural grazing land. This area is part of the Googong township (refer to Figure 3.1) and would ultimately become part of the development.

Land on the western side of Old Cooma Road is open agricultural land with a small number of residential homesteads located in proximity to the road adjacent to the Proposal areas.

A total of 18 existing noise receivers are located in proximity to the Proposal. Figure 6.19 and Figure 6.20 show these properties, with a prefix of 'R' referring to residential properties and 'C' referring to commercial properties (C1 is the existing ICON Water Treatment facility and C2 is a ranger station).

The identified noise receivers, shown in Figure 6.19, are:

- R1 to R10 – existing receivers built prior to the Googong township near to Old Cooma Road
- R11 – existing receiver 'Talpa' built prior to the Googong township, 120 metres north of the WRP
- R14 – representative of residential and non-residential sensitive receivers within the Googong township
- R15 – isolated dwelling east of the Googong township
- R16 – isolated dwelling north of Googong township
- C1 – ICON water treatment facility
- C2 – ranger station.

Receivers R12 and R13, which have been identified in noise assessments for previous stages of the WRP and Permanent Reservoirs, are now contained within the receiver locations for the Googong township (R14).

Sensitive receivers within the Googong township (R14) are shown in Figure 6.20 and are identified as:

- R14-01 to R14-14 – residential receivers within the Googong township
- R14-DF – Duncan Fields
- R14-PPS – Public Primary School
- R14-VCC – Village Childcare Centre
- R14-AS – Anglican School
- R14-RO – Rockley Oval.

Figure 6.19 Identified noise affected receivers in and within proximity to the Googong township

Figure 6.20 Identified noise affected receivers within the Googong township development

WRP

Noise monitoring was undertaken between 19 June and 26 June 2019 at the WRP site boundary and at an undeveloped site within the proposed NH1A Stage 4D proposal, approximately 200 metres west of the WRP. The acoustic environment was influenced by noise sources such as construction noise from residential lots within the vicinity, aircraft noise, road traffic noise and activities at the nearby sports field. Additionally, some potential noise-enhancing meteorological conditions were present, with wind speeds ranging from 1.5 to 5.6 m/s measured during the monitoring period. The monitoring results are summarised in Table 6.10.

Table 6.10 Noise monitoring results at the WRP

Description	Time period[2]	Result
Rating Background Noise Level (RBL)[1]	Day	35 dB $L_{A90(15min)}$[3]
	Evening	30 dB $L_{A90(15min)}$[3]
	Night	30 dB $L_{A90(15min)}$[3]
Ambient noise level	Day	44 dB $L_{Aeq90(15min)}$
	Evening	38 dB $L_{Aeq90(15min)}$
	Night	36 dB $L_{Aeq90(15min)}$

(1) The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. The RBL is defined as the 90th percentile of the daily background noise levels during each assessment period.

(2) Day: 7am to 6pm Monday to Saturday, or 8am to 6pm on Sundays and public holidays; Evening: 6pm to 10pm; Night: the remaining periods.

(3) Under the Noise Policy for Industry (EPA, 2017), where daytime RBL is below 35 dBA and evening and nigh-time RBLs are below 30 DBA, they are set instead to 35 dBA for day and 30 dBA for evening and night.

Permanent Reservoirs

Noise monitoring was conducted in between 23 February to 9 March 2018 near 1241 Old Cooma Road, selected to represent background noise levels of receivers located outside of the Googong township. The monitoring results are summarised in Table 6.11. The acoustic environment of the Permanent Reservoirs site is generally dominated by road traffic noise along Old Cooma road.

Table 6.11 Noise monitoring results at Permanent Reservoirs

Description	Time period	Result
Rating Background Noise Level (RBL)	Day	35 dB $L_{A90(15min)}$
	Evening	30 dB $L_{A90(15min)}$
	Night	30 dB $L_{A90(15min)}$
Ambient noise level	Day	50 dB $L_{Aeq90(15min)}$
	Evening	53 dB $L_{Aeq90(15min)}$

6.6.2 Assessment criteria

Construction noise

The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) defines noise management levels (NMLs) for residential and other sensitive land uses, as well as identifying work practices that should be implemented to reduce noise impacts. NMLs are the level of noise above which receivers are considered to be 'noise affected' and are based on the measured RBL as defined in the NPfI, plus an additional allowance of 10 dB during standard hours and 5 dB outside of standard hours (refer to Table 6.12).

Where construction noise levels are above 75 dBA at residential receivers during standard hours, they are considered 'highly noise affected' and require additional considerations to mitigate potential impacts.

The NMLs for the Proposal are provided in Table 6.13 and Table 6.14.

Table 6.12 Construction noise management levels for residential receivers and working hours

Time of day		NML (dBA $L_{Aeq\ 15minute}$)[1, 2]	Application
Standard hours: • Monday – Friday 7am – 6pm • Saturday 8am – 1pm • No work on Sundays or public holidays		Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured dBA $L_{eq;15\ minute}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
		Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside standard hours (OOHW)		Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent of any development works should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent of any development works should negotiate with the community.

(1) Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.

(2) The RBL is the overall background noise level representing each assessment period (day/evening/night) over the whole monitoring period. The term RBL is described in detail in the NSW NPfI.

Table 6.13 Construction noise management levels for residential receivers

Receiver	NML ($L_{eq\ 15\ min}$ dBA)			
	Day (SH)	Day (OOHW)	Evening (OOHW)	Night (OOHW)
R1 to R10	45	40	35	35
R11 to R14	45	40	35	35
R15 to R16	45	40	35	35

Note: SH = recommended standard working hours, OOHW = outside of recommended standard hours work

Table 6.14 Construction noise management levels for non-residential sensitive land uses

Land use	NML, $L_{eq\ 15\ min}$ dBA (applies when in use)
School classrooms, places of worship	45 (internal) or 55 (external)[1, 2]
Industrial	75 (external)
Active recreation areas	65 (external)
Childcare centre	45 (internal) or 55 (external)[1, 2]

(1) External noise level estimated based on an outside to inside correction of 10 dB, assuming windows are partially open for ventilation.

(2) Based on the maximum recommended internal noise level as specified in Australian Standard AS 2107 Recommended design sound levels and reverberation times for building interiors. External noise level estimated based on an outside to inside correction of 10 dB, assuming windows are partially open for ventilation.

Sleep disturbance

Construction noise during the night has the potential to disturb the sleep patterns of residents within proximity to the Proposal works sites. The potential for sleep disturbance from maximum noise level events and operational noise during the night-time period is detailed in the NPfI. The operational sleep disturbance criteria for developments at the proposed residential locations are the following:

- 40 dB $L_{Aeq,\ 15min}$ or the rating background level plus 5 dB, whichever is the greater, and/or
- 52 dB L_{AFmax} or the rating background level plus 15 dB, whichever is the greater.

Where the development night-time noise levels at a residential location exceeds the following, a detailed maximum noise level event assessment should be undertaken.

Based on the above, the external sleep disturbance screening criteria are set as follows for all residential receivers:

- 40 dB $L_{Aeq,\ 15min}$ and 52 dB L_{AFmax}.

Construction traffic

During construction, the Proposal has the potential to introduce additional road traffic along existing road networks (refer to Section 6.1). The NSW Road Noise Policy (RNP) has been used to assess additional noise from traffic generated by the Proposal on public roads. The external noise criteria are applied one metre from the external facades of the affected building and at a height of 1.5 metres above the level of the most affected storey (refer to Table 6.15).

Table 6.15 Road Noise Policy assessment criteria

Road type	External road traffic noise criteria	
	Day 7am – 10pm	Night 10pm – 7am
Local roads	55 dB $L_{Aeq,\ 1hr}$	50 dB $L_{Aeq,\ 1hr}$

Operational noise

Under the existing Concept Approval and EPL 20188 condition O6.2, all noise emitted from the operation of the project infrastructure shall not exceed 35 dB $L_{Aeq, 15\ min}$ (A-weighted decibel) at any residence on privately owned land.

The Proposal has also incorporated the requirements of the Land and Environment Court settlement and LPA with QPRC to reduce noise emanating from the WRP by 1 dBA through the proposed noise attenuation covers for the recycled water transfer pumps. It is also be noted that 1 dBA is considered a negligible noise measure and for all intents and purposes is within error range of noise measuring instruments.

The LPA requirement and how it has been addressed by the Proposal is also discussed in Section 4.1.2.

The Noise Policy for Industry (NPfI) (EPA, 2017) outlines the procedures to determine the project noise trigger levels relevant to an industrial development. The project specific noise trigger level is determined by the lower of the project intrusiveness noise level and project amenity noise level, which are dependent on:

- The receiver's background noise environment
- The time of day of the activity
- The character of the noise
- The type of receiver and nature of the area.

Project intrusiveness noise level

The NPfI outlines the project intrusiveness noise level for residential receivers as:

- $L_{Aeq, 15minute}$ ≤ Rating Background Level (L_{A90}) + 5 dB(A)

Based on the RBLs (refer to Table 6.10 and Table 6.11), the project intrusiveness level for the operation of the Proposal has been established in accordance with the NPfI and is outlined in Table 6.16.

Table 6.16 Project intrusiveness noise level

Receiver location	Time period	RBL dBA	Project intrusiveness noise level (RBL + 5 dB)
R1 to R10	Day	35	40
	Evening	30	35
	Night	30	34
R11 to R14	Day	35	40
	Evening	30	35
	Night	30	35
R15 to R16	Day	35	40
	Evening	30	35
	Night	30[1]	35

(1) In accordance with NPfI, where the measured rating background level is less than 30 dBA for the evening and night periods, it is set to 30 dBA. When it is found to be less than 35 dBA for the day period, it is set to 35 dBA.

Project amenity noise levels

The NPfI recommends the ambient noise level within an area from all industrial noise sources combined should remain below the amenity noise levels. The amenity noise levels are dependent on the land use types associated with the assessed receivers. As such, the project intrusiveness level is then determined as:

Project amenity noise level ($L_{Aeq, period}$) = Recommended amenity noise level – 5 dB

In order to compare the intrusiveness and amenity criteria using the same time period, the NPfI states that the $L_{Aeq, 15min}$ noise level is taken to equal the $L_{Aeq, period}$ + 3 dB unless sufficient evidence can be provided for an alternative approach. In this case, the approach in the NPfI is considered appropriate.

Based on the Queanbeyan LEP, the Googong Neighbourhood Stage 4D is currently located in zones R1 General Residential and R5 Large Lot Residential for the large lots in the southeast of the Googong township. Land surrounding the Googong township is predominantly Zone R2 Rural Landscape. Based on these landscapes, the applicable amenity levels are presented in Table 6.17.

Table 6.17 Project amenity noise levels

Location	Day	Evening	Night
Recommended amenity noise levels for rural residential use[1]			
R1 Urban general residential use	60 dB $L_{Aeq, period}$	50 dB $L_{Aeq, period}$	45 dB $L_{Aeq, period}$
R5 Rural residential use	50 dB $L_{Aeq, period}$	45 dB $L_{Aeq, period}$	40 dB $L_{Aeq, period}$
Project amenity noise levels (dB $L_{Aeq, period}$)			
R1 Urban general residential use	55 dB $L_{Aeq, period}$	45 dB $L_{Aeq, period}$	40 dB $L_{Aeq, period}$
R5 Rural residential use	45 dB $L_{Aeq, period}$	40 dB $L_{Aeq, period}$	35 dB $L_{Aeq, period}$
Project amenity noise levels (dB $L_{Aeq, 15min}$)[2]			
R1 Urban general residential use	58 dB $L_{Aeq, 15min}$	48 dB $L_{Aeq, 15min}$	43 dB $L_{Aeq, 15min}$
R5 Rural residential use	48 dB $L_{Aeq, 15min}$	43 dB $L_{Aeq, 15min}$	38 dB $L_{Aeq, 15min}$

(1) Daytime RBL <40 dBA, evening RBL <35 dBA, night RBL <30 dBA.

(2) In accordance with the NPfI, the amenity noise level is converted from $L_{Aeq, period}$ to $L_{Aeq, 15min}$ by adding 3 dB to the $L_{Aeq, period}$ level.

6.6.3 Potential impacts

Construction noise

The noise modelling considers the likely construction staging of when certain construction plant may be operational and the known Sound Power Levels for each item of plant to calculate a predicted noise level at a receiver location. The predicted noise level is then compared with the NML for that receiver to determine whether there might be exceedances during construction.

For assessment purposes, construction plant and equipment have been modelled to operate simultaneously to represent the potential worst-case noise impacts. The model also accounts for natural land contours and existing buildings that can provide shielding from noise.

Fifteen construction scenarios representing each of the key construction stages for the Proposal have been assessed (refer to Table 6.18).

It is expected that all construction works would occur during the designated standard hours. Therefore, the modelling and assessment was based on the determined daytime NMLs only. Should out-of-hours works be required, a separate noise assessment should be undertaken to determine the acoustic risks associated with the specific activities proposed to occur outside of standard hours and approval sought from QPRC/EPA.

Table 6.18 Stage D construction scenarios

Equipment	Quantity	Sound power level (SWL) per unit (dBA)
Scenario 1 – Site establishment		
Excavator	1	112
Roller	1	118
Petrol picket driver	1	100
Hand tools	2	106
Compactor	1	106
Crane	1	107
Truck	4	109
Hand power tools	2	109
Overall sound power level		**122**

Equipment	Quantity	Sound power level (SWL) per unit (dBA)
Scenario 2 – Services location		
Truck	1	109
Water cart	1	110
4WD	2	105
Overall sound power level		**114**
Scenario 3 – Mobilisation		
Truck	4	109
Generator	1	103
Excavator	1	112
Roller	1	118
Overall sound power level		**121**
Scenario 4 – Implementation of erosion and sediment controls		
Dozer	1	116
Compactor	1	106
Excavator	2	112
Roller	2	118
Mulcher	1	116
Truck	4	109
Overall sound power level		**124**
Scenario 5 – Clearing, stripping, and stockpiling		
Dozer	1	115
Excavator	1	112
Truck	4	109
Water cart	1	110
Overall sound power level		**120**
Scenario 6 – Construction amenities		
Excavator	1	112
Roller	1	118
Water cart	1	110
4WD	4	105
Overall sound power level		**120**
Scenario 7 – Temporary services		
Generator	2	103
Excavator	1	112
Roller	1	118
Water cart	1	110
4WD	4	105
Overall sound power level		**120**
Scenario 8 – Roads works (WRP only)		
Truck and dog	4	109
Roller	1	118
Excavator	1	112
Concrete truck	4	115
Pavement profiler	1	117

Equipment	Quantity	Sound power level (SWL) per unit (dBA)
Water cart	1	110
4WD	4	105
Overall sound power level		**125**
Scenario 9 – Earthworks		
Excavator	1	112
Truck	4	109
Overall sound power level		**117**
Scenario 10 – Form work, reinforcement, and concrete (WRP only)		
Crane	1	107
Excavator	1	112
Concrete truck	4	115
Concrete pump	1	120
4WD	4	105
Overall sound power level		**124**
Scenario 11 – Services/yard piping		
Excavator	1	112
Roller	1	118
Whacker	1	116
Water cart	1	110
Overall sound power level		**121**
Scenario 12 – Mechanical and process equipment		
Crane	1	107
Scissor lift	1	98
Welder	2	96
4WD	4	105
Overall sound power level		**113**
Scenario 13 – Electrical		
Crane	1	107
Scissor lift	1	98
4WD	4	105
Overall sound power level		**113**
Scenario 14 – Demolition and demobilisation		
Truck	4	109
Crane	4	107
4WD	4	105
Overall sound power level		**118**
Scenario 15 – Restoration and landscaping		
Excavator	1	112
Truck	4	109
Water cart	1	110
Overall sound power level		**118**

Predicted noise levels

Construction of the Proposal would be undertaken over a period of 12 months. Modelling of noise sources (trucks, excavators, concrete trucks etc.) was undertaken for scenarios with the highest (125 dBA SWL) and lowest (113 dBA SWL) noise emissions at both WRP and Permanent Reservoirs sites.

The predicted construction noise levels at sensitive receiver locations are outlined in Table 6.19, and any exceedances of the NMLs are highlighted in purple.

Table 6.19 Predicted construction noise levels during standard hours

Receiver	NML – SH (dBA)	Scenario (dBA)	
		Road works (highest noise emissions)	Mechanical and process equipment (lowest noise emissions)
C1	75	48	36
C2	75	61	49
R1	45	45	34
R2	45	44	32
R3	45	**46**	35
R4	45	**47**	36
R5	45	**49**	38
R6	45	**47**	36
R7	45	**56**	45
R8	45	**58**	**47**
R9	45	**60**	**49**
R10a	45	**59**	**48**
R10b	45	**58**	**47**
R11	45	**63**	**51**
R15	45	**50**	38
R16	45	22	10
Receivers within Googong township (R14)[1]			
R14-01	45	**59**	**47**
R14-02	45	**61**	**49**
R14-03	45	**63**	**51**
R14-04	45	**66**	**54**
R14-05	45	**65**	**53**
R14-06	45	**67**	**55**
R14-07	45	**63**	**51**
R14-08	45	**50**	39
R14-09	45	**47**	36
R14-10	45	40	29
R14-11	45	36	25
R14-12	45	36	25
R14-13	45	41	30
R14-14	45	43	31
R14 – 6B Public Primary School	55	42	30
R14 – Duncan Fields	65	**68**	56

Receiver	NML – SH (dBA)	Scenario (dBA)	
		Road works (highest noise emissions)	Mechanical and process equipment (lowest noise emissions)
R14 – Public Primary School	55	42	30
R14 – Village Centre Childcare	55	55	43
R14 – Rockley Oval	65	45	33

(1) Receiver points set at the boundary closest to the WRP and Permanent Reservoirs site.

Based on the results presented above, the following conclusions were drawn:

- All predicted noise levels were less than the 'Highly Noise Affected' NML of 75 dbA
- At receivers R8 to R10b near Old Cooma Road, the standard hours NML are exceeded for all construction scenarios
- At receiver R11 (Talpa), the standard hours NML was exceeded for all construction scenarios by 6 to 18 dB
- At receivers R14-01 to R14-07, the standard hours NML are exceeded for all scenarios by 2 to 22 dB
- At Duncan Fields, the standard hours NML are exceeded for active recreation
- At all schools and childcare centres, noise levels are predicted to meet the respective NMLs.

It should be noted that construction noise has formed part of the acoustic characteristic of the Googong township in recent years. While the majority of bulk earthworks associated with the Googong township have been completed, construction of individual dwellings throughout the township is still underway. As such, the potential construction noise impacts associated with the WRP and Permanent Reservoirs sites are not likely to result in additional noise impacts to residents. Additionally, no noise complaints were received during the construction of Stage AB and C projects, which included noisier construction activities such as major earthworks and road construction.

Construction road noise

Construction traffic associated with the WRP site is expected to utilise Old Cooma Road and Googong Road, while traffic associated with the Permanent Reservoirs site is expected to entirely utilise Old Cooma Road. The expected peak daily traffic generation from construction of Stage D at both the WRP and Permanent Reservoirs sites is provided in Table 6.31 (refer to Section 6.1).

A road noise assessment was undertaken to identify the potential noise impacts on the closest receivers as a result of construction of the Proposal. The key roads, relevant trigger levels and setback distances between the nearest receivers and the key roads is outlined in Table 6.20.

Table 6.20 Road noise criterion and receiver setback distances

Road	Category	Noise trigger level	Setback distance between receiver and road
Old Cooma Road	Sub-arterial	60 dB $L_{Aeq, 15min}$	110 metres
Googong Road	Local	55 db $L_{Aeq, 1hr}$	40 metres

Based on the assumptions in Table 6.20, the following road noise levels have been predicted for construction of the Proposal:

- 45 dB $L_{Aeq, 15min}$ at 110 metres from Old Cooma Road; this noise level meets the daytime criterion for an arterial road
- 57 dB $L_{Aeq, 1 hr}$ at 40 metres from Googong Road; this noise level exceeds the daytime noise criterion of 55 dBA by 2 dB.

Although above the noise criterion for a local road, the noise level difference of 2dB along Googong Road was not considered significant and unlikely to be a perceptible change. Further, construction traffic would not be generated outside of standard construction hours unless out of hours works are approved.

It should also be noted that a conservative, worst case scenario was used in the assessment and construction traffic would typically generate much lower noise levels.

