5 Description of the project

The Environmental Assessment (EA) must include a **detailed description** of Stage 1 of the Project, including construction, operation, and staging. Sufficient information must be provided on the remaining stages to enable a clear understanding of these components.

This chapter describes the concept design and Stage 1 of the Project. Reference should also be made to the following reports prepared by MWH:

- The concept design report, which provides detailed drawings and further information about the design of the Project (Appendix B).
- A site water balance, which contains further details on the interaction of the potable, sewage and recycled water systems for the Project (Appendix C).

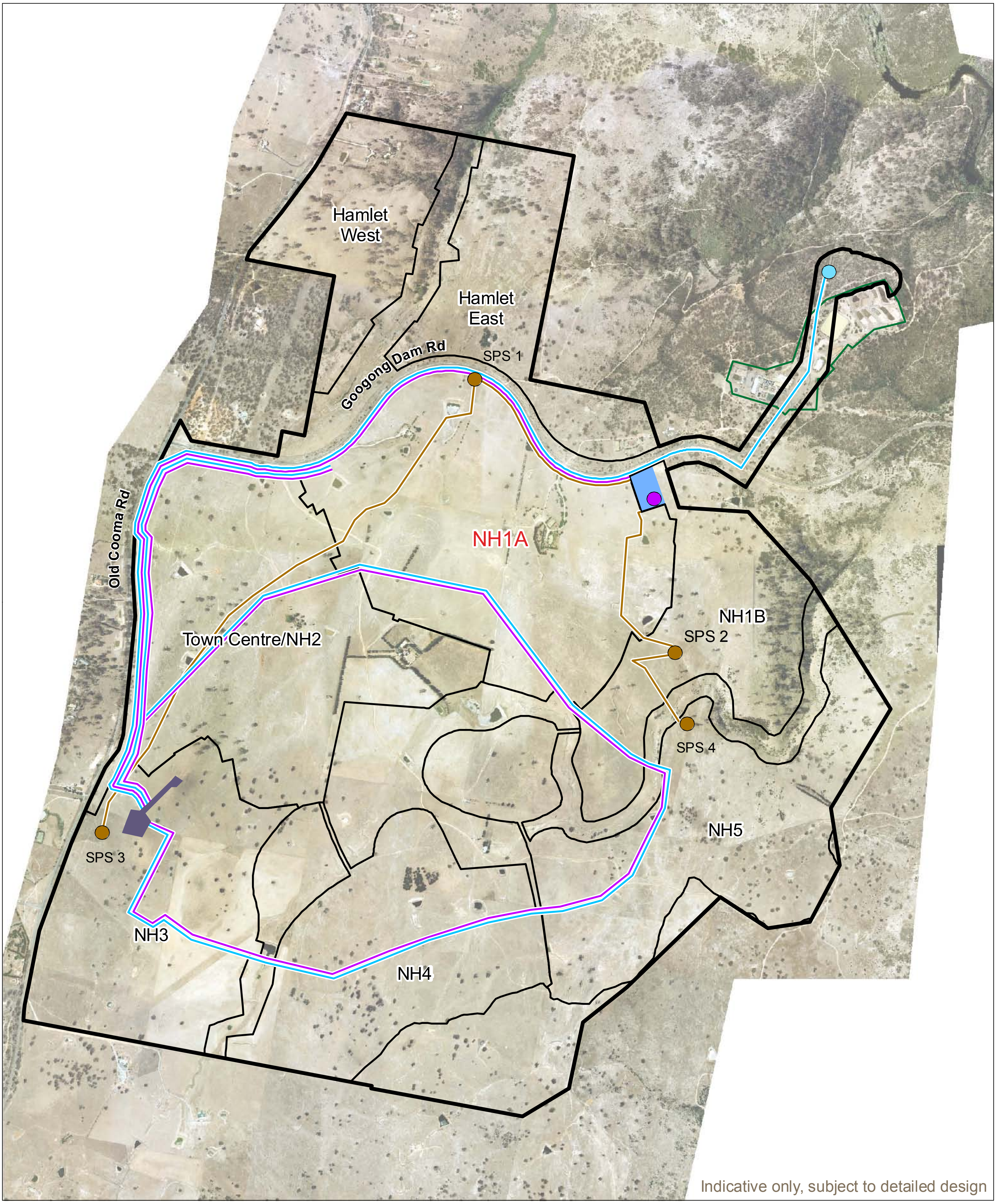
The Project would provide all necessary infrastructure to deliver a new potable water distribution system together with a new sewerage system that would transfer waste flows to a new water recycling plant (WRP). The water recycling plant (WRP) would treat sewage to a standard suitable for non-potable urban re-use for garden watering, toilet flushing and washing machines. The recycled water system would be supplemented by rainwater collected at households and, where necessary, potable water top-up.