Construction vibration

The most dominant construction vibration sources from the assessed scenarios presented in Table 6.18 are considered to be vibratory rollers which have the potential to result in vibration impacts on nearby sensitive receivers if appropriate mitigation measures are not implemented.

To assist with assessment of the potential construction, Roads and Maritimes Services (RMS) *Construction Noise and Vibration Guidelines* (2016) (CNVG) provides minimum working distances from sensitive receivers for dominant vibration generating equipment. Table 6.21 presents the indicative safe working distances for the most dominant vibration generating plant. The distances are based on meeting the five millimetres per second limit for cosmetic damage from British Standard (BS) 7385 and human comfort as given in EPA's vibration guidelines.

Table 6.21 Recommended safe working distances for vibration intensive equipment (CNVG, 2016)

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage (m)	Human response (m)
Vibratory roller	< 50 kN (typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (typically 2 – 4 tonnes)	6	20
	< 200 kN (typically 4 – 6 tonnes)	12	40
	< 300 kN (typically 7 – 13 tonnes)	15	100
	< 300 kN (typically 13 – 18 tonnes)	20	100
	< 300 kN (< 18 tonnes)	25	100
Small hydraulic hammer	300 kg (5 – 12 tonne excavator)	2	7
Medium hydraulic hammer	900 kg (12 – 18 tonne excavator)	7	23
Large hydraulic hammer	1600kg (8 – 34 tonne excavator)	22	73
Jackhammer	Hand held	1 (nominal)	2

All identified sensitive receivers are located at least 100 m or greater from the perimeter of the WRP and Permanent Reservoirs sites. This excludes any further development that may occur closer to the proposed construction areas. It is however understood that any possible development near these construction areas is likely to only occur after the construction of Stage D. Based on the above, the proposed construction methodologies are not expected to cause significant vibration impacts at the identified sensitive receivers.

Operational noise

To determine the operational noise impacts of the Proposal, site surveys and noise measurements were conducted at the existing WRP and Permanent Reservoirs sites. The primary objectives of these surveys were to determine the actual operational noise levels associated with the operational WRP and Permanent Reservoirs sites as well as to determine the current dominant noise sources.

WRP

The modelled sound power levels of the dominant noise sources at the existing WRP and assumed Stage D WRP sound power levels are summarised in Table 6.22.

Table 6.22 Modelled sound power levels of dominant sources at the WRP

WRP item	Modelled Stage AB and C sound power level (dBA)	Assumed Stage D sound power level (dBA)
A recycle pump	63	66
Filtrate pump	85	88
Membrane feed pump	79	82
R recycle pump	59	62
Scum pump	66	69
WAS feed pump	79	82
Inlet works – coarse screen	73	-
Inlet works – fine screen	73	-
Inlet works – grit classifier	78	-
Inlet works – washpress	76	-
Effluent transfer pump (enclosed)	63	63
Foul air fan (enclosed)	71	-
Neutralisation transfer pump	81	-
Polymer dosing pump	72	72
Recycled water transfer pump	85	85
Site service water pump	71	-
Sludge dewatering feed pump	65	-
Tertiary filter feed pump (enclosed)	61	61
WAS recuperative thickening pump	75	75
Aeration blower ductwork (enclosed)	42 dBA/metre	45 dBA/metre
Digestion blower ductwork	56 dBA/metre	-
Membrane blower ductwork	34 dBA/metre	-
Bioreactor membrane tank	56 dBA/m^2	56 dBA/m^2
Blower pipework pit	42 dBA/m^2	-
Centrifuge north block wall	55 dBA/m^2	-
Centrifuge west roller door	61 dBA/m^2	-
Foul air fan ductwork	65 dBA/m^2	-
Pump associated with new aerobic digester	-	80
Motor associated with the rotary drum thickener	-	77

The modelled noise sources were used to predict the Stage D operational noise levels at existing and future receivers closest to the WRP site. These receivers are shown in Figure 6.21, and include future residential developments depicted by yellow lines.

The assessment also considered noise-enhancing meteorological conditions at the WRP. It was determined that potential noise-enhancing meteorological conditions (light winds blowing up to 3 m/s) should only be considered for receivers in the north and west of the WRP, as the conditions are not expected to affect receivers in the south or east of the WRP. The predicted operational noise levels at each receiver are summarised in Table 6.23, with exceedances of the criterion highlighted.

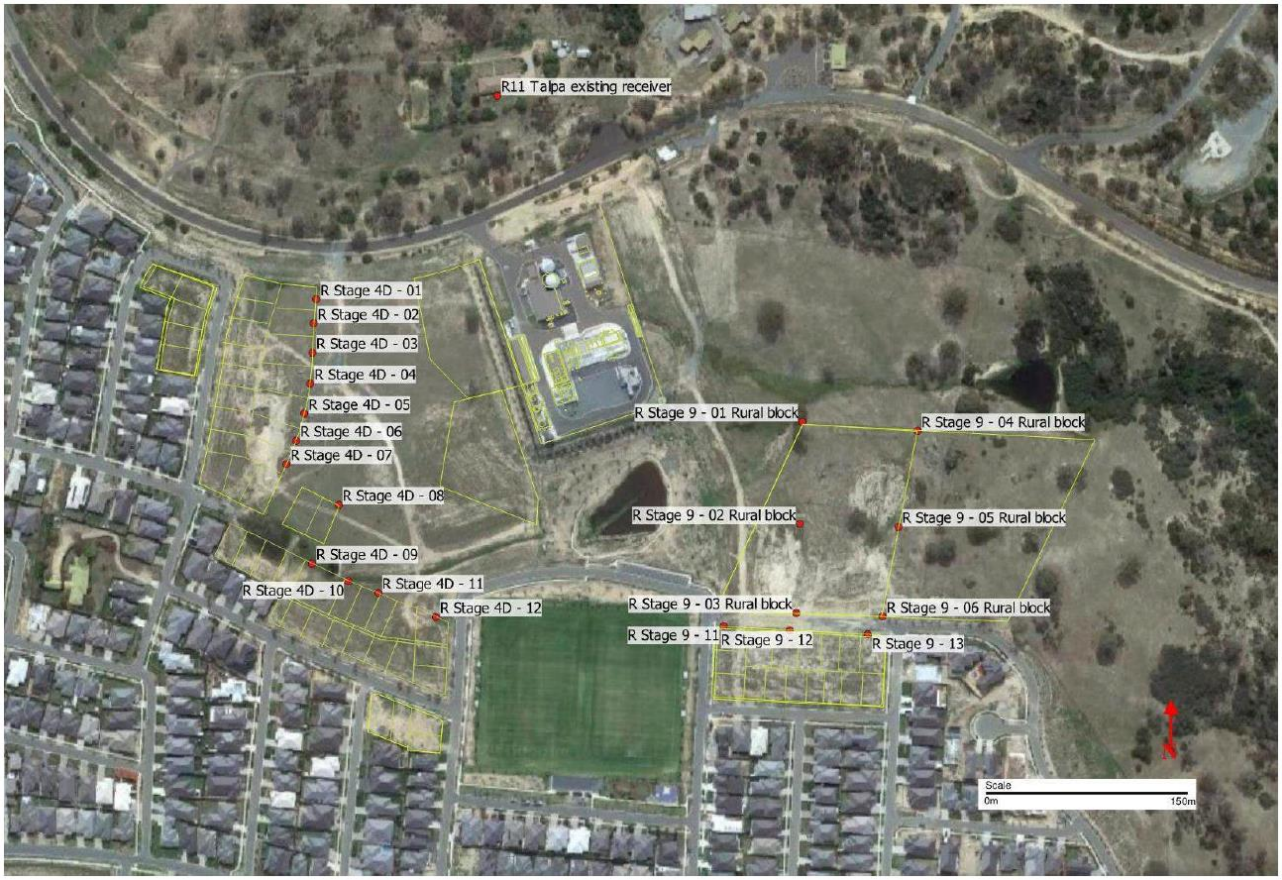

Figure 6.21 Assessed receivers for Stage D operational noise at the WRP (WSP, 2020)

Table 6.23 Predicted operational noise levels at ultimate WRP

Receiver	Direction (relative to WRP)	Operational noise criterion	Predicted operational noise levels ($L_{Aeq, 15min}$) (dBA,	
			Standard meteorological condition	Up to 3 m/s blowing from source to receiver
R11 Talpa existing receiver	North	35 dB $L_{Aeq, 15\ min}$	27	29
R Stage 4D - 01	West	35 dB $L_{Aeq, 15\ min}$	32	35
R Stage 4D - 02	West	35 dB $L_{Aeq, 15\ min}$	32	35
R Stage 4D - 03	West	35 dB $L_{Aeq, 15\ min}$	33	**36**
R Stage 4D - 04	West	35 dB $L_{Aeq, 15\ min}$	31	33
R Stage 4D - 05	West	35 dB $L_{Aeq, 15\ min}$	26	28
R Stage 4D - 06	West	35 dB $L_{Aeq, 15\ min}$	20	22
R Stage 4D - 07	West	35 dB $L_{Aeq, 15\ min}$	19	21
R Stage 4D - 08	Southwest	35 dB $L_{Aeq, 15\ min}$	29	Not applicable
R Stage 4D - 09	Southwest	35 dB $L_{Aeq, 15\ min}$	22	Not applicable
R Stage 4D - 10	Southwest	35 dB $L_{Aeq, 15\ min}$	26	Not applicable
R Stage 4D - 11	Southwest	35 dB $L_{Aeq, 15\ min}$	25	Not applicable
R Stage 4D - 12	Southwest	35 dB $L_{Aeq, 15\ min}$	28	Not applicable
R Stage 9 - 01 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	**36**	Not applicable

Receiver	Direction (relative to WRP)	Operational noise criterion	Predicted operational noise levels ($L_{Aeq, 15min}$) (dBA,	
			Standard meteorological condition	Up to 3 m/s blowing from source to receiver
R Stage 9 - 02 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	35	Not applicable
R Stage 9 - 03 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	33	Not applicable
R Stage 9 - 04 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	33	Not applicable
R Stage 9 - 05 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	33	Not applicable
R Stage 9 - 06 Rural block	Southeast	35 dB $L_{Aeq, 15\ min}$	32	Not applicable
R Stage 9 - 11	Southeast	35 dB $L_{Aeq, 15\ min}$	33	Not applicable
R Stage 9 - 12	Southeast	35 dB $L_{Aeq, 15\ min}$	32	Not applicable
R Stage 9 - 13	Southeast	35 dB $L_{Aeq, 15\ min}$	32	Not applicable
Council depot	West	68 dB $L_{Aeq, 15\ min}$	46	Not applicable
Scout's hall	West to southwest	53 dB $L_{Aeq, 15\ min}$	42	Not applicable

Based on the results resent above, the following conclusions were drawn:

- The ultimate WRP is predicted to generally comply with the Part 3A approval noise limit at all future receivers within Googong Stage 4D. at the existing 'Talpa' receiver to the north and non-residential receivers (including council depot and scout's hall).
- A 1 dB exceedance is predicted during possible noise-enhancing meteorological conditions at a Stage 4D lot (R Stage 4D – 03).
- A portion of one proposed rural block within Googong Stage 9 is predicted to exceed the noise limit by up to 1 dB, though the exceedance is considered acceptable as 1 dB is generally acoustically negligible. In addition, the majority of the proposed rural block is predicted to meet the limit. When developed, it is recommended the associated dwelling be constructed within the area predicted to be within the 35 dBA limit.

A noise colour plot of the predicted operational noise impact of Stage D WRP under noise-enhancing meteorological conditions is presented in Figure 6.22, with the 35 dBA limit outlined.

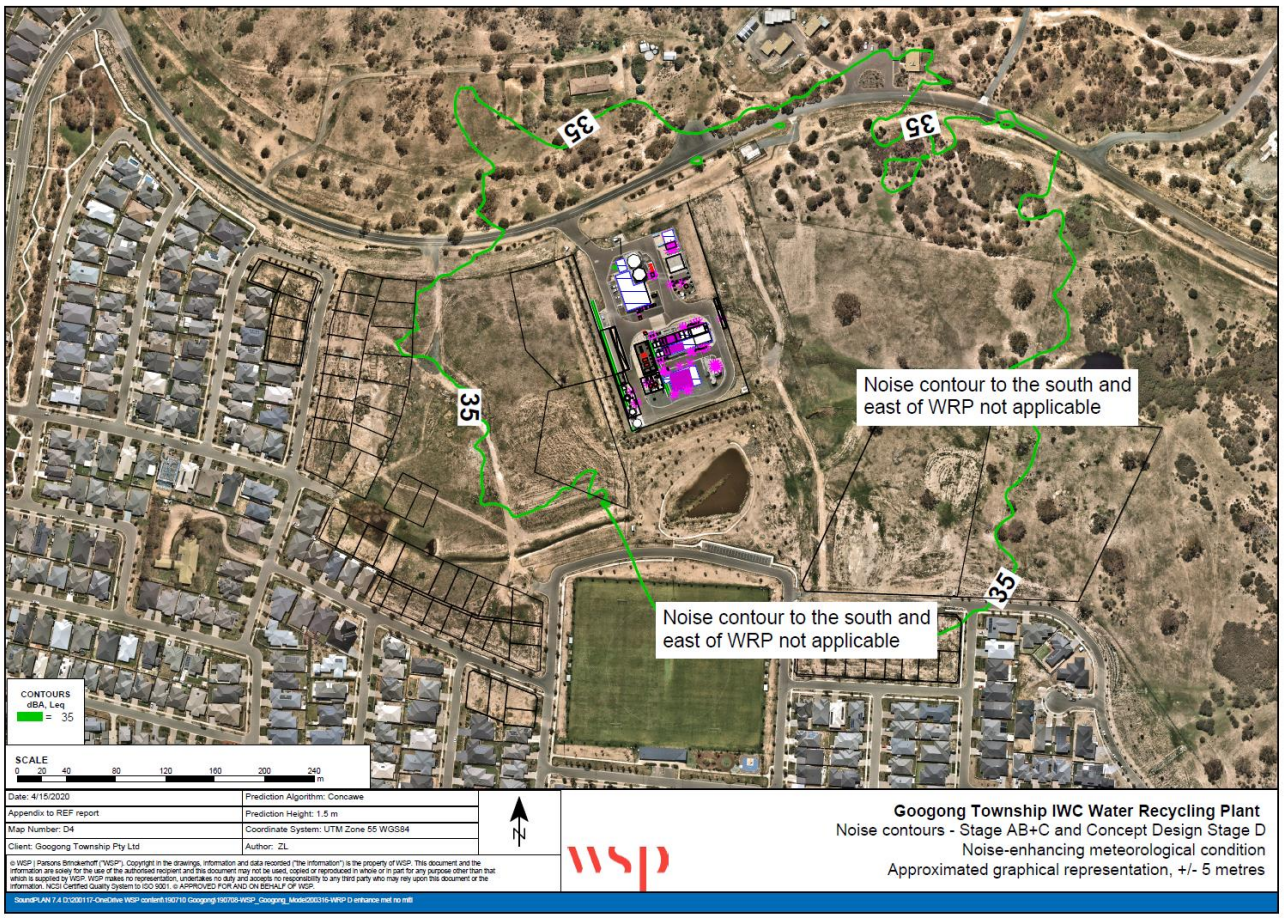

Figure 6.22 Operational noise at the WRP under noise-enhancing meteorological conditions (WSP, 2020)

Permanent Reservoirs

The modelled sound power levels of the dominant noise sources at the existing Permanent Reservoirs are described in Table 6.24.

Table 6.24 Modelled sound power levels of dominant noise sources at Permanent Reservoirs

Item	Quantity	Modelled sound power level (dBA)
Existing recycled water booster pump	5	85 each
New potable water booster pump	3	85 each
New recycled water booster pump	5	85 each
Chemical dosing pump	4	69 each

The modelled noise sources were used to predict the Stage D operational noise levels at existing and future receivers closest to the Permanent Reservoirs site. These receivers are shown in Figure 6.23, and include future residential developments depicted by yellow lines. The predicted operational noise levels at each receiver are summarised in Table 6.25.

Figure 6.23 Assessed receivers for Stage D operational noise at the Permanent Reservoir site (WSP, 2020)

Table 6.25 Predicted operational noise levels at ultimate Permanent Reservoirs

Receiver	Direction (relative to Permanent Reservoirs)	Operational noise criterion	Predicted operational noise levels (dBA, $L_{Aeq, 15min}$)	
			Standard meteorological condition	Up to 3 m/s blowing from source to receiver
R NH2 - 01	North	35 dBA $L_{Aeq. 15min}$	28	28
R NH2 - 02	East	35 dBA $L_{Aeq. 15min}$	27	Not applicable
R NH2 - 03	South	35 dBA $L_{Aeq. 15min}$	29	Not applicable
R NH2 - 04	West	35 dBA $L_{Aeq. 15min}$	27	27

The assessment determined that the potential noise impacts associated with the operation of Stage D Permanent Reservoirs is generally insignificant as:

- Compliance with the Part 3A approval noise limits have been predicted for future residential receivers, including under noise-enhancing meteorological conditions.

A noise colour plot of the predicted operational noise impact of Stage D WRP under noise-enhancing meteorological conditions is presented in Figure 6.24 with the 35 dBA limit outlined.

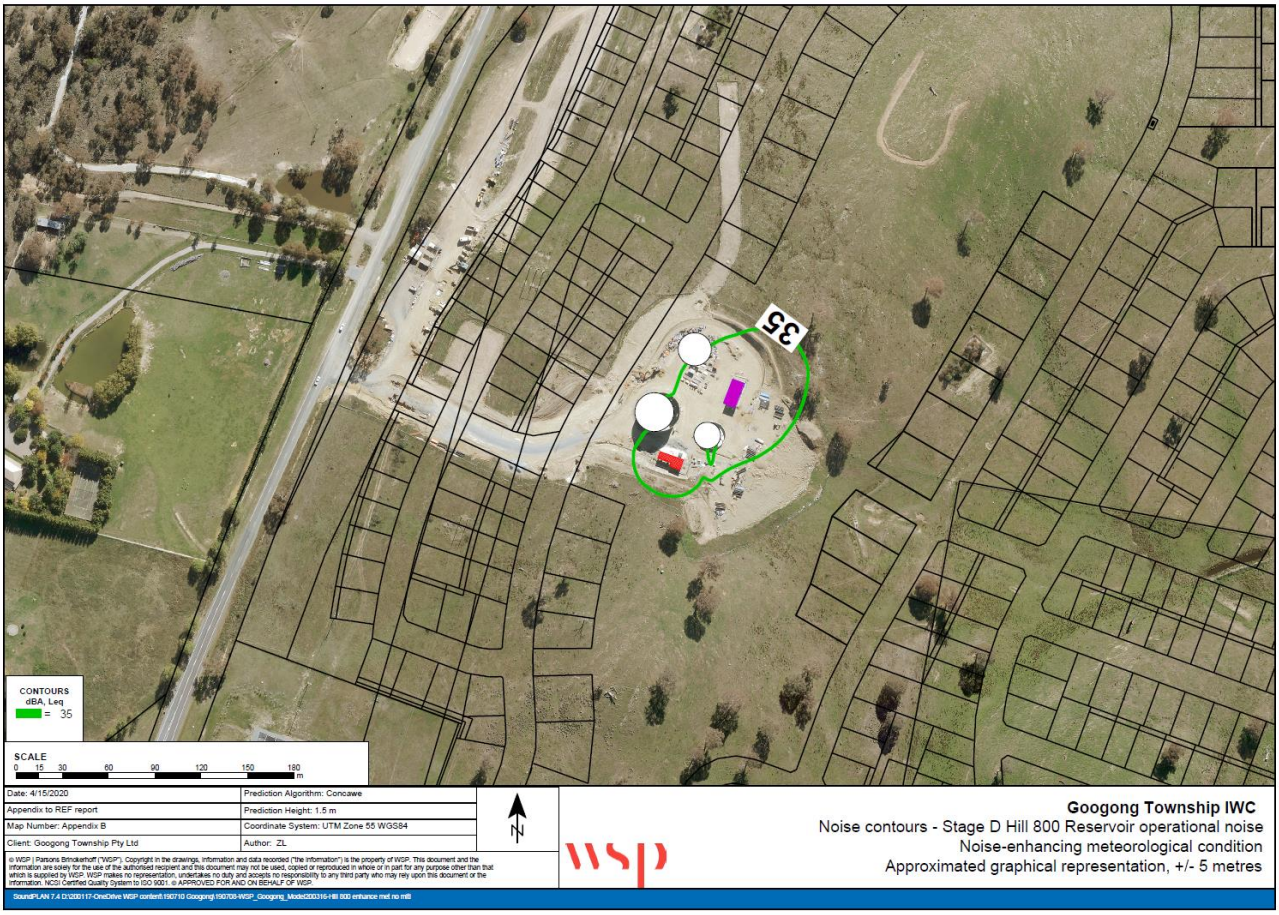

Figure 6.24 Operational noise at Permanent Reservoirs under noise-enhancing meteorological conditions (WSP, 2020)

Sleep disturbance

During noise monitoring previously conducted at 35 metres to the west of the WRP, several maximum noise events were observed. These noise events were observed to be generally <50 dBA Lmax, at a worst-case scenario of 35 metres.

The Proposal is not expected the alter the nature of the existing maximum noise events. The potential maximum noise levels at the proposed Googong Stage 4D and Stage 9 (and all other residential receivers) are expected to comply with the sleep disturbance screening criterion of ≤52 dBA L_{max}.

Based upon a review of the noise sources at the Permanent Reservoirs site, it is understood that noise is expected to be generally steady. Notable maximum noise events that could increase the risk of sleep disturbance are not expected to occur.

Operational road noise

A minor volume of road traffic is expected to be generated during operation of the Proposal. Traffic movements are expected to be limited to light vehicles used by site staff or service personnel. As such, additional noise impacts from the operation of the Proposal are expected to be negligible.

Operational vibration

No operational vibration impacts are expected as a result of the Proposal.

6.6.4 Mitigation measures

Construction

Due to the predicted exceedances of the NMLs at numerous locations, the ICNG requires that feasible and reasonable mitigation strategies be considered to reduce the potential noise impact. Prior to the commencement of works, a Construction Noise and Vibration Management Plan should be developed for all construction activities and included in the CEMP.

This plan would outline measures to minimise construction noise and vibration impacts on sensitive receivers and should be prepared on the basis of detailed construction methodologies from the contractor. It would include (but not limited to) the following:

- Identification of nearby residences and other sensitive land uses, including identification of all occupied dwellings within the Googong township.
- Approved hours of work and what work would be undertaken.
- Construction works would be planned and carried out during standard construction hours wherever possible. Should works be required outside of standard hours, a detailed assessment should be undertaken specific to the proposed activities. Any works conducted outside of standard hours would also be accompanied with a strong justification.
- Identification of dominant noise and vibration generating activities.
- Details of noise mitigation and management measures to be applied.
- Information for worker training to minimise noise impacts.
- Community consultation protocol(s).
- Complaints handling protocol(s).

Further management measures would be included as appropriate from Transport for NSW's *Construction Noise Strategy* outlined in Table 6.26.

Operation

Based on the predicted noise contours, noise impacts associated with the Stage D WRP and Permanent Reservoirs were compliant with the criterion at all existing receivers and future residential lots within the Googong township and all receivers outside of the Googong township. No additional noise mitigation measures are therefore required for the Proposal to comply with the relevant operational noise limits.

Table 6.26 Transport for NSW's *Construction Noise Strategy* mitigation measures

Action required	Details
Management measures	
Implement any project specific mitigation measures required	In addition to the measures set out in this table, any project specific mitigation measures identified in this report.
Implement community consultation measures	Periodic notification (monthly letterbox drop or equivalent), website, project Infoline, Construction Response Line, email distribution list.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one (1) hour between each block.

Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels	The noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels.
Rental plant and equipment	Noise emissions should be considered as part of the selection process.
Use and siting of plant	Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Plant and vehicles to be turned off when not in use. Noise-emitting plant to be directed away from sensitive receivers.
Plan works site and activities to minimise noise and vibration	Plan traffic flow, parking, and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

6.7 Air quality

An air quality assessment (and supplementary dust assessment) has been prepared by Stantec to assess the potential impacts of the Proposal (Stantec, 2020). This assessment included a desktop review of background information/data and modelling of odour impacts using CALPUFF software. The findings of the assessment are summarised in this section and the full report is included at Appendix H.

6.7.1 Existing environment

The Proposal sites are located within a rural landscape characterised by large rural landholdings that is transitioning into a suburban area with the ongoing development of the Googong township. The surrounding area is predominantly characterised by low-intensity grazing, bushland, and rural residential land uses; no intensive agricultural activities are known to occur.

Googong is located within a temperate climate, distinctively characterised by dry (and warm) summers and cold winters. Mean temperatures are within the range of 13–27°C during summer and 0.5–12°C in winter. Uniform rainfall is experienced throughout the year with an average of 615.5 mm received per annum.

An automatic weather station was installed on site at the Stage AB WRP in late 2013 and it collects data on wind speed and wind direction. The mean wind speed for a one-year period (1 September 2013 to 31 August 2014) was 3.1 m/s. Prevailing wind directions are listed in Table 6.27.

Table 6.27 Prevailing wind conditions

Period	Prevailing wind direction
Time of year	
Summer	South-south east, south east, north west, west-north west, east, and east-south east
Autumn	South-south east, south east, north west and west-north west
Winter	South-south east, south east, north west and west-north west
Spring	South-south east, south east, north west and west-north west
Time of day	
Early morning	South-south east and south east
Morning	South-south east, south east, north west and west-north west
Afternoon	West-north west and north west
Evening	South-south east, south east, north west and west-north west

The ambient air quality of the study area is affected by the predominantly agricultural use of the surrounding area and is considered to be good. There are minimal odour impacts from the agricultural uses due to the low-intensity farming.

Various external factors would impact on air quality in the area to varying degrees. These include:

- The existing IWC Project components.
- Construction activities related to the ongoing development of the Googong township.
- Seasonal bushfires, burn-offs and hazard reduction burning, which produce smoke and ash.
- Extreme weather events combined with drought, which can cause dust or particulates from the ongoing construction activities related to the development of the Googong township.

6.7.2 Potential impacts

Construction

Construction would generate minor dust impacts. Dust and particulate matter emissions from construction activities would generally be associated with earthworks and traffic movement along the temporary construction access. The extent of the impact would vary depending upon soil type, soil moisture, ground cover and the prevailing wind conditions at a given location.

The following construction activities are potential sources of dust generation:

- General construction activities
- Rock excavation, trenching, backfilling, and reinstatement
- Wind erosion from stockpiling of excavated topsoil and trench spoil
- Movement of vehicles and construction machinery, both within and in/out of the construction sites.

In addition, adverse weather conditions and potential for dust storms; adverse impacts on air quality due to smoke and other conditions; or emissions from vehicles may also create additional air quality risks.

During construction, it is unlikely that there would be any odour impacts that would affect air quality, as construction plant and vehicles at the WRP and Permanent Reservoirs sites are the only sources and any odour emissions would be negligible within the context of the open areas used for construction. Therefore, the key air quality issue during operation of the Stage D WRP is the potential odour impact. The assessment of odour impact is provided below.

Operation

During operation, it is unlikely that particulate matter (dust) would affect air quality at either the WRP or Permanent Reservoirs sites. The proposed Stage D works would not introduce any significant potential sources of dust in comparison to the existing WRP and Permanent Reservoirs infrastructure.

Roads, laydown areas and working areas would be sealed or landscaped. The sites would also be rehabilitated after construction, minimising the potential for dust generation. Dust issues arising from vehicle and equipment movement during maintenance operations are also considered to be negligible and should not create any long-term or permanent impact on air quality in the region.

Odour impacts associated with the Proposal at the Permanent Reservoirs site are expected to be negligible. All chemicals stored at the Permanent Reservoirs site do not have potential odour impacts and the expansion for Stage D is not expected to result in additional odour sources or impacts on the surrounding environment.

Due to the nature of the infrastructure and materials at the WRP site, an odour assessment was undertaken to identify the potential for odour nuisance and air quality impacts associated with the construction and operation of the Proposal at the WRP site. The potential impacts during operation are described below.

WRP Odour assessment

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit per cubic metre or 1 ou.

The Technical Framework – Assessment and Management of Odour from Stationary Sources in New South Wales (DEC, 2006a) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 ou. This is expressed as the 99th percentile value, as a nose-response-time average (approximately one second).

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005 (The Approved Methods) impact assessment criteria uses a sliding scale of odour impact criteria based on the density of the population potentially affected, as shown in Table 6.28.

Table 6.28 Impact assessment criteria for complex mixtures of odorous air pollutants (nose-response-time average, 99th percentile)

Population of affected community	Impact assessment criteria (ou)
Urban area (>2,000)	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence (<2)	7.0

Source: The Approved Methods (OEH, 2005)

The Approved Methods states that the impact assessment criteria for complex mixtures of odorous air pollutants must be applied at the nearest existing or likely future offsite sensitive receptor(s).

The incremental impact (predicted impact due to the pollutant source alone) must be reported in units consistent with the impact assessment criteria (ou), as nose response time concentration (i.e. approximately one second average) and as the:

- 100th percentile of dispersion model predictions for 'Level 1' impact assessments, or
- 99th percentile of dispersion model predictions for 'Level 2' impact assessments (using a minimum of one year of site-specific meteorological data).

Given the high density of potential sensitive receptor locations in the immediate vicinity of the WRP site (i.e. the Googong township), the odour impact assessment criterion of 2 ou has been considered the appropriate odour impact criterion for odour emissions from the WRP following the stage D expansion.

An atmospheric dispersion modelling study was undertaken using CALPUFF. The model was set up in accordance with the general guidance contained in *Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia'* (OEH, 2011).

The planned odour control, for all stages of development of the WRP, is that all odorous sources at the WRP are enclosed or covered, with the odorous air from under the covers extracted and passed through an OCF

before the treated air is discharged to atmosphere via a stack. Biosolids are treated in a dedicated building, with odour extraction and control being applied to equipment inside the building.

Given the extent of odour control currently, and to be, installed, there are no significant uncontrolled odour sources on site.

The principal emission sources at the Stage D WRP are the volume sources (OCF stack and sludge handling building) with some emissions from the total area sources, as indicated below:

- OCF stack – 3,735 ou/s (91.7% of total site odour emissions)
- Sludge handling building – 278 ou/s (7.7% of total site odour emissions); and
- Total area sources – 23.6 ou/s (0.7% of total site odour emissions).

The 28 areas sources (inlet works, grit and screenings bins, bioreactor, aerobic digester and sludge storage hopper) only contribute 0.7 per cent of the total site odour emissions primarily because it was assumed that a high level of odour capture would be achieved at each emission source. It is noted that odour emission rates for Stage D area sources were assumed to be constant (i.e. 24 hours a day, 7 days a week) throughout the one-year model run period, making the model very conservative and accounting for non-routine events (such as process upsets) and maintenance activities where process unit covers would be required to be open to provide access.

Sensitive receptors

Thirty-three sensitive receptors (dwellings, a school, sports grounds, open space, and future commercial and recreational) were identified in the dispersion modelling. Receptors R1 to R25 are associated with the development stages incorporated in existing WRP Stages A, B and C. Receptors R26 to R33 (shaded green in Figure 6.25) are locations associated with GTPL's planning proposal for NH1A Stage 4D, associated with additional residential lots to the west of the WRP.

The locations of the identified sensitive receptors are outlined in Table 6.29 and shown in Figure 6.25.

Table 6.29 Sensitive receptor locations

Receptor	Type	Address	Distance (m) and direction from WRP site boundary
R1	Dwelling	191 Googong Road	100 / N
R2	Dwelling	Carraway Crescent	240 / W
R3	Dwelling	Merlin Crescent	530 / NW
R4	Dwelling	Bonarba Link	550 / WNW
R5	Dwelling	Pickering Street	500 / W
R6	Dwelling	McTavish Street	560 / WSW
R7	Dwelling	Badgery Street	340 / SW
R8	School	Rosa Street	800 / SW
R9	Dwelling	44 Googong Road	1000 / SW
R10	Dwelling	Bonarba Link	710 / WNW
R11	Dwelling	Carraway Crescent	160 / W
R12	Dwelling	Carraway Crescent	160 / W
R13	Dwelling	Carraway Crescent	180 / W
R14	Dwelling	Unnamed road	130 / WSW
R15	Dwelling	Unnamed road	130 / WSW
R16	Dwelling	Unnamed road	140 / WSW
R17	Dwelling	Larkin Street	120 / SW
R18	Dwelling	Larkin Street	110 / S
R19	Sports ground	Duncan Loop	120 / S
R20	Sports ground	Duncan Loop	110 / S

R21	Sports ground	Duncan Loop	140 / S
R22	Dwelling	Duncan Loop	180 / SSE
R23	Dwelling	Duncan Loop	250 / SE
R24	Dwelling	Unnamed road	270 / SE
R25	Open space	Unnamed road	140 / SE
R26	*Dwelling*	*Unnamed road*	*98/NW*
R27	*Dwelling*	*Unnamed road*	*103/SW*
R28	*Dwelling*	*Unnamed road*	*22/NW*
R29	*Commercial*	*Unnamed road*	*61/W*
R30	*Recreational*	*Unnamed road*	*21/SW*
R31	*Recreational*	*Unnamed road*	*64/SW*
R32	*Dwelling*	*Unnamed road*	*47/SW*
R33	*Dwelling*	*Unnamed road*	*96/SW*

Note: Receptors in italics represent additional lots within the GTPL planning proposal for NH1A Stage 4D for land west of the WRP.

The nearest existing receptors to the Googong WRP are receptors R1 and R2, which are situated to the north and west of the WRP at distances of 100 and 240 metres from the WRP site boundary, respectively.

Receptors R1 to R25 are associated with the development stages incorporated in previous WRP Stage A, B and C. and receptors R26 to R33 (shaded green in Figure 6.25) are future locations associate with the GTPL planning proposal for NH1A Stage 4D.

Odour impact assessment

The one second mean (as 99th percentile) ground-level odour concentrations predicted by CALPUFF at the 33 discrete sensitive receptors (with comprehensive odour control at the Stage D WRP) are shown in Figure 6.26.

In Figure 6.26, the discrete sensitive receptor locations (R1 to R25) are shown by the white symbol, while the future receptor locations (R26 to R33) are shown by the green symbol.

Figure 6.26 indicates that odour concentrations of greater than the 2 ou assessment criterion were only predicted within the boundary of the WRP site (shaded orange) and that odour concentrations were predicted to be well below the odour assessment criterion at all existing and future sensitive receptor locations. Given that a conservative approach to odour emissions was undertaken, it is considered very unlikely that odour nuisance impacts would occur at sensitive receptor locations under normal WRP operating conditions.

Predicted odour emissions for the Stage D WRP were also compared with emissions data from previous assessments undertaken for the Stage C WRP (both prior and during operation) to identify if the Proposal would result in any significant odour changes between Stage C and Stage D. The comparison revealed that the odour footprints are very similar between Stage C and Stage D. and that the Stage D assessment conclusion of no offsite odour impacts is consistent with previous assessments undertaken for prior stages of the WRP.

Residual odour risk

It is generally accepted that even with good odour containment and treatment there is potential for unintended emissions associated with intermittent events such as equipment failure, abnormal operation, accidents, or abnormal weather. The existing WRP is designed with extensive odour covers and odour abatement including a high level of redundancy, however such unplanned events may still occur and have the potential to cause offsite odour impact.

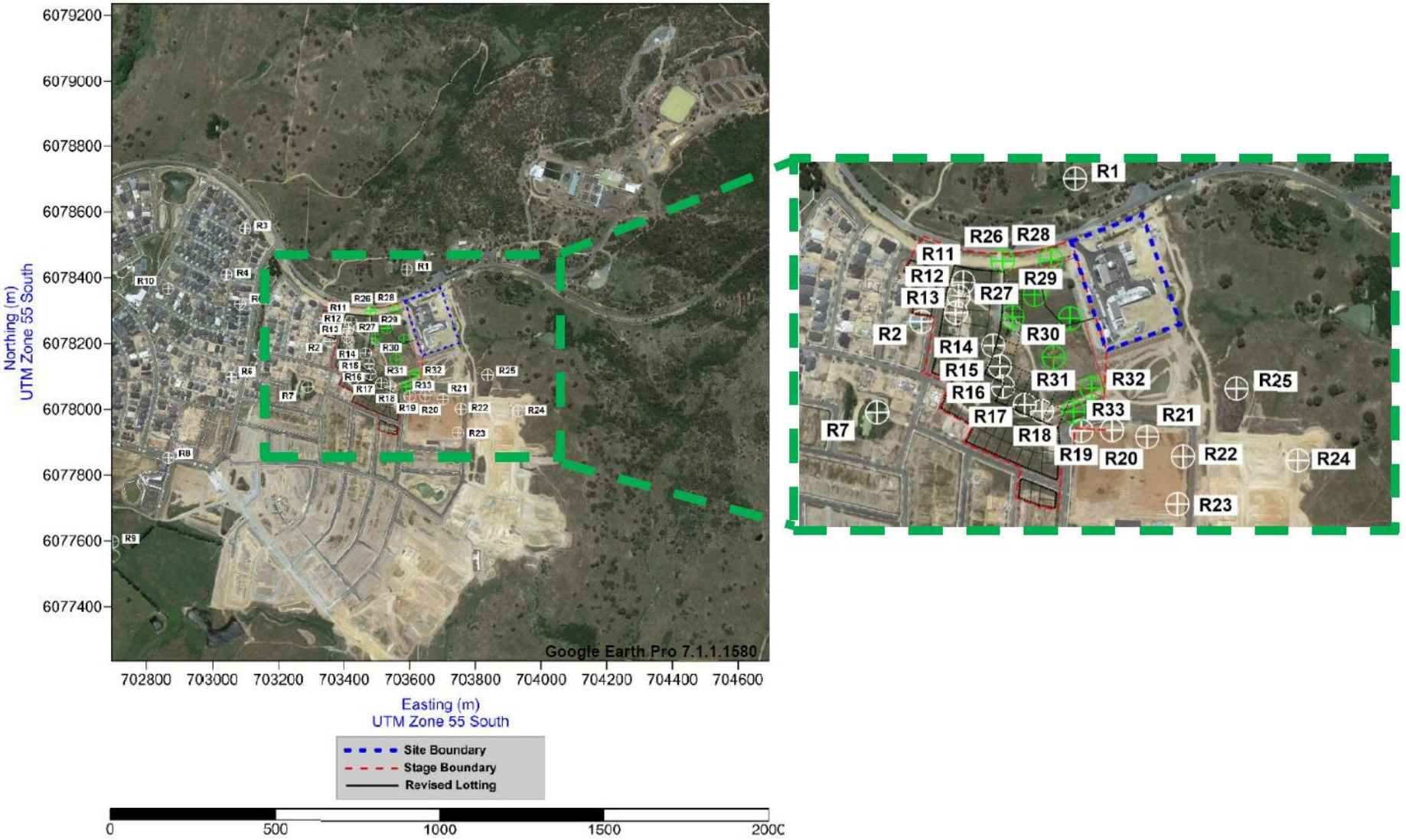

Figure 6.25 Sensitive receptors at the WRP site (Stantec, 2020)