5.1 Location and overview of the concept plan

5.1.1 Location

The concept plan for the Project comprises the following infrastructure elements (locations are shown in Figure 5.1):

- WRP – This would be located within the north east corner of the study area. This location is higher than some parts of the study area, and would require a number of pumping stations and rising mains to transport sewage to the WRP. These are detailed below. The location of the WRP has been selected to separate the infrastructure from residential areas and optimise the use of Googong Dam Road as a maintenance and service vehicle corridor, consolidating maintenance and service vehicles for the WRP with similar movements for ACTEW's existing Googong Water Treatment Plant.
- Reservoirs for recycled and potable water – This would be located within the reservoir area in the south western corner of the study area. This area is referred to as Hill 800 or Reservoir Hill. As described in Section 5.2.1, temporary reservoirs would be constructed in Stage 1 of the Project, adjacent to Old Cooma Road (around 400m from the intersection of Old Cooma Road and Googong Dam Road), and would be located closer to the first stages of the Googong township.
- Six pumping stations –There would be:
  - Four sewage pumping stations located in the north (SPS1), west (SPS3) and east (SPS3 and SPS4) of the study area.



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig5-1

Source Brown Consulting, MWH

- Bulk water pumping station
- Recycled water pumping station
- Sewage pumping station
- Potable water mains
- Recycled water mains
- Sewage mains
- Neighbourhood boundary
- Existing ACTEW Googong water treatment plant site
- Reservoir area
- Water recycling plant
- Study area

1:20,000

0 150 300 450 600m

Figure 5.1 Concept plan (the Project)

    - One bulk water pumping station for potable water would be located within the north-east corner of the study area, adjacent to ACTEW's existing WRP.
    - One recycled water pumping station would be located within the WRP site.
- Rising and distribution mains – for sewage, recycled water and potable water.

5.1.2 Overview of the key elements of the concept plan for the Project

Approval is sought at a concept level for the potable water, recycled water and sewerage system required to service the anticipated population of the Googong township at ultimate development. CIC envisages that completion of the Project would occur in stages, corresponding to the development of the five neighbourhoods shown in Figure 1.3, and would be completed over an estimated 25 years. The completion date would depend on the growth rate of the Googong township, which is estimated to grow at 150–350 dwellings per year.

The concept design would be followed by more detailed design accompanying project approval applications for subsequent stages, prior to construction. Concept approval is sought for the construction and operation infrastructure facilities as detailed in Figure 5.1 for water (potable and recycled) and wastewater management. The stormwater system is not part of the request for approval, but details of the system are provided in this EA (Section 5.4) due to the interactive nature of the components of the Project.

An overview of each element of the Project is discussed in this section and their interrelationships are shown in Figure 5.2.

1 Potable water system

A new bulk water pumping station located adjacent to the existing Googong water treatment plant would be provided to transfer flows from the existing ACTEW water supply system to new potable water reservoirs via a new rising main. Potable water distribution mains would be provided to transfer flows from the potable water service reservoirs to the township's water reticulation system. The potable water system would be separated from both the sewerage and recycled water systems. A potable water main would also be constructed to allow the recycled water system to be topped up when demand is high.

2 Sewerage system

Sewage would be collected from the Googong township and transferred to the WRP using the sewerage mains. In some sections, sewage would be pumped; in others, it would flow by gravity. The system would therefore contain a series of sewage pumping stations to transfer the flow to the WRP.