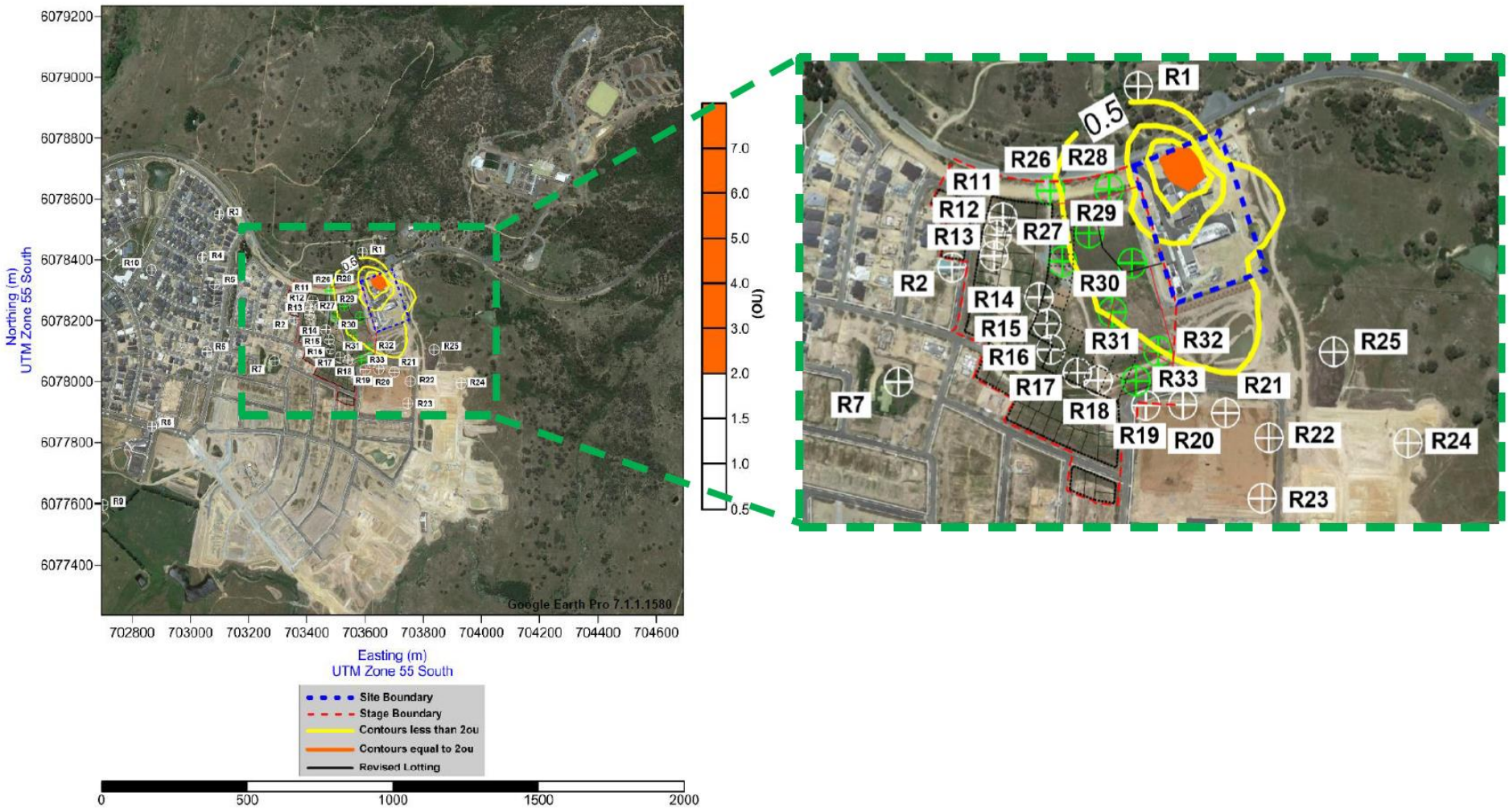

Figure 6.26 99th percentile one-second mean odour concentrations at the Stage D WRP (ground level) (Stantec, 2020)

6.7.3 Mitigation measures

Construction

The following mitigation measures would be implemented to mitigate potential air quality impacts:

- The CEMP would include typical dust suppression measures, including:
  - Water trucks and/or the recycled water system would be employed to reduce dust in dry, windy conditions
  - Speed limits would be reduced during high dust/windy conditions
  - Clearing of vegetation and topsoil would be limited to the designated footprint required
- Rock excavation would be conducted at appropriate times, with consideration of site conditions and sensitive receivers
- Working practices would be modified during periods of high winds by limiting the use of some machinery, particularly when in close proximity to dwellings in addition to reducing travel speeds
- The burning of material on site would be prohibited, except under the instruction of NSW Rural Fire Services
- Vehicles would be well-maintained to ensure emissions are kept to the minimum practicable.

These dust suppression measures are based on standard construction industry measures based on the 'Blue Book' (Landcom, 2004) and would be sufficient to adequately manage dust during the construction phase.

Operation

Googong WRP does have extensive odour control measures including both chemical dosing to the incoming sewage and covering and ventilation throughout the potentially odorous areas of the plant combined with odour control on the ventilation exhaust stream (the OCF exhaust).

The WRP was also designed to locate areas with the highest risk of fugitive emission events, such as the inlet works and biosolids areas, away from boundaries with sensitive receptors, where possible. The odour abatement scheme also has redundancy throughout including in chemical dosing facilities, extraction fans and the activated carbon filters which provide treatment.

The odour impact assessment and dispersion modelling indicate that there are unlikely to be any odour nuisance effects at any existing or future sensitive receptors located in the vicinity of the WRP boundary, including the future council depot and scout hall, provided that the following conditions are met:

- Odour control covers, ventilation and foul air treatment consistent with the existing WRP and the proposed Stage D would be adopted i.e. the inlet works, all bioreactor areas, the general purpose pump station, the aerobic digester and the appropriate biosolids processing equipment would be covered / enclosed and ventilated to an OCF.
- Odour capture efficiencies of at least 95% at the inlet works grit and screenings bins, and of at least 99% at the bioreactor, aerobic digester and sludge storage hopper would be required (as per the installed Stage AB and Stage C systems). The odorous gases at each additional area source would be extracted by forced air ventilation for treatment in the OCF, as per the measures adopted for the existing WRP and proposed Stage D.
- The existing WRP OCF would be modified at Stage D and should be designed, operated, and maintained to achieve a maximum in-stack odour concentration of 500 ou.
- The exit velocity at the OCF stack would be at least 16.9 m/s with an internal stack exit diameter of 0.75 m for the Stage D flows. This equates to an actual volumetric flow rate of 7.47 m^3/s. The OCF stack tip height would be at least 16 m above ground level.
- Where possible and practicable, all doors to the sludge handling building would be kept closed at all times (particularly when the centrifuge is operational), to reduce the potential release of odours from this source.

The OEMP, and specifically the Odour Management Plan would be amended to include Stage D works to reduce the risk of odour impact associated with abnormal operation and maintenance activities.

6.8 Visual amenity

A Visual Impact Assessment has been prepared by RPS (RPS, 2020) for the proposed works. A summary of the findings of this assessment are summarised below, with the full report attached as Appendix I.

6.8.1 Existing environment

The overall Proposal area is located in a predominantly rural setting. Land uses in the area include cleared agricultural lands (predominantly for grazing), and rural and new residential development. The surrounding areas have been largely modified through clearing, within a larger natural setting of mountain ranges and foothills.

The areas within the Googong township are largely open fields and rolling hills with both local and more distant views possible. Existing mature Eucalyptus species (Gum) and other remnant trees are scattered across the landscape contrasting the low pasture grasses that provide visual continuity throughout the landscape (refer to Figure 6.27).

WRP

The existing WRP is located in the north eastern corner of Neighbourhood 1A, off Googong Road, with residential areas located to the south and west of the site.

Surrounding residential areas have already been cleared and levelled creating open views to much of the WRP infrastructure. The area adjacent to the WRP comprises a growing residential development with neighbourhood centre comprising vacant, partially and fully constructed residential lots (1-2 storeys) completed in the past five years along with landscaped elements (e.g. street trees, parks and playing fields and Beltana Pond).

The industrial nature of the WRP strongly contrasts with both the natural surroundings and emerging residential setting. However, views to the WRP from the west and south are mitigated through the use of a berm and tree planting along the western and southern boundaries of the WRP site (already in place). A telecommunications tower, which is approximately 36 metres high, is located in the north of the WRP site.

The WRP and surrounding Neighbourhood 1A areas lie within an undulating landscape that falls toward the north east. The areas to the west of the WRP are therefore higher allowing views over the WRP, whereas areas to the north and east are generally lower and visually separated by both landform and vegetation. Views to the existing WRP are intermittent due to varying topography, which will be further interrupted as vegetation matures within the development and the built character of the wider area is established. Typical existing slope gradients are 1 in 10, however they are being modified to suit the new township.

Permanent Reservoirs

The precinct to the west of the existing Googong development (in proximity to the Permanent Reservoirs site) is yet to be developed however is an area of important scenic value. Hill 800, where the Permanent Reservoirs are located, is the highest point in the overall Googong township development and is both prominent and visible from the surrounding areas. From the top of Hill 800, views are possible in all directions to the surrounding hills and mountain ranges and conversely views to the top from surrounding areas are also possible.

Masterplanning of this area currently indicates that the lower areas immediately to the west and east of the Hill 800 crest will be subdivided into residential lots. Internal streets may follow topographic contours connecting with other areas of the development in the north and south. The higher elevated areas around Hill 800 are indicated as a “Hilltop Park Lookout”.

The Permanent Reservoirs are located in the saddle between two hill tops. There are four hill crests in close proximity limiting or preventing views of the reservoirs to areas immediately north and south. Typical existing slope gradients are 1:10 – 1:12 to the east and west of the saddle and steeper closer to the crests (up to 1:8). Levels however will likely be modified to suit the development providing level areas for dwellings and the reservoirs.

The construction footprint area at the Permanent Reservoirs comprises of cleared, developed land with no trees or other notable habitat features. There are numerous scattered trees on the eastern boundary of the Hill 800, however these areas are outside of the construction footprint.

Figure 6.27 Examples of existing vegetation surrounding the Proposal

6.8.2 Potential impacts

Construction

Construction works at the WRP and Permanent Reservoirs would be undertaken mostly within the existing site boundaries, therefore construction activities would tend to be obscured by the existing infrastructure and is therefore likely to have a minimal to negligible visual impact on the adjacent receivers. Additionally, as there are few houses near the Permanent Reservoirs site works during construction, there are expected to be minimal to visual impacts.

Temporary elements likely to be introduced into the visual environment include:

- Fencing and hoardings
- Scaffolding
- Stockpiles
- Road barriers and signage
- Cranes and other construction plant
- Site office/compound and amenities.

Operation

The extent of visual amenity impact of the Proposal is largely determined by the visual prominence of the new elements proposed, the extent of viewshed from the Proposal, and the type and number of visual receivers likely to be impacted.

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas. The assessment is based on the number of people affected, land use, and the distance of the viewer from the proposal. For example, a significant change that is not frequently seen may result in a low visual sensitivity although its impact on a landscape may be high. Generally, the following principles apply:

- Visual sensitivity decreases as the viewer distance increases.
- Visual sensitivity decreases as the viewing time decreases.
- Visual sensitivity can also be related to viewer activity (e.g. a person viewing an affected site whilst engaged in recreational activities will be more strongly affected by change than someone passing a scene in a car travelling to a desired destination).

Visual effect is the interaction between the Proposal and the existing visual environment. It is often expressed as the level of visual contrast of the proposal against its setting or background in which it is viewed.

- Low visual effect – occurs when a proposal blends in with its existing viewed landscape due to a high level of integration of one or several of the following: form, shape, pattern, line, texture or colour. It can also result from the use of effective screening often using a combination of landform and landscaping.
- Moderate visual effect – occurs when a proposal is visible and contrasts with its viewed landscape however, there has been some degree of integration (e.g. good siting principles employed, retention of significant existing vegetation, provision of screen landscaping, appropriate colour selection and/or suitably scaled development).
- High visual effect – results when a proposal has a high visual contrast to the surrounding landscape with little or no natural screening or integration created by vegetation or topography.

The relationship matrix between visual sensitivity and visual effect is shown below in Figure 6.28.

		VISUAL EFFECT ZONES		
		HIGH	MODERATE	LOW
VISUAL SENSITIVITY LENS	HIGH	HIGH IMPACT	HIGH IMPACT	MODERATE IMPACT
	MODERATE	HIGH IMPACT	MODERATE IMPACT	LOW IMPACT
	LOW	MODERATE IMPACT	LOW IMPACT	LOW IMPACT

Figure 6.28 Visual impact matrix

Viewpoints have been carefully selected to be representative of the range of views within the Proposal area. The selection of viewpoints is informed by topographical maps, field work observations and other relevant influences such as access, landscape character and the popularity of vantage points.

Six viewpoints have been identified for the Proposal, taken from private and public sites surrounding the Proposal. The viewpoints which have been included represent the areas from where the development would appear most prominent, either based on the degree of exposure or the number of people likely to be affected:

- Viewpoint 1 – Looking east from Lot 964
- Viewpoint 2 – Looking northeast from Lot 6
- Viewpoint 3 – Looking northeast from Lot 27
- Viewpoint 4 – Looking east from Old Cooma Road
- Viewpoint 5 – Looking west from the proposed sports fields
- Viewpoint 6 – Looking southeast from Old Cooma Road.

The locations of these viewpoints are shown below in Figure 6.29, with the view from each individual viewpoint shown from Figure 6.30 to Figure 6.35. The analysis of potential impacts at each viewpoint is described in Table 6.30.

Figure 6.29 Viewpoint locations

Figure 6.30 The view of the Proposal from Viewpoint 1

Figure 6.31 The view of the Proposal from Viewpoint 2

Figure 6.32 The view of the substation from Viewpoint 3

Figure 6.33 The view of the Proposal from Viewpoint 4

Figure 6.34 The view of the Proposal from Viewpoint 5

Figure 6.35 The view of Proposal from Viewpoint 6

Table 6.30 Viewpoint analysis

Viewpoint	Analysis	Visual sensitivity	Visual impact
1	Visual receivers are assumed to be existing residents and passengers travelling Old Cooma Road. Views of the Proposal by visual receivers may be partially or wholly blocked by the landscape berm and planting and the existing reservoir tanks. The magnitude of change in character that would be created by the height of the proposed new reservoir tank height within the context of the existing reservoirs is considered to be low due to its lack of visual prominence in the overall landscape.	Low	Low
2	Visual receivers are assumed to be existing residents and passengers travelling Old Cooma Road. Views of the Proposal by visual receivers may be partially or wholly blocked by the landscape berm and planting and the existing reservoir tanks. The magnitude of change in character that would be created by the height of the proposed new reservoir tank within the context of the existing reservoirs is considered to be negligible due to its lack of visual prominence in the overall landscape.	Low	Negligible
3	Visual receivers are assumed to be existing residents and passengers travelling Old Cooma Road. Views of the Proposal by visual receivers may be partially or wholly blocked by the landscape berm and planting and the existing reservoir tanks. The Permanent Reservoir site is not visible from this viewpoint. The magnitude of change in character that would be created by the height of the proposed new reservoir tank within the context of the existing reservoirs is considered to be negligible due to its lack of visual prominence in the overall landscape.	Low	Negligible
4	Visual receivers are assumed to be passengers travelling along Old Cooma Road. The Permanent Reservoir site is located in an elevated saddle above most of the surrounding landscape. The scale, higher position relative to the residents and contrasting industrial character of the existing and proposed reservoir tanks mean the Proposal will be prominent within the landscape. Additionally, the surrounding landscape will have little capacity to visually absorb the existing and proposed infrastructure.	Low	Medium
5	Visual receivers are assumed to be future residents and may have long viewing times from properties to the Permanent Reservoirs. Visual receivers are also residents within the Googong township development using publicly accessible areas such as streets and footpaths. The proposed new reservoir tank will be higher than the viewers from the east, meaning the Proposal will have a strong visual presence. The size and contrasting industrial character of the existing and proposed reservoir tanks mean they will be prominent within the landscape. The existing surrounding landscape may have little capacity to visually absorb the structures.	Low	Medium
6	Visual receivers are assumed to be future residences west of the Permanent Reservoirs site. Residents are within 200 metres of the Permanent Reservoirs site and are likely to have views to the reservoirs from their properties. Visual receivers are also residents within the Googong township development. The proposed new reservoir tank is located in an elevated saddle above most of the surrounding landscape. The scale, higher position relative to residences and contrasting industrial character of the existing and proposed reservoir tanks mean the Proposal will be prominent within the landscape. The surrounding landscape will likely have little capacity to visually absorb the structures.	Low	Medium

The Proposal would also introduce additional industrial elements into the visual landscape through the expansion of the WRP, though the new membrane bioreactor would mirror the existing bioreactors and would therefore be consistent with the nature and scale of the existing infrastructure. All proposed works and additional infrastructure at the WRP would be contained within the existing WRP site boundary and would also be visually screened from visual receptors through the earth mounding and established landscape berms on the southern and western boundaries of the site. As such, the Proposal is not expected to be prominent within the landscape or result in visual impacts to the surrounding environment.

6.8.3 Mitigation measures

Construction

The management of the potential visual impacts during construction would include the following measures:

- Temporary fencing would be installed for security and to visually delineate the areas of construction
- The Proposal sites would be kept tidy and well-maintained, including the removal of all rubbish at regular intervals. No materials would be stored beyond the construction boundaries
- Temporary hoardings, barriers, traffic management and signage would be removed when no longer required
- Any night-lighting needed for construction would be located away from public or sensitive viewing areas
- Residual site areas would be revegetated upon completion.

Operation

The management of visual impacts during the operation would include the following measures:

- Similar colours and materials to the existing WRP infrastructure would be used to decrease the visual prominence of the new bioreactor and other Stage D infrastructure.
- Muted colours and non-reflective surfaces would be used to decrease the visual prominence of the new reservoir tank.
- Effective screening of the Permanent Reservoirs would be implanted through the use of locally endemic vegetation close to the site. Species selection would aim to inhibit views at the ground and mid-levels up to 10 metres in particular on the eastern and western sides of the reservoirs.

6.9 Traffic and access

6.9.1 Existing environment

Old Cooma Road at the Googong Road intersection is a two lane (one in each direction) arterial road connecting Queanbeyan with townships to the south before connecting to the Monaro Highway. Old Cooma Road runs along the western boundary of the Googong township and includes a T-intersection with Googong Road. Old Cooma Road has a 100 km per hour speed limit in the vicinity of the Googong township south of the T-intersection with Googong Road. It is a rural road with dirt shoulders and drains running parallel to the road. Old Cooma Road is under the control and authority of TfNSW.

Googong Road runs along the north edge of the Googong township. It joins Old Cooma Road to the west and the Googong Foreshores land to the east. A number of T-intersections connect off to the south of Googong Road providing access into the Googong township. Googong Road is currently a semi-rural road with minimal formal kerb and gutters along the length of the road. The majority of the road has a dirt shoulders with table drains, however this would change with the ongoing development of the Googong township. The speed limit on Googong Road is 60 km per hour. Googong Road is under the control and authority of QPRC.

Construction traffic would use Old Cooma Road and Googong Road. This would include staff vehicles and large vehicles for the delivery and removal of equipment and materials. Currently, access into the WRP site is via an existing formal driveway access off Googong Road and access into the Permanent Reservoirs site is via an existing formal driveway access off Old Cooma Road. Parking for construction staff and vehicles would be available in temporary carparks located:

- Between Googong Road and the northern boundary of the WRP site, and
- Between Old Cooma Road and the south-western boundary of the Permanent Reservoirs site.

Formal access routes around the southern and western portions of the WRP site within the site boundary were established for the development of Stage C WRP and would continue to provide access around the entire WRP site and work areas.

A formal access road exists at the Permanent Reservoirs site and would be used to provide access around the entire Permanent Reservoirs site and work areas.

6.9.2 Potential impacts

Construction

Throughout construction there would be increases in vehicle movements to, from and throughout the Proposal area. These would change dependent on the stage and progress of construction activities. Construction vehicle activities would include:

- At initial set up stage – large construction plant and equipment would be delivered to the construction site using flatbed trucks, articulated trucks, and low loaders up to 25 metres in length. Where feasible construction plant would be left on site for the duration and use in order to minimise impacts to the local road network.
- Throughout construction – vehicle movements would predominantly involve the delivery of equipment and materials and staff accessing the site.
- Completion of construction – large construction plant would be removed from the site.

Table 6.1 outlines the estimated number of vehicle movements per day throughout construction. It has been assumed that each vehicle movement would equal approximately two (2) trips per day. These vehicle movements would not all be undertaken at the same time as construction would be progressive.

Table 6.31 Peak construction vehicle movements estimated per day

Construction activity	Peak trips per day to WRP site	Peak trips per day to Permanent Reservoirs site	Construction activity description
Construction staff	20	20	Construction staff accessing the sites
Set-up and mobilisation	20	10	Delivery of plant and amenities to sites
Roadworks	30	20	Delivery of road base materials Construction of temporary and permanent roadwork (WRP)
Earthworks	15	20	Fuel and materials delivery Preparation and excavation for foundation work
Concrete works and pouring	40	50	Concrete truck deliveries for WRP and reservoir foundation pours
Mechanical and electrical	15	10	Delivery and installation of unit process equipment, pipeline, and electrical equipment (WRP) Delivery and installation of reservoir and booster pump plant equipment (Permanent Reservoirs)
Demolition, restoration, and removal of waste	20	10	Demolition of existing package inlet works, site officers, amenities buildings, and the rehabilitation/landscaping of the site (WRP) Decommission of Stage C sedimentation bund and other assets for upgrade (Permanent Reservoirs)

Operation

During operation, access to the WRP would be via Old Cooma Road, Googong Road, and the formal driveway access off Googong Road. Access to the Permanent Reservoirs site would be via Old Cooma Road and the formal driveway access off Old Cooma Road.

Traffic generation during the operation of the Proposal would be generally consistent with the traffic generated by the existing WRP and Permanent Reservoirs sites:

- Given the same number of operators would work at the WRP and Permanent Reservoirs, operator vehicle movements are expected to be similar and low in number.
- Although a greater volume of grit and screenings would be generated, the use of larger storage bins may result in fewer truck movements compared to those for the Stage C WRP.
- Although chemical usage would increase as more wastewater is treated, tanker volumes are generally greater than chemical storage volumes and the frequency of deliveries is expected to be consistent with those for the Stage C WRP.
- The Permanent Reservoirs site would continue to operate as an unmanned site and vehicle movements to and from the site would be limited to ongoing maintenance and service operations.

The exception would be the removal of biosolids from the WRP, with greater volumes of biosolids produced by the Proposal. Currently, approximately one two-way truck movement per week is required for biosolids disposal. The Proposal is expected to increase this frequency to 2.5 two-way movements per week.

Given the low volumes of operational traffic that would be generated by the Proposal and the good access to the WRP provided by Googong Road and Old Cooma Road, impacts of operational traffic are expected to be minimal.

6.9.3 Mitigation measures

Construction

- A detailed traffic and access management plan would be prepared prior to construction to outline all access routes to, from and within the construction zones, traffic control methods to be utilised and methods to minimise impacts on the operation of the existing WRP, existing permanent reservoirs and pedestrians and the users of the local road network. This plan would be prepared in accordance with the relevant standards and submitted to the relevant road authority for consultation and approval.
- All relevant GTPL and QPRC employees, consultants and contractors would be inducted into the site and would receive appropriate training to fulfil their individual and environmental responsibilities, including requirements and responsibilities under the traffic and access management plan.
- Where feasible, construction deliveries would be scheduled outside of peak periods, in particular peak residential access times.
- Access to residential properties would be maintained at all times.
- Construction staff and delivery vehicles would not park in public areas where supply is limited.
- Any permits required for oversize vehicles to transport plant or equipment are to be obtained from RMS.

Operation

The Proposal is not expected to significantly increase the number of operation vehicle movements to and from the WRP and therefore all existing measures required under the Googong IWC Project OEMP would be appropriate.

6.10 Aboriginal heritage

6.10.1 Existing environment

The area now known as Googong has a rich history of Aboriginal culture. The Ngunnawal people have lived in and maintained the area for thousands of years prior to European contact. Since the early to mid-nineteenth century, the land in Googong was predominantly used for grazing and other agriculture.

A search of the Aboriginal Heritage Information Management Systems (AHIMS) database was taken on 1 April 2020 and identified seven Aboriginal heritage sites were identified within 200 metres of the WRP site, and no Aboriginal sites identified within 200 metres of the Permanent Reservoirs site. No Aboriginal Places were identified in proximity to either site.

A description of the identified sites is provided in Table 6.32 and their locations in relation to the WRP site boundary are depicted in Figure 6.36.

Table 6.32 Recorded Aboriginal cultural heritage sites within proximity to the Proposal

Site ID	Site name	Site features
57-2-0389	GA23	Artefact; 3
57-2-0782	GWTP1	Artefact; 4
57-2-0783	GWTP2	Artefact; 6. Previously salvaged from the GWTP2 site at the WRP.
57-2-0784	GWTP3	Artefact; 6
57-2-0794	G1BAS1	Artefact; 1
57-2-0795	G1BAS2	Artefact
57-2-1058	GRW39	Artefact

There was one recorded Aboriginal heritage site located in the WRP site (GWTP2). This site was an artefact scatter comprising six stone artefacts and originally recorded in 2009 and assessed as having low local and regional significance. A surface salvage collection of the artefacts was conducted at site GWTP2 in 2013 under an approval to salvage issued by the OEH. The location of GWTP2 has subsequently been impacted by the construction of the Stage AB WRP and an Aboriginal site impact recording form was submitted to OEH.

The other recorded Aboriginal cultural heritage sites are either located within the Googong township to the west of the WRP (52-7-1058) or within the Googong Foreshores to the east of the WRP).

Further, the Proposal areas have recently undergone modifications as a result of bulk earthworks to construct the existing WRP and Permanent Reservoirs sites. These areas are not considered to be located within a landscape features likely to indicate the presence of Aboriginal objects in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010).

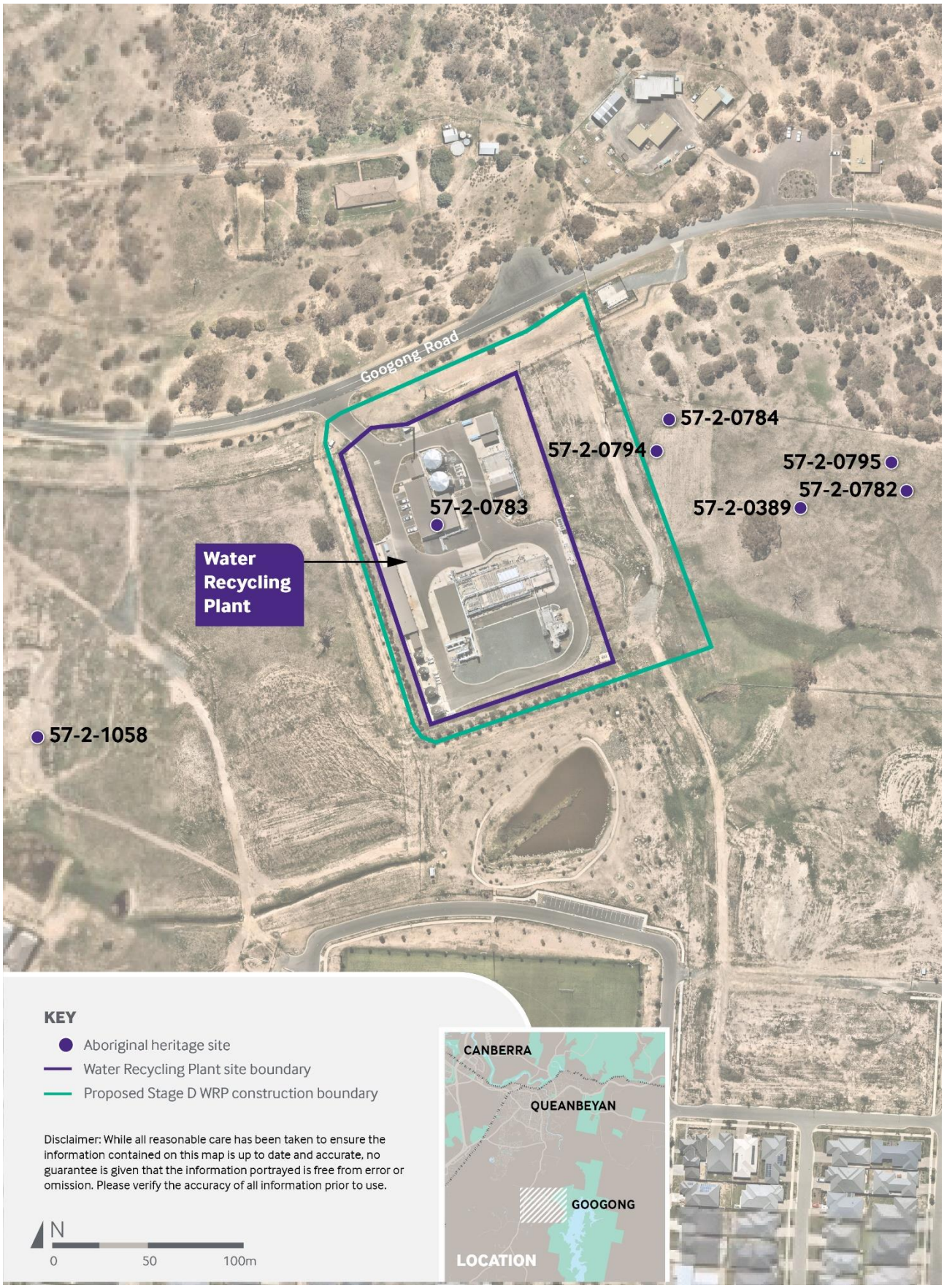

Figure 6.36 Recorded Aboriginal heritage sites near the WRP

6.10.2 Potential impacts

Construction

No known Aboriginal sites would be directly impacted by the construction of the Proposal.

Access to the four Aboriginal sites located to the east of the WRP would be restricted by an existing fence on the eastern boundary of Lot 4 DP 1217396. Given the past land use and location of nearby sites, there is potential to encounter Aboriginal artefacts during excavation works. However, as the WRP site has been surveyed by an experienced archaeologist and been disturbed by the construction of Stage AB and C WRP, the risk of encountering unknown Aboriginal items is considered to be low.

One Aboriginal site, GA6, is located 12 metres from the defined project area at the Permanent Reservoirs site and is vulnerable to indirect and/or inadvertent impact during construction activities at the Permanent Reservoirs site.

Operation

There would be no risks to Aboriginal heritage from the operation of the Proposal.

6.10.3 Mitigation measures

The location of nearby Aboriginal heritage sites should be clearly marked on all site plans and maps utilised for the construction of the Proposal. If changes are made to the Proposal that would result in impacts to areas not covered by this assessment, further assessment would be required.

If unforeseen items/objects are uncovered during construction, work would cease in the vicinity of the find and GTPL would be notified immediately to assist in co-ordinating next steps which are likely to involve consultation with an archaeologist, EES and Local Aboriginal Land Council. If human remains are found, work should cease, the site should be secured and the NSW Police and the EES should be notified.

6.11 Non-Aboriginal heritage

6.11.1 Existing environment

This assessment has considered previous heritage assessments prepared for the Googong township development, along with a search of heritage registers including the National Heritage List, the Commonwealth Heritage List, the Register of the National Estate (non-statutory archive), the NSW State Heritage Register and the heritage schedule of the Queanbeyan LEP undertaken for the Proposal area and surrounds on 5 March 2020. No known non-Aboriginal heritage items were identified within the Proposal site.

In 2003, NOHC conducted a survey as part of a Local Environmental Study (LES) for the proposal to rezone approximately 1,000 ha of rural land at Googong for a new residential development. Seventeen historic sites, including several previously identified sites, were recorded as part of this assessment. Of the recorded sites, four were located within the Googong township area and investigated further. One site (GH12 – potential European midden) was located south of the WRP, but its heritage status has since been revised by NOHC as having no significance (NOHC, 2014).

In 2014, NOHC conducted a cultural heritage assessment of the remaining areas of the Googong township not previously assessed, (i.e. south of Googong Road). Five additional non-Aboriginal heritage sites (Grwh1-5) were recorded during this survey; none of these were located within or near the Proposal site.

Other nearby heritage items identified from the review of the heritage databases include the McCawley “Sunset” Homestead complex, located on the northern side of Googong Road, and listed on the heritage schedule of the Queanbeyan LEP (item I5). It is a rare surviving stone ruin from the 19th century that was associated with early settlement of the area and is locally significant.

6.11.2 Potential impacts

Construction

There would be no impacts to known non-Aboriginal heritage items due to the distance from the Proposal sites to these items. The risk of encountering previously unrecorded heritage items would be low, given the previous investigations undertaken.

Operation

There would be no risk to non-Aboriginal heritage from the operation of the Proposal.

6.11.3 Mitigation measures

The location of nearby non-Aboriginal heritage sites should be clearly marked on all site plans and maps utilised for the construction of the Proposal. If changes are made to the Proposal that would result in impacts to areas not covered by this assessment, further assessment would be required.

If unforeseen items/objects are uncovered during construction, work would cease in the vicinity of the find and GTPL would be notified immediately to assist in co-ordinating next steps which are likely to involve consultation with an archaeologist and the heritage division of EES. If human remains are found, work should cease, the site should be secured and the NSW Police and the EES should be notified.

6.12 Waste management

6.12.1 Existing environment

Waste management would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The objectives of the Act that are applicable to the Proposal are:

- To encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development.
- To ensure that resource management options are considered against a hierarchy of the following order:
  - Avoidance of unnecessary resource consumption
  - Resource recovery (including reuse, reprocessing, recycling, and energy recovery)
  - Disposal of waste.
- To provide for the continual reduction in waste generation.
- To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of water, to assist in the achievement of the objectives of the POEO Act.

6.12.2 Potential impacts

Waste generation

Table 6.45 shows the types, quantities and classifications of waste that would be generated by the Proposal. It also shows the risk to the environment from potential contamination caused by leaks or spills. General management measures have been proposed for each type of waste in order to reduce the risk to acceptable levels.

A number of waste streams would be produced during construction for which exact quantities are unknown although are expected to be low. These include general construction wastes and refuse, which would be classified and disposed of at a licensed facility in accordance with the Waste Classification Guidelines (EPA, 2014). The key wastes produced at the WRP and Permanent Reservoirs during the operation of Stage D would be the same as those generated by the existing WRP (i.e. recycled water, grit and screenings and biosolids) and existing Permanent Reservoirs site (i.e. empty storage chemicals and general waste). For

wastes that still pose medium or higher risks, specific mitigation measures are presented in the following section.

Construction

Waste streams from construction activities would vary depending on the construction activities being undertaken at any one time. General expected waste streams would include:

- Vegetation waste from clearing and stripping activities
- Excess spoil from excavation
- Spent fuel and chemical containers
- Packaging waste from delivery of construction materials and plant and equipment
- General construction waste such as excess concrete, formwork, pipe offcuts, cabling, and wiring
- Contaminated soil material caused by accidental fuel and chemical spills
- General waste from site amenities including food waste, office waste and wastewater
- Disused environmental controls such as sediment fences, straw bales, gravel socks etc.

Generally, waste to be produced would be in minimal quantities and would be disposed of at an appropriately licenced facility. It is not expected that any contaminated waste (except as a result of accidental spills) would be produced as a result of the proposed construction activities.

The Proposal involves the decommissioning of the Stage C sedimentation bund at the Permanent Reservoirs site and numerous infrastructure upgrades across both sites, and this would result in the existing materials being removed of and disposed of as waste. These materials include existing bunds and concrete foundations, pumps, pipes, blowers and compressor units, ducts, and electrical equipment.

Section 3.2.3 outlines a list of materials that would be required for the Proposal. Resources would be sourced from local suppliers where feasible and volumes required would be minimised where possible. No materials required for the Proposal are likely to become in short supply in the near future.

Additionally, the nature and volume of waste generated during the construction of the Proposal, if not managed appropriately, may potentially impact on:

- Water quality of local drainage lines and watercourses. This is particularly relevant for gross pollutants (litter) and accidental release of contaminated liquids.
- Health and safety of workers and visitors to the site.

Operation

Operation of the Stage D WRP is likely to generate the following waste types:

- Production of biosolids during the treatment process.
- Waste such as litter, grit and screenings generated from the operation of the WRP.
- Discharge of excess recycled water during operation of the WRP. The composition of the discharged recycled water is expected to be well within the EPL concentration limits and as such would pose little risk to the surrounding environment.
- Discharge of off-specification water resulting from the failure of a CCP. The quality of this water is expected to meet the requirements of the EPL for the WRP.
- Storage and handling of fuels and chemicals that have the potential to contaminate soils, water, and groundwater.

Operation of the Permanent Reservoirs site is not expected to generate any substantial amounts of waste. The likely types of waste would include:

- Empty bottles and storage containers from the treatment chemicals
- General waste from staff attending the operation of the facility.

As such, impacts from operational waste are expected to be minor and suitable standard operational procedures would be implemented to manage any operational waste produced.

It is expected that every 5 – 10 years maintenance on the potable and recycled water reservoirs would be required. This would include allowing the tanks to empty to about one third full. This lower layer may be heavily silted. Therefore, it would be pumped out into a temporary sedimentation basin and treated in accordance with a management plan to ensure it is of a suitable quality prior to being released into the discharge points within the facility. The remaining silt/sediment left at the bottom of the basin would then be manually removed from site and disposed of at a licenced facility. The infrastructure is being built as part of the proposed works to provide for this in the future.

6.12.3 Mitigation measures

Construction

In general, waste streams would need to be managed throughout the project to satisfy the following principles:

- Waste management strategies would be developed in accordance with the WARR Act and by adopting the resource management hierarchy principles (in order of priority) of avoidance, resource recovery and disposal.
- Waste to be disposed of off-site would be disposed of to a waste facility that is licensed under the POEO Act to receive wastes of that type.

These principles would be embodied in the CEMP.

The CEMP would be prepared prior to the initiation of construction activities and include:

- Procedures to classify all waste types in accordance with the *Waste Classification Guidelines* (EPA, 2014) and NSW legislative requirements.
- Resource recovery and reuse strategies for each type of material where applicable.
- Details of how waste would be stored and treated on site.
- Procedures and disposal arrangements for all material according to waste classification.
- Reporting and recording requirements for all waste movements, allowing determination of recycling and reuse levels achieved (landfill diversion).

Table 6.33 outlines specific management measures that would be implemented for classified wastes, as defined in the Waste Classification Guidelines.

Table 6.33 Waste types, classification and general management measures

Classification[1]	Type of waste	Source	Quantities	Potential impacts	Management measures
Construction					
Special waste	Waste tyres	Construction vehicles	Expected to be low	Resource use, and difficulties with disposal	• Waste tyres must be tracked when transported interstate, but not when transported within NSW. • Waste to be transferred to an appropriately licensed facility.
Liquid waste	Liquid waste from human waste storage facilities or waste treatment, including pump-out waste and wastewater.	Construction site offices and portable toilets.	Expected to be low	Soil and water contamination from leaks or transportation.	• Wastewater disposal during construction via truck by an approved contractor to a local sewage treatment plant.
	Fuels, oils, greases, engine coolant.	Vehicle maintenance and refuelling.	Expected to be low	Soil and water contamination from leaks or spills.	• Bunding of storage and work areas. • Licensed facilities to receive waste.
Hazardous waste	Adhesives, lubricants, cleaning agents, water treatment chemicals, other plastic material.	Maintenance during construction, and construction of WRP.	Expected to be low	Soil and water contamination from leaks or spills.	• Bunding of storage and work areas. • Licensed facilities to receive waste.
	Any other waste material that meets the criteria for dangerous goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG7.4).	Maintenance during construction, and construction of WRP.	Expected to be low	Contamination or incidents during transportation.	• Storage and transportation in accordance with relevant codes and standards.

Classification[1]	Type of waste	Source	Quantities	Potential impacts	Management measures
General solid waste (putrescible)	Non-recyclable and other putrescible general solid waste.	Construction site offices and other activities.	Expected to be low	Soil and water contamination, resource use, odour.	• Implement procurement policies to reduce waste during construction. • Appropriate disposal.
General solid waste (non-putrescible)	Recyclables – glass, aluminium cans, PET plastic bottles, scrap metal and off-cuts, paper, and cardboard.	Operation and decommissioning of temporary site offices, and general site maintenance during construction.	Expected to be low	Resource use and recycling potential for waste.	• Segregation and recycling of wastes.
	Concrete, metallic materials, brick, rubble, soils (topsoil, fill materials, spoil).	Construction at WRP, pipelines and other infrastructure; and trenching, excavation, grading, and other earthworks.	Up to 1000m^3 of excess fill is expected during construction	Increased resource use, dust, sedimentation of runoff water, visual impacts, and dispersal of building rubbish.	• Segregation, recycling of wastes and appropriate disposal. • In situ waste classification during geotechnical investigations for water infrastructure. • All spoil re-used elsewhere on site for landscaping. • Handling in accordance with the ‘Blue Book’.
	Drained and crushed oil filters, and rags, oil absorbent materials that do not contain free liquids.	Maintenance during construction and operation.	Expected to be low	Soil and water contamination	• Segregation and appropriate disposal.
Operation					
Special waste	Waste tyres	Operational and maintenance vehicles	Expected to be low	Resource use, and difficulties with disposal.	• Waste tyres must be tracked when transported interstate, but not when transported within NSW. • Waste to be transferred to an appropriately licensed facility.