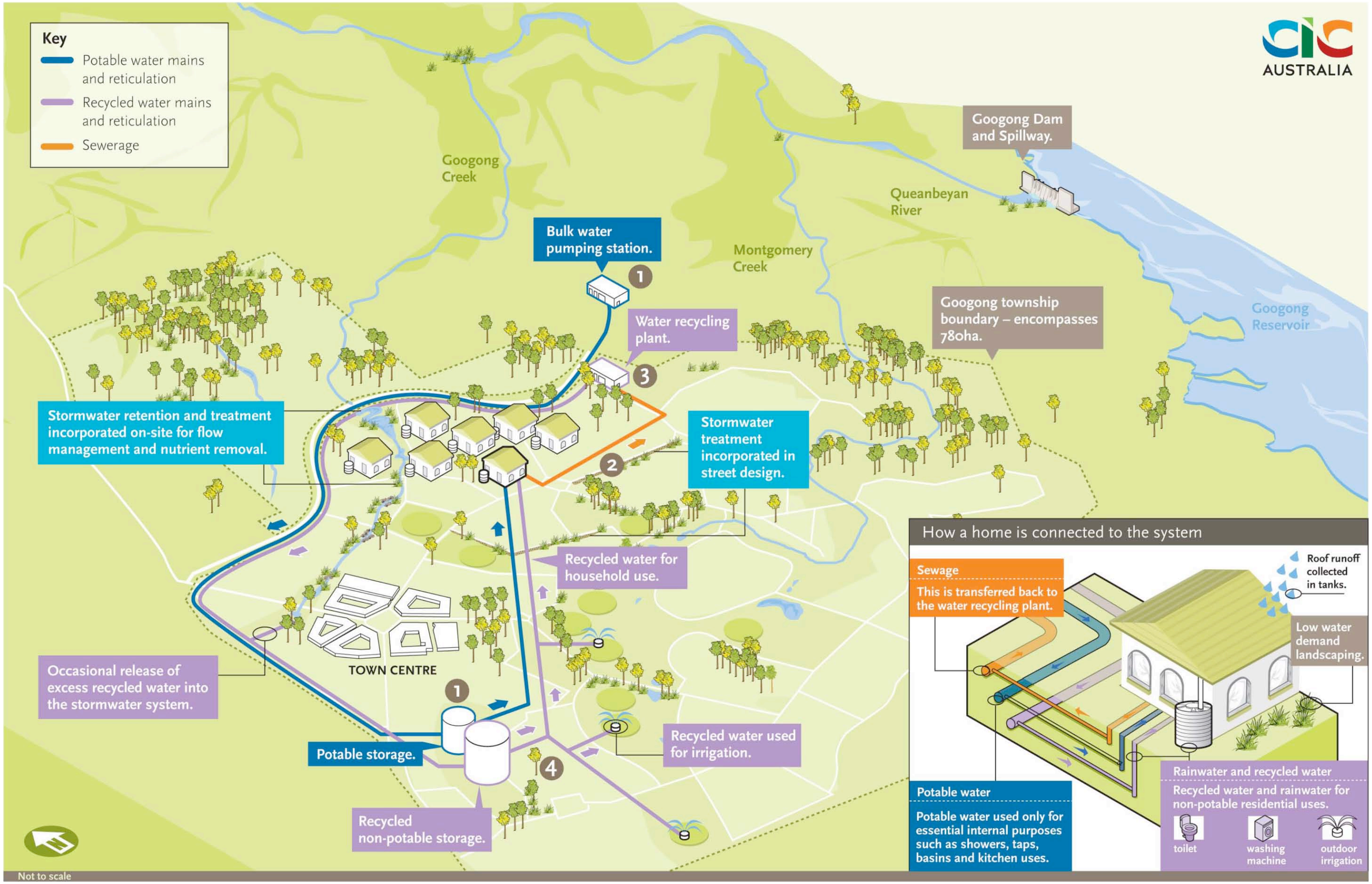
3 Water recycling plant

A new WRP would treat sewage from the Googong township to a standard suitable for non-potable urban re-use and discharge to the environment. The plant would utilise physical removal, biological and chemical treatment and disinfection to meet these standards, and membrane bioreactor technology at the core of the treatment process. Treated effluent from the plant would primarily be used for the recycled water system. When recycled water availability exceeds demand, excess water would be discharged into the stormwater management system.

4 Recycled water system

Recycled (non-potable) water produced by the WRP would be pumped to reservoirs. Flow from these reservoirs would then be transferred to the recycled water reticulation system through distribution mains and be used as necessary within the Googong township for non-potable household uses such as toilet flushing, garden watering and washing machines, as well as open space irrigation; this would reduce potable water demand by an estimated 60 per cent. Rainwater would also be collected throughout the new 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 5.2 Proposed Googong Water Cycle Project



Stormwater system

The stormwater management system for Googong township is not part of the Project assessed in this EA. However, as the stormwater system forms part of the integrated water cycle, it is described in this document as context for the Project. The stormwater management system would utilise the principles of water-sensitive urban design and mitigate the potential impacts of the township's development on stormwater quality, stormwater peak flows, flood risk and riparian zones.