Classification[1]	Type of waste	Source	Quantities	Potential impacts	Management measures
Liquid waste[2]	Liquid wastes from water recycling process	Discharge of excess recycled water during operation.	Average of 514kL/day for Stage D (minimum 4kL/day daily).	Soil and water contamination. Spills or leaks during transportation.	• Operating conditions of WRP and capture and treatment mechanisms within the plant.
		Discharge of off spec recycled water due to a CCP failure.	Estimated maximum of 2000kL/day for Stage D (infrequent occurrence).	Soil and water contamination. Impacts on human health. Spills or leaks during transportation.	• Operating conditions of WRP and capture and treatment mechanisms within the plant.
		Discharge of untreated or partially treated effluent in case of emergency.	Unknown, however extremely rare occurrence	Soil and water contamination from out of specification effluent. Effects on downstream habitats and biology.	• Operating conditions of WRP and capture mechanisms within the plant.
General solid waste (putrescible)	Dewatered grit and screenings from effluent treatment.	Operation of WRP	2 m^3 per month of dewatered screenings	Contamination of soils, water or groundwater from transportation or storage.	• Bunding of storage, use of licensed contractors for transportation.
General solid waste (non-putrescible)	Biosolids categorised for Restricted Use 2.	Operation of WRP	20 m^3 per week	Contamination from spills or leaks of inadequately treated sludge during transport.	• Storage and transportation in accordance with the DECCW's Environmental Guidelines • on the Use and Disposal • of Biosolids Products.
	Drained and crushed oil filters, and rags, and oil-absorbent materials that do not contain free liquids.	Maintenance during operation.	Expected to be low	Soil and water contamination	• Segregation and appropriate disposal.

Note:

1. Wastes classified in accordance with six steps of the *Waste Classification Guidelines, Part 1: Classifying Waste*, NSW EPA, November 2014.

2. The composition of liquid wastes from the water recycling process and their potential for contamination of soils and groundwater is assessed in Section 6.3.

Operation

Mitigation measures proposed during operation at the WRP site include:

- Collection and dewatering of grit and screenings from inlet works of the WRP and transportation off site for disposal at an appropriately licensed facility.
- Treatment of biosolids (activated sludge) to a minimum Grade B stabilisation standard and Grade C contamination standard, suitable for restricted use in agriculture, forestry, soil and site rehabilitation and disposal to landfill.
- Collection and dewatering of any solid matter removed through maintenance activities and transportation off-site for disposal at an appropriately licensed facility.
- Implementation of waste management procedures for other putrescible and recyclable waste generated from the WRP and other water cycle infrastructure.
- Bunding of all chemical and fuel stores to 110 per cent of the capacity of the largest container.
- All chemicals and fuels would be stored on hardstand areas and in accordance with manufacturers' recommendations.
- Design of the WRP with a 'first flush' system to capture the first 10mm of stormwater in the designated areas during rain events and redirect it to the head of works. In this way, any incidental spills or minor contaminated runoff within the designated areas of the WRP would be contained and passed through the treatment train.

Operation of the Permanent Reservoirs site is not expected to generate any substantial amounts of waste. Waste management principles outlined in the existing Googong IWC Project OEMP would continue to be implemented to appropriately managed during the operation of the Permanent Reservoirs site.

6.13 Hazards and risks

6.13.1 Potential impacts

Construction

Potential construction hazards and risks would be associated with:

- Workplace health and safety of construction personnel, as well as the safety of passers-by.
- Construction activities on and in the vicinity of roads (including the delivery of equipment materials etc). Potential impacts on traffic safety have been considered in Section 6.1 of this report
- Construction near powerlines and other existing services.
- Environmental events, such as major storms, bushfires, and the like.

These construction hazards and risks are considered typical of such projects and would generally be adequately managed by standard industry practices and procedures.

Operation

Hazards and risks associated with chemical storage and transport

WRP

During operation, there would be 10 chemicals stored at the WRP site, as detailed in Table 6.34. No further physical changes to chemical storage are proposed as part of the Stage D WRP although additional skid mounted dosing systems are proposed to be constructed in the existing chemical storage and dosing facility. The existing chemical storage was assessed and constructed as part of the existing WRP and no expansion is proposed for Stage D.

Table 6.34 Chemicals stored at the WRP site

Chemical	DG Transport hazard class	Packaging group	Tank size (kL)	Storage arrangements
Ferric Sulphate	8	III	21	FRP tank storage
Sodium Hydroxide/caustic solution	8	II	13	FRP tank storage
Supplementary Carbon (such as Acetic Acid)	8	II	11	Stainless steel tank storage
Sodium Hypochlorite	8	III	20	FRP tank storage
Sludge Thickening Polymer	NA	NA	0.25	
Sludge Dewatering Polymer	NA	NA	0.25	
Citric Acid	NA	NA	4	FRP tank storage
Sulphuric Acid	8	II	1	Intermediate bulk container
Alum (liquid)	8	III	3	FRP tank storage
Sodium Metabisulphite	NA	NA	1	Intermediate bulk container

Note: The detailed design of the chemical storage areas for Stage D WRP is in accordance with the requirements of the relevant Australian Standards and have been approved by the relevant chemical supplier and submitted to WorkCover for information.

These chemicals are currently stored on-site, located together with dosing pumps, in a centralised bunded facility as previously assessed as part of the Stage C WRP approvals. Chemical storage tanks have been sized for an average of 30 calendar days (ultimate) storage, and a bunded tanker delivery area is located adjacent to the storage area. The proposed works of Stage D WRP would increase the overall capacity of the WRP from 9,400 EP to 18,850 EP, with provision to service 19,550 EP. As the capacity of the WRP is doubling, it can be assumed that the amount of chemical consumed would also increase proportionally. While the chemical consumption is increasing, storage amounts would remain the same as the chemical storage area was designed and constructed for the ultimate capacity of the WRP (i.e. 18,850 EP). It is predicted that the chemical tanker delivery frequency may be double the current frequency in line with the expanded capacity of the WRP.

All chemicals are classified as aqueous solutions of chemicals, six of which are classified as “dangerous goods” under transport legislation harmonised throughout the Commonwealth (e.g. NSW *Dangerous Goods (Road and Rail Transport) Regulation 2009*) or as Schedule 11 hazardous chemicals under NSW *Work Health and Safety Regulation 2011* because they are “corrosive liquids”.

The relevant Australian Standard for the storage Class 8 dangerous goods, including fire protection requirements, is AS 3780:2008 The storage and handling of corrosive substances. The acetic acid is considered a combustible liquid, but not flammable. As a result, the storage area does not need to be zoned, hence special fire protection is not deemed to be required. This is consistent with other facilities in NSW such as Sydney Water’s wastewater treatment plants.

The chemicals for the WRP would continue to be stored in accordance with Australian Standards within the existing chemical storage area.

Permanent Reservoirs

During operation, there would be three chemicals stored at the southern end of the Permanent Reservoirs site, as detailed in Table 6.35. No further physical changes to chemical storage are proposed as part of the Stage D Permanent Reservoirs upgrades.

Table 6.35 Chemicals stored at the Permanent Reservoirs site

Chemical	DG Transport hazard class	Packaging group	Storage volume	Storage arrangements
Sodium Hypochlorite	8	III	Potable water 1.0 m^3 Recycled water 2.9 m^3	FRP tank storage
Sodium Metabisulphite	NA	NA	780 L	Intermediate bulk container
Sulphuric Acid	8	II	236 L	Intermediate bulk container

All three chemicals are classified as all aqueous solutions of chemicals, two of which are classified as “dangerous goods” under transport legislation harmonised throughout the Commonwealth (e.g. NSW

Dangerous Goods (Road and Rail Transport) Regulation 2009) or as "Schedule 11 hazardous chemicals" under NSW *Work Health and Safety Regulation 2011* because they are "corrosive liquids". None of these chemicals are flammable or combustible.

The relevant Australian Standard for the storage Class 8 dangerous goods, including fire protection requirements, is AS 3780:2008 "The storage and handling of corrosive substances". As all three are not flammable or combustible, there are no prescribed fire protection equipment requirements for any of them under any of the applicable legislation or AS 3780.

The assessment concluded there are no requirements for hydrants, hose reels or sprinklers for the proposed chemical storage.

Hazards and risks associated emergencies or maintenance activities

Potential operational hazards and risks associated with emergencies or maintenance activities include:

- Spills of chemicals or fuels.
- Discharge of untreated or partially treated effluent into Montgomery Creek in overflow events or emergencies such as power failures – this is further outlined in Sections 6.2 and 6.3.
- Discharge of off-specification water to Googong Creek in the event that there is a failure at a CCP.
- Recycled or potable water discharge from the reservoirs into the stormwater management system, either through dewatering of reservoirs for maintenance or unplanned overflows.

In addition, there would be general occupational health and safety issues for maintenance and operational personnel.

6.13.2 Mitigation measures

Construction

Mitigation measures that would be implemented during construction would be outlined in the CEMP and would include (but not limited to):

- Implementation of appropriate safety and training procedures, such as safe work method statements, safety management plan(s), auditing of contractors' safety management and approval of construction equipment.
- Risks register and risk minimisation process.
- Implementation of a Traffic Management Plan (see Section 6.1).
- Liaison with local emergency services, in particular regarding high fire-danger periods.
- Ensuring emergency access to the access roads around the facility is maintained at all times.
- Installing exclusion fencing, where appropriate, to avoid impacts to existing components of the WRP and Permanent Reservoirs sites or other exclusion zones.

Operation

A variety of measures would be implemented to manage the operational risks of the storage and delivery of chemicals associated within the project. These measures would be outlined in the OEMP and are typical of those applied at similar facilities and include:

- Storing quantities of certain chemicals on site that are within the relevant thresholds.
- Undertaking activities in accordance with the relevant material and safety data sheets.
- Maintaining bunded areas for the storage and delivery of chemicals in accordance with Australian Standard AS 3780:2008 and the relevant material and safety data sheets.
- Maintaining and implementing appropriate procedures for delivering, handling and accidental spills of chemicals.

Measures associated with the management of risks from emergency or maintenance events associated with the system are largely incorporated in the design. These measures include:

- Implementing back-up procedures should power to infrastructure be interrupted.
- implementing emergency management plans and undertaking ongoing liaison with the local emergency services.
- Installing appropriate management measures at the recycled water discharge pipeline at the permanent reservoirs site.
- Ensuring all access roads surrounding the infrastructure are maintained as a defendable space and grasses and vegetation managed adjacent to these roads.
- Ensuring emergency access to the access roads around the facility is maintained at all times.

6.14 Bushfire assessment

The WRP site and Permanent Reservoirs site are not located on mapped bushfire prone land, however the land to the north, east and south-east of the WRP, including the Googong Foreshores land, is anticipated to be bushfire prone land (refer to Figure 6.37). Accordingly, the existing WRP have been positioned as far as possible away from this area as possible to exclude them from bushfire impact. Where this cannot be avoided, buildings have been subject to bushfire attack risk would be constructed in accordance with the latest revision of AS 3959.

The Stage D expansion would adopt an approach to bushfire consistent to the design of previous stages.

6.14.1 Existing environment

WRP

The WRP is located approximately 20 metres west of the Vegetation Category 2 Buffer, 50 metres west of Vegetation Category 2 and 140 metres southwest of Vegetation Category 1 zones. The proposed temporary construction access located in the corridor east of the WRP is located within the Vegetation Category 2. A description of these zones is provided in Table 6.36.

Table 6.36 Description of relevant bushfire mapped zones

Bushfire zone category	Description	Buffer
Vegetation Buffer	External buffer to each vegetation category zone	
Vegetation Category 1	Highest risk for bushfire. This zone has the highest combustibility and likelihood of forming fully developed fires including heavy ember production.	100 metres
Vegetation Category 2	Lower bushfire risk than Category 1 but higher than excluded areas. This zone has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices.	30 metres

The WRP is primarily set amongst urban development to the west and south, and open grassland and woodland to the north and east. Terrain surrounding the WRP is undulating, although deeper gullies are present with drainage lines into the Googong Foreshores.

The grassland surrounding the WRP to the east is on downslopes ranging from 0°-10° downslope, and the grassy woodland north of Googong Road was identified to have a slope of 5°-10°downslope (EMBER Bushfire Consulting, 2018).

Permanent Reservoirs

The Permanent Reservoirs site is approximately 300 metres from the nearest bushfire vegetation buffer zone. The land surrounding the Permanent Reservoirs site is denuded of wooded vegetation and is characteristic of the sheep grazing land of the surrounding district. The bushfire hazard consists of pasture interspersed with native grass and is in a minimal condition such that it would not present a hazard. In a

worst-case scenario, grazing practices, growth, and curing rates could change such that a grassland hazard could eventuate. It is worthy to note that grazing is likely to occur until such time that the later stages of the Googong township develop the lower flanks of the hill effectively removing the majority of the bushfire threat in years to come.

The grassland surrounding the Permanent Reservoirs site is on downslopes ranging from a slope of 5-10° downslope to 10-15° downslope (Ecological, 2015).

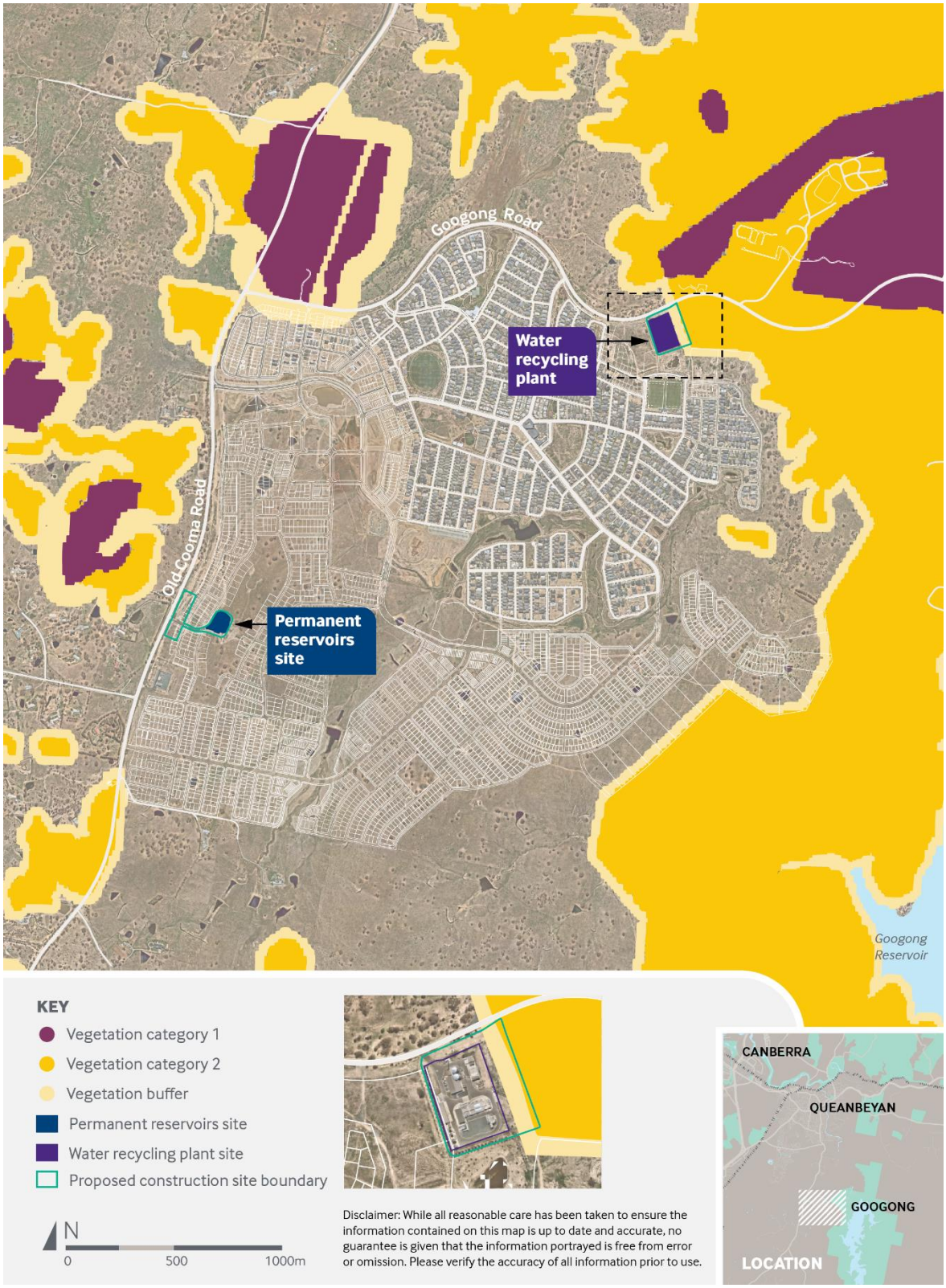

Figure 6.37 Bushfire prone land within proximity to the Proposal

6.14.2 Potential bushfire risk

While there is the potential for a grassfire to spread towards the WRP and Permanent Reservoirs sites, this potential is limited by the availability of fuel, which in turn is influenced by the season (rainfall, rate of growth and curing) and grazing. Grazing pressure or maintenance activities would need to be significantly reduced to allow fuel accumulation to occur.

The proposed Stage D works would be within the existing WRP and Permanent Reservoirs site boundaries and therefore are surrounded by other existing infrastructure components and maintenance roads. Additionally, the WRP site is separated from any bushfire hazard by Googong Road to the north and the advancing stages of the Googong township to the south. The Googong Road easement is also considered an asset protection zone (APZ) between the unmanaged grassy woodland areas north of Googong Road and the Googong township development. The Permanent Reservoirs site is separated from any bushfire hazard by Old Cooma Road to the west and is also a greater distance from the nearest bushfire zone.

The proposed temporary construction access is disturbed grassland, with the existing roads forming breaks in the connectivity of ground fuel. The temporary access would not require structures or storage of materials within the corridor, and as such bushfire risk is considered to be low for this aspect of the Proposal.

Aboveground assets and infrastructure at the WRP and Permanent Reservoirs sites are rated to be of low vulnerability primarily due to the nature of construction and external materials used. The reliance on steel (non-combustible) construction means that the risk of significant or costly damage is low. However, given that some assets at the WRP are constructed of combustible material (e.g. plastics) or are susceptible to fire damage (e.g. electrical components) there remains the risk of disruption to the operation of the WRP in the event of fire.

Overall, given the low threat grassland and open woodland landscape surrounding the Proposal, the gentle topography, the age and quality of existing infrastructure and services and the provision of established APZs where required, the Proposal is considered to possess a general low bushfire risk.

6.14.3 Mitigation measures

It is noted that recycled water is available in Googong township for firefighting, with hydrants provided on the recycled water reticulation system. In the event of a major fire that disrupts the supply of recycled water to the Googong township, water would still be available for firefighting. The following contingencies would be available:

- The recycled water permanent reservoir at Hill 800 has a storage capacity of 4 ML.
- Hydrants are provided on the potable water reticulation system in the Googong township as a backup supply.
- Stormwater could be available in Beltana Pond and other parts of the stormwater management system in the Googong township for tanker supply.

Additional mitigation measures to reduce the bushfire threat of the Proposal include:

- All access roads surrounding the infrastructure would be maintained as a defendable space and grasses and vegetation should be managed adjacent to these roads.
- Emergency access to the access roads around the facilities would be maintained at all times.

6.15 Human health

6.15.1 Existing environment

The *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (AGWR) (NRMMC, EPHC and AHMC, 2006) is a set of national guidelines that can be applied to the management of both human and environmental risks associated with the application and discharge of recycled water. The central principle of the AGWR is that all recycled water schemes require a risk management plan.

QPRC have developed an Essential Sewage and Recycled Water Quality Management Plan (RWQMP) (QPRC, 2015), for Stage 1 of the Googong Township IWC, which is being continuously evaluated and reviewed to assure safety throughout the project lifecycle.

Stage D works would provide infrastructure to increase the storage capacity of the current IWC Project under the RWQMP and increase the supply of recycled water to the Googong township. The IWC Project would continue to allow for re-use for non-potable purposes such as irrigation of playing fields and open space, garden watering, toilet flushing and firefighting. Therefore, the potential impacts of the Proposal on human health related to the use and discharge of recycled water are not predicted to change from those already approved and addressed in the RWQMP and the WMP (RPS, 2018).

Table 6.37 is an extract from the RWQMP, demonstrating how the plan meets the 12 elements of the AGWR's Framework for the Management of Recycled Water Quality and Use.

Prior to Stage D commencing operations, the RWQMP would be updated by QPRC to incorporate the new assets. Review of the RWQMP would include a review of the recycled water system analysis. The RWQMP would act as an effective management tool, containing a process for the ongoing review and maintenance of the documents.

6.15.2 Potential impacts

Construction

Construction of the Proposal would have no direct impact on human health. As such, no construction impact mitigation and management measures are required in relation to human health.

However, environmental management measures that have an indirect benefit for human health are covered in other sections in this REF.

Operation

Using recycled water and discharging excess recycled water or off-specification water to the environment would present a number of pathways through which the public could be exposed to elements that may impact on their health.

Human exposure can occur inadvertently or accidentally through skin contact, inhalation and/or ingestion. This can occur from:

- Planned or controlled discharge into the environment.
- Use of recycled water for irrigation and car washing (e.g. inadvertent inhalation or ingestion).
- Use of recycled water inside the home (for non-potable uses).

In addition, the failure of the system at any point can also result in unplanned or accidental exposure to raw wastewater, partially treated wastewater or recycled water and thereby exposure to potential contaminants. This exposure could be caused by:

- Accidental spill or discharge to the environment.
- Accidental potable use of recycled water.
- Cross-connection of dual-reticulation systems with drinking water supplies, leading to accidental ingestion of recycled water.

The main risk to human health is caused by the presence of residual pathogens in the recycled water after treatment. The ingestion of recycled water may cause gastrointestinal illness, and inhalation of recycled water sprays may cause respiratory illness. While possible, this scenario is extremely unlikely to occur.

Table 6.37 Approach and outcome in meeting the 12 AGWR Elements for the Googong Township RWQMP

AGWR element	Approach and outcome
1. Commitment to responsible use and management	
1.1 Responsible use of recycled water	The development of the scheme involved collaboration between QPRC, GTPL, NSW Department of Health, DPIE Water, and the NSW EPA. Googong township is designed around an IWC, which aims to cut the potable water consumption up to 60 per cent of the modelled demand. Amongst the uses

AGWR element	Approach and outcome
	of the recycled water are toilet flushing, irrigation of parks and other public domain features in the township.
1.2 Regulatory and formal requirements	Regulatory and guideline requirements identified include in particular the *Local Government Act 1993* – Section 60, the EP&A Act, Australian Drinking Water Guidelines, WSAA Water Supply and Sewerage Code of Australia. A Register of Regulatory and Formal requirements is maintained and updated regularly.
1.3 Partnerships and engagement of stakeholders (including the public)	Engagement of stakeholders is generally between QPRC, GTPL, state environmental protection agencies, health departments and other relevant government entities. Other stakeholders are local community, plumbers and builders and the general public. A Stakeholder Register, which provides information on entity type, roles in recycled water management, nominated personnel and contact details, is maintained and updated regularly by QPRC.
1.4 Recycled water policy	QPRC supports and promotes the responsible management and use of recycled water and the application of a multi-barrier management approach. QPRC maintains recycled water management systems to effectively manage risks to public and environmental health. The Recycled Water Policy is signed by the QPRC General Manager and is reviewed periodically.
2. Assessment of the recycled water system	
2.1 Source of recycled water, intended uses, routes of exposure, receiving environments and routes of exposure	The source of recycled water is the Googong WRP, which treats domestic sewage from Googong township as an essential service. The sewage has some commercial content from activities such as schools and shops. Intended uses include public domain water features, toilet flushing, washing machines, irrigation of sports fields and parks, washing pavements/cleaning of public domain areas, residential garden use, residential car washing and firefighting. Receiving environments include groundwater, surface water, plants, soils, and air.
2.2 Recycled water system analysis	The design of the water recycling scheme includes a 4-stage chemical phosphorus removal MBR process with the capability to operate as a 5-stage biological phosphorus removal MBR process. Biological phosphorous removal has been included to serve as a back-up system should there be a failure or non-compliance in the TDS levels from the chemical phosphorus removal system.
2.3 Assessment of water quality data	The Googong township is a greenfield project and as such historical data is not available for analysis. Design criteria for raw sewage and influent have been determined and are described at Table 0-1-10 and Table 0-1-11of the RWQMP.
2.4 Hazard identification and risk assessment	**Human health** Hazard identification and risk assessment for human health found that the microbial hazards for humans include enteric bacteria, viruses, and protozoa. **Environmental performance** Hazard identification and risk assessment for the environment found the following: • Preliminary risk assessment identified surface water, groundwater, landscape and garden plants as potential environmental endpoints for hazards • Preliminary screening identified TDS, nitrogen, phosphorus, hydraulic flow, oil and grease, turbidity, chlorine, and pathogens as high to very high risks • All key hazards required preventive measures to lower risks to acceptable levels. A risk assessment identified a range of preventive measures (see Element 3) that aim to reduce risks to an acceptable level (i.e. low). A Risk Register is maintained that covers catchment to customer end use as well as unintended uses and users. Residual risk ranking is generally low or as low as reasonably possible. Key findings on the risk assessment are: • The assessment resulted in the identification of 102 hazards • The uncontrolled risks assigned 33 Very High risks, 41 High risks, 11 Moderate risks, 4 Low risks.

AGWR element	Approach and outcome
	• After preventive measures were assessed, only 15 High risks, 32 Moderate risks, 54 Low risks remained.
3. Preventative measures for recycled water management	
3.1 Preventive measures and multiple barriers	**Human health** Preventive measures to manage risks to human health include: • Secondary and tertiary treatment and disinfection, providing log reduction of protozoa, bacteria, and viruses • Backflow prevention and cross-connection control • Restricting public access during irrigation • Colour coded pipe work and signage at site indicating that recycled water is being used. **Environmental performance** Preventive measures to manage risks to the environment include: • TDS of the recycled water entering the recycled reticulation system kept below 700 mg/L • Nutrient control in the recycled water via secondary treatment and chemical phosphorus removal • Education programs on irrigation practices • Irrigation schedule devices and controls to monitor and/or control water application rates, soil moisture, water movement through the soil • Nutrient content of recycled water to be considered when determining fertilising requirements.
3.2 Critical control points	**Human health** Critical control points related to human health were identified as follows: • Preliminary treatment • Secondary biological treatment • MBR • UV disinfection • Chlorination • Final effluent (diversion can occur) • Re-chlorination. **Environment performance** Critical control points related to the environment were identified as follows: • Secondary nutrient removal • Phosphorus removal – Balancing phosphorus removal processes to maintain required TDS levels in effluent through biological, chemical and potable water shandy methods.
4. Operational procedures and process control	
4.1 Operational procedures	**Human health** Operational procedures are identified for all processes and activities associated with the system including the operation of the treatment processes. Documented procedures are available to all operations personnel and available for inspection anytime. **Environmental performance** Irrigation procedures are established to minimise salinity impacts, maintain nutritional levels, and minimise leaching and impacts on groundwater quality and quantity.
4.2 Operational monitoring	**Human health** Monitoring requirements in relation to human health: • Standard wastewater plant requirements – Biological oxygen demand, TSS, etc. – Turbidity of filtered water (continuous) – *critical limit set* • Disinfection (continuous) – *critical limit set*

AGWR element	Approach and outcome
	• On-site auditing of controls (signage, backflow prevention, etc.). **Environmental performance** Monitoring requirements in relation to the environment: • Recycled water TDS, total nitrogen, total phosphorus • Pressure sensors in the reticulation system to identify pipe bursts and automatic cessation of supply once detected • Moisture sensors and groundwater monitoring are used to maximise irrigation efficiency.
4.3 Operational corrections	The plant Operation and Maintenance (O&M) manual includes troubleshooting guides or procedures for corrective actions when operational parameters are not met.
4.4 Equipment capability and maintenance	Critical operational monitoring instruments are inspected every day and calibrated regularly as per manufacturer's recommendations or at a suitable frequency based on operational experience.
4.5 Materials and chemicals	Quality assurance of materials and chemical are applied to ensure that they do not introduce contaminants into the recycled water system.
5. Verification of recycled water quality and environmental performance	
5.1 Recycled water quality monitoring	A verification monitoring plan has been developed for the Googong WRP. This includes essential sewage management, operational needs, CCPs and verification of design and modelling. Stage A, B and C monitoring will provide input to Stage D design and construction.
5.2 Application site and receiving environmental monitoring	A monitoring plan has been developed for the Googong WRP. The receiving environment includes surface water, groundwater, soils, and air.
5.3 Documents and reliability	System operation and procedures manuals, relevant drawings and risk management plans will all be kept on site. Performance logs are maintained by the system on site.
5.4 Satisfaction of users of recycled water	Satisfaction of users of recycled water is monitored by QPRC. QPRC will also carry out an annual customer satisfaction survey which is used to generate trends and improve the preventive actions for the recycled water scheme.
5.5 Short-term evaluation of results	Sampling results are provided routinely to NSW EPA, DPIE – Water and NSW Health. Exceedances of set guideline values are reported immediately, in accordance with an agreed incident procedure.
5.6 Corrective responses	Corrective responses involve investigation of plant performance records to confirm normal operation and additional testing to confirm exceedances and identify source. If the target criteria are exceeded, preventive measures are reassessed, and corrective actions taken to ensure that performance is improved.
6. Management of incidents and emergencies	
6.1 Communication	Communication protocol has been defined which include emergency contact details of relevant agencies and stakeholders.
6.2 Incident and emergency response protocols	The Incident Management Plan outlines the processes for initiation, management and reporting on incidents and details the timeframe and responsibilities for actions under this plan. The Recovery Action Plan sets out the actions required to maintain or restore system operations in the event of incident.
7. Operator, contractor and end user awareness and training	
7.1 Operator, contractor and end user awareness and involvement	The plant is operated by appropriately trained and skilled personnel. The minimum skill level required is Certificate 3 in Water Industry Operations. The number of operators required to operate the sewage management and recycled water plan will be periodically reviewed to ensure efficient operation. Education programs and campaigns are carried out to inform the users of recycled water. Information packages dealing with authorised uses, best practices for irrigation, restrictions and responsibilities are provided to Googong residents and plumbers.
7.2. Operator, contractor, and end user training	

AGWR element	Approach and outcome
8. Community involvement and awareness	
8.1 Consultation with users of recycled water and the community	Googong community are given an opportunity to participate in local decision making of the Council through engagement.
8.2 Communication and education	Residents are informed of the authorised uses of recycled water and its limitations through printed materials, community briefings and workshops.
9. Validation, research, and development	
9.1 Validation of processes	Pre-validated UV lamps and membranes were selected for the WRP. Chlorine Contact time was validated during commissioning. Verification is continued during the first few years of operation of the recycling plant to ensure that seasonal variations are met. The Stage AB and C verification and validation monitoring will inform Stage D design and construction.
9.2 Design of equipment	Testing is undertaken to verify the efficiency of the tertiary MBR and UV to achieve log reduction of protozoa, bacteria, and viruses. The capacity of the chlorination system will also be assessed via residual chlorine.
9.3 Investigation of studies and research monitoring	Programs are established to increase understanding of the recycled water supply system and use this information to improve management of the recycled water supply system. This will also inform validation of design loadings and modelling.
10. Documentation and reporting	
10.1 Management of documentation and records	All operating procedures are documented with controlled copies maintained. All results from continuous monitoring system are recorded and stored.
10.2 Reporting	Reports are prepared on a regular and agreed basis to regulatory authorities and for circulation by QPRC.
11. Evaluation and audit	
11.1 Long-term evaluation of results	An annual report on compliance with licence conditions is submitted to regulatory authorities. Evaluation is also against industry benchmarks and looks for trends of concern that may require additional preventive measures.
11.2 Audit of recycled water quality management	Audits are done both internally and externally. All monitoring results are analysed as part of annual audit. On completion of the audit, an Internal Audit report is prepared, noting compliance or non-compliance.
12. Review and continuous improvement	
12.1 Review by senior managers	Performance of the essential sewage and recycling plant and customer complaints/satisfaction are reviewed by senior managers.
12.2 Recycled water quality management and improvement plan	Management systems are reviewed and evaluated. Plans are established for introduction of potential improvements identified from operating experience. An Improvement Plan is maintained (and is provided in Appendix E of the RWQMP for the current version).

Source: Table 0-1 of the QPRC Googong Township Essential Sewage and Recycled Water Quality Management Plan, June 2018

6.15.3 Mitigation measures

To limit inappropriate exposure to recycled water, GTPL and QPRC would apply the following risk management practices:

- Installation regulations and codes of practice that include systematic processes to reduce the probability of cross-connections.
- Materials codes and regulations that easily discriminate specific plumbing for drinking and recycled water.
- Regulations that require only licensed tradesmen to legally install or modify plumbing systems.
- Education on recycled water use and the need to avoid the creation of cross-connections.

- Installation of advisory signs at the entrances to the Googong township and in public areas where recycled water is being used or may be present.
- Opportunities to apply pressure differentials in certain situations to ensure that, if cross-connections occur, they are from higher to lower water quality.
- Installation of backflow prevention devices.
- Operational checking (i.e. testing of recycled effluent quality post-treatment) and connection auditing.

These practices are documented in the RWQMP, which is continuously evaluated and reviewed to ensure its effectiveness.

6.16 Socioeconomic

6.16.1 Existing environment

The Proposal is an integral component of the Googong township, being developed by GTPL, and would provide services for the next stage of the growing township. The Googong township is currently partially developed, with development expected to be ongoing over the next 25 years. It includes significant residential areas, along with commercial areas and social (e.g. recreational and educational) infrastructure. The Googong township is expanding, quadrupling in population from 2011 to 2020 and is anticipated to grow steadily with the development. Likewise, the economic profile of the Googong is likely to improve as population increases with working families, mirroring the economic indicators of the Queanbeyan area which are higher than the NSW average.

6.16.2 Potential impacts

Construction

The Proposal would benefit the community by directly creating around 200 jobs across the construction process and injecting over $18.4 million (the capital construction cost of Stage D) into the regional economy.

The Proposal would continue to support the objectives of creating a new sustainable township that would:

- Demonstrate that a truly water-efficient, ecologically sustainable town can be developed, which can serve as an Australian benchmark for future communities and developments.

The Proposal would predominantly be confined to the existing WRP and Permanent Reservoirs sites located within the Googong township. Therefore, a relatively small proportion of the local community would be directly affected by the construction of the Proposal.

During construction, the Proposal may create the following socio-economic issues:

- Potential disturbance to surrounding residential areas.
- Potential disruption of recreational activity at various nearby sites, such as the Googong Foreshores.
- Possible loss of privacy at nearby residences due to the increase in presence of nearby workers.

The majority of socio-economic impacts that may arise during construction are addressed in Section 6. They include:

- Traffic and transport impacts (refer to Section 6.1)
- Noise and vibration impacts (refer to Section 6.4)
- Air quality impacts (refer to Section 6.7)
- Visual amenity impacts (refer to Section 6.8)
- Hazards and risks (refer to Section 6.13).

Operation

Through the continued operation of the IWC Project, there would be a significant transformation of the landscape with the development of the Googong township, including about 6,200 dwellings.

The Proposal would support the future development of Googong township and would have many socio-economic benefits, including housing, new recreational areas and increased regional water security. Residents in the surrounding areas would benefit from the creation of schools and other community facilities in closer proximity than existing services.

6.16.3 Mitigation measures

Impacts during construction would be short-term and minimised as far as practical by the implementation of consultation and mitigation measures as part of the works.

Ongoing consultation measures are outlined in Section 5.4. A Consultation Plan would be prepared prior to construction of Stage D works to ensure the local community and other stakeholders are kept up to date. Furthermore, the existing IWC Project hotline (1800 838 438), compliance website (compliance.googong.net) and complaints register would continue to be maintained.

6.17 Cumulative impacts

6.17.1 Current and future projects in the region

Googong township is currently under development, with roads, housing, community facilities and infrastructure under construction. This development would be continually occurring throughout the Stage D process. The impacts of the Googong township were considered by Manidis Roberts (2010) and the IWC Project was approved with mitigation measures under Part 3A of the EP&A Act (repealed).

There are several projects within the Googong township that could have cumulative impacts with the Proposal as outlined below.

- Ongoing subdivision works of approximately 250 lots per annum in NH2 and NH3
- First stage of the Town Centre development
- Development of the Indoor Sports and Aquatic Centre
- Development of the Multi-Purpose Centre.

A search of the QPRC development application notification register, Southern Regional Planning Panel and Major Projects Register was undertaken on 27 March 2020. Projects identified within close proximity to the Proposal are listed in Table 6.38.

Table 6.38 Other projects and developments in the Googong region

Project name	Summary of proposed works	Potential construction impacts	Potential operational impacts
Expansion of the Anglican School • DA Number: DA.2019.1227 • Planning Panel reference number: PPSSTH-19 (currently under assessment)	Expansion of the Anglican School – Googong – 16 New Classrooms, Car Park & Landscaping	• Increased noise and dust due to earthworks and other construction works • Increased traffic along Old Cooma Road and Googong Road due to the presence of construction vehicles and deliveries • Minor visual impacts during construction of the new reservoir at Hill 800.	• Minor visual impacts due to the presence of the new reservoir at Hill 800.

6.17.2 Consequential impacts of the IWC Project

The IWC Project facilitates the development of the Googong township, which would have impacts on the study area. The majority of these potential impacts were considered during the Local Environmental Study in 2004 and have been subsequently addressed by the recent approval of the rezoning of the land. As each neighbourhood of the Googong township is developed, development applications would be prepared, which would address the impacts of each subdivision stage under Part 4 of the EP&A Act.

The general impacts of the creation of a township at Googong have been considered as part of the planning for the Sydney–Canberra corridor region and the greater Queanbeyan area (refer to Chapter 2 of Manidis Roberts (2010)).

Consequential impacts of the project also include the potential changes to the recreational uses of Googong Foreshores, due to the increased local population adjacent to the Foreshores. The recreational facilities within the Googong township would be extensive, so it is difficult to predict the level of recreational use of the Googong Foreshores by future residents. The relevant land managers of the Googong Foreshores should monitor any changes as the development of the Googong township progresses. Appropriate management measures could then be implemented, particularly at the existing gate on Googong Road. Although it is unlikely that the Proposal would facilitate any negative impacts on the Googong Foreshores, the ACT and/or Commonwealth governments could restrict access to the Foreshores or impose other management measures on the Commonwealth land. Approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* has been obtained and ongoing consultation with the Department of Agriculture, Water and the Environment is being undertaken to address these potential consequential impacts.

7 ENVIRONMENTAL MANAGEMENT

7.1 Environmental management plans

A CEMP for the construction phase of the Proposal will be prepared in accordance with the Statement of Commitments in Table 7.1. The CEMP will incorporate as a minimum all Statement of Commitments, any conditions from licences or approvals required by legislation, and a process for demonstrating compliance with such mitigation measures and conditions.

For operation, a number of existing management plans have been prepared and are being implemented for the existing IWC Project and it is proposed that these management plans would be revised and updated for Stage D, should the Proposal be approved.

The hierarchy and structure for environmental management plans is represented in Figure 7.1.

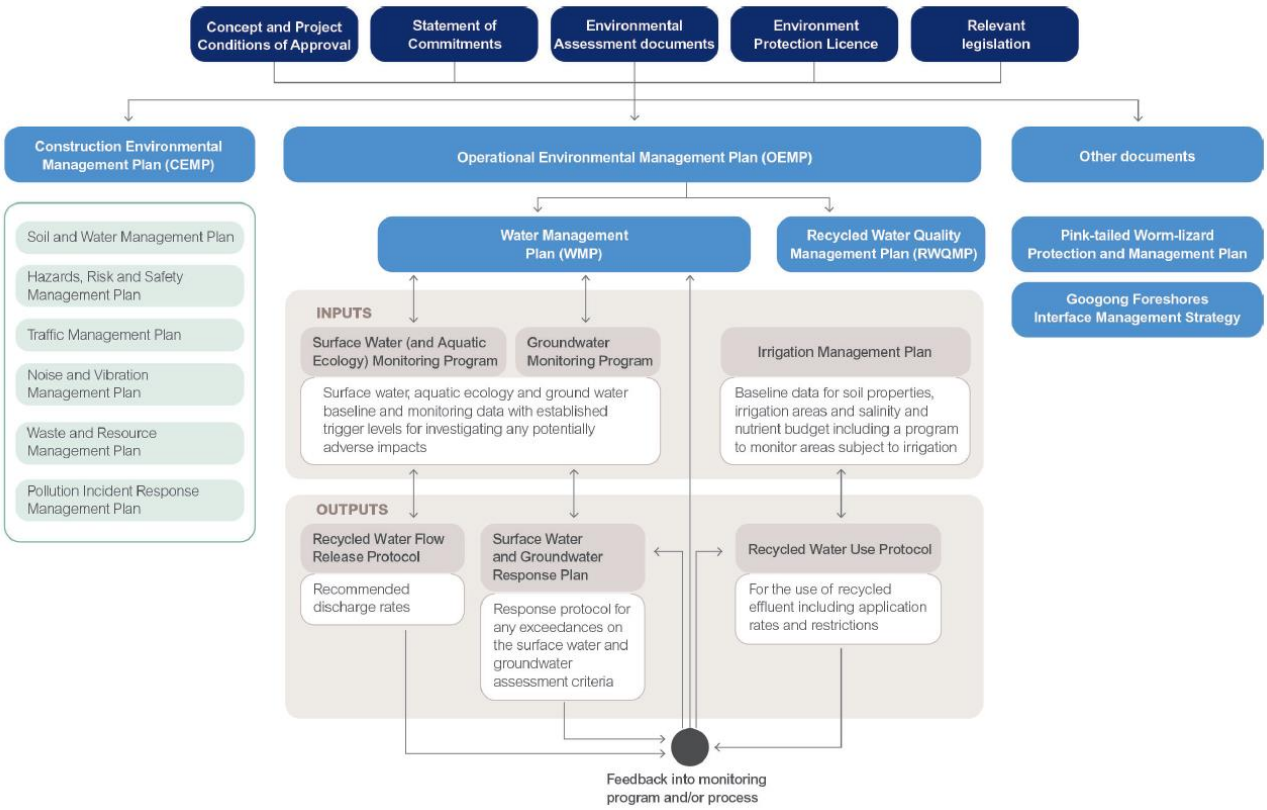

Figure 7.1 Outline of environmental management plans for the Proposal

7.2 Statement of Commitments

Mitigation measures and other commitments outlined in the REF have been summarised into a Statement of Commitments, which would be included in the relevant CEMP and OEMP documentation. The Statement of Commitments are summarised in Table 7.1.

Table 7.1 Statement of Commitments

SoC #	Management measure/commitment	Responsible
Construction		
General		
C1	The Proposal must be carried out generally in accordance with the Concept Approval, REF, Project Approval, and the Statement of Commitments. Any modifications to the Proposal, if approved, would be subject to further assessment by GTPL and approval by QPRC. The assessment would need to demonstrate that any environmental impacts resulting from the modifications have been minimised.	GTPL/Contractor
C2	All other licences, permits and approvals necessary for the construction of the Proposal would be obtained and maintained (e.g. Environment Protection Licence under the PoEO Act).	GTPL/Contractor
C3	All Contractors would be inducted on the key project environmental risks, procedures, mitigation measures and Conditions of Approval.	Contractor
C4	An Environmental Controls Map would be prepared that would clearly mark no-go areas and other important environmental features/areas of sensitivity along with key environmental controls.	Contractor
C5	Site inspections to monitor environmental compliance and performance would be undertaken during construction at appropriate intervals.	Contractor
C6	A CEMP would be prepared to manage the environmental issues assessed in this REF and ensure implementation of the identified mitigation measures where required during construction.	GTPL/Contractor
C7	All potentially impacted residents would be notified of the proposed works, including the nature and duration of construction activities, predicted noise levels and contact details would they have any issues with the construction activities. A community hotline would be maintained throughout the construction period any complaints would be responded to and logged in the complaints register for the Proposal.	GTPL/Contractor
Soils and water		
C8	Prior to commencement of works, a Soil and Water Management Plan would be prepared in accordance with the 'Blue Book' *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004) and the recommendations made in this REF.	Contractor
C9	A site-specific Erosion and Sediment Control Plan would be prepared to support the Soil and Water Management Plan and would include detail on the erosion and sediment controls to be installed. The Erosion and Sediment Control Plan would be implemented prior to and throughout construction and be updated and managed throughout as relevant to the activities during the construction and commissioning phases.	Contractor
C10	Erosion and sediment control measures would be established prior to any clearing, grubbing and site establishment activities and would be maintained and regularly inspected (particularly following rainfall events) to ensure their ongoing functionality. Erosion and sediment control measures would be left in place until the works are complete and areas are stabilised.	Contractor
C11	Stockpiles would be checked for stability weekly and after heavy rainfall.	Contractor

SoC #	Management measure/commitment	Responsible
C12	All run-off from the site would be directed to sediment basins (or other appropriate sediment control structures) which must be appropriately sized and maintained as per the Blue Book. Sediment basins would only be discharged to receiving waters once field tests/laboratory tests confirm the water quality parameters are within guideline limits.	Contractor
C13	Vehicle wash down would take place in designated areas within the WRP and Permanent Reservoirs sites and away from drainage lines. Water from the wash down would be appropriately treated before being reused on site or discharged.	Contractor
C15	Temporary and permanent fuel storage areas would be designed and operated in accordance with Australian AS 1940 – The storage and handling of flammable and combustible liquids.	Contractor
C16	Refuelling would occur within contained, hardstand areas in accordance with AS 1940 wherever possible. Where this is not possible, refuelling activities would be located away from drainage lines and be closely supervised, with a spill kit available.	Contractor
C18	A spill response procedure would be prepared and implemented and would detail the following: • Information on spill kits • Steps for containing and cleaning up a spill • Waste disposal methods • Training and induction requirements.	Contractor
C19	Spill clean-up kits would be located in appropriate locations, based on the risk of a spill occurring and potential volume of material that might be spilled at the particular location.	Contractor
C20	Bunding would be established during the upgrade or replacement of plant containing chemicals or biosolids to minimise the risk of spills.	Contractor
C21	If potentially contaminated land, spoil or fill is encountered works in the vicinity would be stopped or modified and would not recommence until the material has been analysed, the hazard has been assessed and appropriate action has been taken (including delineating areas of concern as required until earthworks can resume safely).	Contractor
C22	In the event of a pollution incident, works would cease in the immediate vicinity and the EPA/QPRC would be notified by GTPL (if required), in accordance with Part 5.7 of the POEO Act.	GTPL/Contractor
C23	The site would be re-profiled to achieve soil stability and congruity with the surrounding landscape. This would be done in consideration of the landscape and open space strategy for the Googong township development. Topsoil would be conserved and used for rehabilitation where possible.	Contractor
C24	A groundwater monitoring bore would be installed down-gradient of the Permanent Reservoirs site to capture construction impacts.	GTPL
C25	The application of fertilisers on revegetated or rehabilitated areas, if required, would be limited.	Contractor
Biodiversity		
C26	Clearing of topsoil would be limited to the area within the designated construction footprint.	Contractor
C27	The Contractor would be required to undertake construction of the Proposal having regard for the trees on the northern boundary of the WRP and Tree Protection Zones (TPZs) would be established in line with AS 4970-2009 Protection of Trees on Development Sites and would include exclusion fencing of TPZs.	Contractor

SoC #	Management measure/commitment	Responsible
C28	Weed control measures would be implemented in line with the Schedule 1 of the *Biosecurity Act 2015*.	Contractor
C29	Cleared or exposed areas would be restored/rehabilitated in order to stabilise soils and improve visual amenity. Any additional landscaping undertaken during the restoration of the site would use native species, where possible.	Contractor
C30	The measures outlined in the Googong Foreshores Interface Management Strategy would be implemented for the land to the east of the WRP including weed removal and restoration with native vegetation.	GTPL/Contractor
Noise and vibration		
C31	A Construction Noise and Vibration Management Plan Would be prepared and implemented in accordance with the requirements of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009), Construction Noise Strategy (TfNSW, 2012) and this REF.	Contractor
C32	Works would generally be carried out during normal work hours (i.e. 7.00 am to 6.00 pm Monday to Friday; 8.00 am to 1.00 pm Saturdays). Any works outside these hours may be undertaken if approved by the EPA and any other relevant authorities.	Contractor
C33	All impacted residents would be notified of the proposed works, including the nature and duration of construction activities, predicted noise levels and contact details should they have any issues with the construction activities.	Contractor
C34	Construction schedule would provide for respite periods when noisy activities are being undertaken, and the distance between noise construction activities and sensitive receivers would be maximised where feasible and reasonable.	Contractor
C35	Construction plant and equipment would be well maintained (including noise reduction fittings where feasible) and would be turned off when not in use to minimise noisy emissions.	Contractor
C36	Where feasible reversing equipment would use ‘quacker’ alarms or would be minimised to prevent causing a nuisance.	Contractor
Air quality		
C37	Plant and machinery would be regularly checked and maintained in a proper and efficient condition.	Contractor
C38	Dust suppression measures would be implemented, including but not limited to: • Water trucks would be used to reduce dust in dry, windy conditions • Water (or alternate measures) would be applied to exposed surfaces (e.g. unpaved roads, stockpiles, hardstand areas and other exposed surfaces) • Stockpiles would be covered when not in use • Loads on trucks transporting material to and from the construction site would be appropriately covered and tailgates of road transport trucks would be securely fixed prior to loading and immediately after unloading • Mud and dirt would be prevented from being tracked onto sealed road surfaces.	Contractor
C39	The burning of material on site would be prohibited, except under the instruction of NSW Rural Fire Services.	Contractor
Visual amenity		
C40	Temporary fencing would be installed for security and to visually delineate the areas of construction.	Contractor
C41	The Proposal construction sites would be kept tidy and well-maintained, including the removal of all rubbish at regular intervals. No materials would be stored beyond the construction boundaries.	Contractor

SoC #	Management measure/commitment	Responsible
C42	Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.	Contractor
C43	Any night-lighting needed for construction would be located away from public or sensitive viewing areas.	Contractor
C44	Residual site areas would be revegetated upon completion.	Contractor
Traffic and access		
C45	A Traffic Management Plan would be prepared prior to construction to outline all access routes to, from and within the construction zones, traffic control methods to be utilised and methods to minimise impacts to the local road network. This plan would be prepared in accordance with the relevant standards and submitted to the relevant road authority for consultation and approval.	Contractor
C46	All permits and approvals under the *Roads Act 1993* or for oversize vehicles would be obtained as required.	Contractor
C47	Where feasible, construction deliveries would be scheduled outside of peak periods, in particular peak residential access times.	
Aboriginal heritage	**and non-Aboriginal heritage**	
C48	The location of nearby Aboriginal and non-Aboriginal heritage sites would be clearly marked on all site plans and maps utilised for the construction of the Proposal.	Contractor
C49	If unforeseen items/objects are uncovered during construction, work would cease in the vicinity of the find and the Environment Manager would be notified immediately to assist in co-ordinating next steps which are likely to involve consultation with an archaeologist, EES and Local Aboriginal Land Council. If human remains are found, work would cease, the site would be secured and the NSW Police and the EES would be notified.	Contractor
Waste		
C50	A Waste and Resource Management Plan would be prepared which details waste management strategies which are consistent with the Waste Avoidance and Resource Recovery Act 2007 and the resource management hierarchy principles (in order of priority) of avoidance, resource recovery and disposal.	Contractor
C51	The Waste and Resource Management Plan would include procedures to classify all waste types in accordance with the Waste Classification Guidelines (EPA, 2014) and NSW legislative requirements.	Contractor
C52	Waste disposed of off-site would be disposed of to a waste facility that is licensed under the POEO Act to receive wastes of that type.	Contractor
Hazards and risks		
C53	A Hazards, Risk and Safety Management Plan would be prepared that would detail the following (at a minimum): • Implementation of appropriate safety and training procedures • Risk register • Emergency access • Emergency response plan/s.	Contractor
C54	Exclusion fencing would be installed, where appropriate, to avoid impacts to existing components of the WRP and Permanent Reservoirs sites or other exclusion zones.	Contractor

SoC #	Management measure/commitment	Responsible
C55	All access roads surrounding the infrastructure would be maintained as a defendable space and grasses and vegetation should be managed adjacent to these roads.	Contractor
C56	Emergency access to the access roads around the facilities would be maintained at all times.	Contractor
Operation		
General		
O1	The operation of the Proposal must be carried out generally in accordance with the Concept Approval, REF, Project Approval, and the Statement of Commitments.	QPRC
O2	All other licences, permits and approvals for operation would be obtained and maintained (e.g. Environment Protection Licence under the PoEO Act).	QPRC
O3	The existing operational management plans for the IWC Project would be revised and amended to reflect the increased operational capacity of the WRP and Permanent Reservoirs. They would be revised to address the recommendations in each of the specialist reports and include additional mitigation measures, as required, to ensure the ongoing management of environmental risks. Approval for each of the revised management plans would be sought in line with the review procedures for that plan. Plans to be revised include (but would not be limited to): • Operational Environmental Plan (OEMP) • Recycled Water Quality Management Plan (RWQMP) • Water Management Plan (WMP), including sub plans (e.g. IMP).	QPRC
Soils and water		
O4	Operational water quality and hydrology management measures would be outlined in the Googong IWC Water Management Plan, and would include but not be limited to: • The temporary sediment fence at reeds at Site 8 would be replaced with a more permanent series of gabion walls and smaller bio-swales/wetlands within the aim of minimising pooled water areas while also improving water quality. • A series of gabion walls would be installed in the lower reaches of Googong Creek to reduce flow velocity and minimise erosion in the plateau area between Beltana Pong and the existing dam on Googong Creek • Heavy metals analysis would be added to the surface water monitoring program, including monitoring for metals with a bio-accumulated toxicity • Diatoms and macroinvertebrates surveys would be reviewed after two years of irrigation with recycled water. • The installation of six groundwater monitoring bores in NH2 (1), Common A (1), NH4 (2) and NH5 (2) • The updated groundwater model for the whole of the Googong township development after one year of recycled water irrigation (i.e. 2021) • The updated groundwater monitoring program during the first two years of recycled water irrigation • A revision of geophysical electromagnetic survey • The addition of the groundwater spring at the WRP into the groundwater monitoring program, including quality and flow rate.	GTPL/QPRC

SoC #	Management measure/commitment	Responsible
Biodiversity (aquatic ecology)		
O5	Operational aquatic ecology management measures would be outlined in the Googong IWC Surface Water and Aquatic Ecology Monitoring Program, as part of the WMP and would include but not be limited to: • Ensuring ongoing monitoring in accordance the Surface Water (Aquatic Ecology) Monitoring Program and adherence to adaptive management measures to managing potential impacts. • Ongoing restoration and remediation of Googong Creek where required (if erosion is identified through monitoring of drainage lines and creeks) to further reduce the likelihood of alterations to the structure of beds, banks and riparian vegetation • Aquatic monitoring through diatom and macroinvertebrate surveys would be undertaken for the first two years of open space irrigation with recycled water. Macroinvertebrate surveys would be undertaken in Spring 2020 in line with the AUSRIVAS protocols and the commencement of recycled water irrigation • Removal of Site 6 and Site 7 from the aquatic ecology monitoring program.	GTPL/QPRC
Noise and vibration		
O6	During operation plant and machinery would be well maintained in order to minimise operational noise emissions.	QPRC
Air quality		
O7	Odour control covers, ventilation and foul air treatment (consistent with the existing WRP) would be adopted for the Proposal – i.e. the inlet works, all bioreactor areas, pumping stations, aerobic digester and the appropriate biosolids processing equipment would be covered and ventilated to the odour control facility.	GTPL/QPRC
O8	The existing Stage AB and C WRP odour control facility and vent stack would be modified for Stage D and would be designed, in accordance with the recommendations of this REF and operated and maintained to achieve a maximum in-stack odour concentration of 500 ou.	GTPL/QPRC
O9	Where possible and practicable, all doors to the sludge handling building would be kept closed at all times (particularly when the centrifuge is operational), to reduce the potential release of odour from the building.	GTPL/QPRC
Visual amenity		
O10	Similar colours and materials to the existing WRP infrastructure would be used to decrease the visual prominence of the new bioreactor and other Stage D infrastructure.	GTPL
O11	Muted colours and non-reflective surfaces would be used to decrease the visual prominence of the new reservoir tank/	GTPL
O12	Effective screening of the Permanent Reservoirs would be implanted through the use of locally endemic vegetation close to the site. Species selection would aim to inhibit views at the ground and mid-levels up to 10 metres in particular on the eastern and western sides of the reservoirs.	GTPL
Waste		
O13	The collection and dewatering of grit and screenings from the inlet works of the WRP would be transported off site for disposal at an appropriately licensed facility.	QPRC

SoC #	Management measure/commitment	Responsible
O14	Biosolids (activated sludge) would be treated a minimum Grade B stabilisation and Grade C contamination standards, suitable for Restricted Use 2, in activities such as agriculture, forestry, soil and site rehabilitation.	QPRC
O15	Waste management procedures for other putrescible and recyclable waste generated from the WRP and other water cycle infrastructure would be developed and implemented as part of the OEMP.	QPRC
O16	The design, storage and operation of chemical and fuel storage areas would be undertaken in accordance with Australian Standards and EPA Guidelines. This would also include appropriate spill response procedures to be documented and implemented as part of the OEMP.	GTPL/QPRC
O17	A standard operating procedure (SOP) would be developed for the ongoing management of the reservoir facilities, including management of waste at the site as part of the OEMP.	QPRC
O18	Independent separate work approvals are to be sought for any maintenance works on the reservoir tanks. Any works which impact the quality of water leaving the facility through the discharge point would be prepared in consultation with the EPA.	QPRC
Hazards and risks		
O19	Emergency response plans would be revised/updated as part of the OEMP.	QPRC
O20	All access roads surrounding the infrastructure would be maintained as a defendable space and grasses and vegetation should be managed adjacent to these roads.	QPRC
O21	Emergency access to the access roads around the facilities would be maintained at all times.	QPRC
Human health		
O22	The Community Education Strategy in place for the existing IWC Project, which includes information on recycled water, avoiding cross connections and signage, would continue to be implemented during operation. Information on how to contact the operator about recycled water or complaints would also be communicated to the public.	QPRC

8 CONCLUSION

Stage 1 and the first sub-stage of Stage 2 (Stage C) of the IWC Project has been approved, constructed and is currently being operated by QPRC and Icon Water. The existing IWC Project has a capacity of 9,400 EP and the development of the Googong township is expected to reach this capacity in 2024, therefore the final sub-stage of Stage 2 (Stage D) of the IWC Project is being progressed in order to upgrade the existing facilities to their ultimate capacity of 18,850 EP.

The construction and operation of Stage D (i.e. the Proposal) has been assessed in this REF under Part 4 and Part 5 of the EP&A Act, with consideration of the Part 3A Concept Approval issued by the NSW Minister for Planning in 2011. This REF has examined and considered to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

The Proposal is unlikely to affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required. The Proposal is also unlikely to affect Commonwealth land or have a significant impact on any matters of national environmental significance.

The Proposal, as described in this REF, is consistent with the Part 3A Concept Approval granted for the IWC Project and is considered justified as it would provide the ultimate stage of infrastructure to service the growing Googong township through the expansion of the existing WRP and Permanent Reservoirs. The Stage D upgrades would also include allowance for a potential future capacity increase up to 19,550 EP.

The construction and operation of the Proposal has the potential to result in minor impacts on surface water and groundwater quality, aquatic ecology, noise, air quality, visual amenity, and traffic. These impacts are not considered to be significant and would be managed by the safeguards and mitigation measures as detailed in this REF.

On balance, the Proposal is considered justified on the basis of providing for the future growth of Googong and that the predicted environmental impacts are acceptable and would be mitigated where possible. The Proposal would continue to demonstrate that a sustainable community with a fully integrated water cycle is feasible in regional Australia.

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