5.2 Staging of the Project and its elements

It is estimated that the Googong township would be developed over a 25-year period and all elements of the Project described in Section 5.1 would be constructed in stages to ensure the infrastructure is correctly sized to meet the incremental level of demand. Appendix B provides details of the proposed stages. For the purposes of this EA, staging has been simplified to be consistent with the approvals process for the concept plan and the part of Project assessment discussed in Section 3.2. Hence, this EA presents a two-staged approach:

- Stage 1 of the Project, which has been designed to service the initial residents of the Googong township in Neighbourhood 1A (NH1A).
- Ultimate development, which services the entire Googong township.

The proponent, CIC, seeks project approval for works related to Stage 1 of the Project, which is designed in greater detail than the subsequent stages, and concept approval for works related to the ultimate development.

To assist with the staging of the Project, the sizing of the various infrastructure elements and staging of the works have been linked to anticipated population growth, to better reflect the likely points throughout the 25-year period when the next stage would commence. The population growth rates forecast have been converted into 'equivalent population' (EP) to assist with the design of the infrastructure.

5.2.1 Stage 1 of the Project

The area to be assessed as Stage 1 of the Project is known as the subject site.

Stage 1 of the Project involves the infrastructure required to service the initial stage of the subdivision, which mainly relates to the first of the five neighbourhoods. This initial stage is called NH1A (refer Figure 1.3).

Generally, Stage 1 of the Project represents a design level for an EP of 3,600. Figure 5.3 shows the proposed water cycle infrastructure required to provide complete water and sewerage services to NH1A and its location within the subject site. Project approval is sought for these facilities. Stage 1 does not include pipework or reticulation within NH1A. Queanbeyan City Council is assessing this separately under Part 4 of the EP&A Act.

Infrastructure for Stage 1 of the Project includes:

- Stage 1 of the WRP – details are provided in Section 5.3.3.
- The establishment of the temporary reservoir site at Hill 765 for recycled and potable water service reservoirs.

Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig05-3

Source Brown Consulting, MWH

Bulk water pumping station
Recycled water pumping station
Sewage pumping station
Potable water mains
Recycled water mains
Sewage mains
Existing ACTEW Googong water treatment plant site
Water recycling plant
Interim reservoir area
Subject site

1:20,000

0 150 300 450 600m

Figure 5.3 Stage 1 of the Project

Maunsell Roberts

- Stage 1 pumping stations for sewage, recycled water and potable water:
  - SPS1 would be located within the northern part of the subject site, adjacent to Googong Dam Road and SPS2 would be located within eastern part of the subject site. The sewage pumping stations would collect flows from NH1A and would be sized with a capacity to collect flows from all future stages of the Googong township (ultimate development).
  - Stage 1 of the bulk water pumping station, located within the northern corner of the subject site adjacent to ACTEW's existing WRP.
  - The recycled water pumping station, located within in the WRP site.

Stage 1 rising and distribution mains pipework for sewage, recycled water and potable water to connect to NH1A (as shown on Figure 5.3).

To describe in further detail how Stage 1 of the Project would be developed, it has been divided into two substages, referred to as:

- Stage 1a – to service an EP of up to 1000.
- Stage 1b – to service an EP of 1001–3600[1].

During Stage 1a, the bulk water pumping station would provide potable water to a potable reservoir located at the interim reservoir site, just south of the intersection of Old Cooma Road and Googong Dam Road. At this stage, the Googong township would only be supplied with potable water, as sufficient sewage load would not yet be available to bring the WRP into operation. Sewage from the Googong township would be transferred to SPS1 and sewage would be transported off site by tankers until the EP reaches 150 people. After this point, sewage would be transferred to the WRP, where it would be treated, and recycled water would start to be produced. After commissioning and licence proving of the WRP, recycled water would be transferred to a stormwater basin for use in open space irrigation.

In Stage 1b, recycled water produced by the WRP would be transferred to a new recycled water reservoir located at the interim reservoir site. SPS2 would also be constructed, located to the south east of the subject site. As the Googong township expands within the subject site, it is proposed to construct elevated potable and recycled water tanks with booster pumps to provide sufficient water pressure to certain areas. However, discussions are ongoing with Queanbeyan City Council to determine whether booster pumps alone would be sufficient for this interim arrangement, negating the need for the small, elevated temporary reservoirs.

5.2.2 Subsequent stages of the Project

At ultimate development, all key infrastructure elements would be expanded to their full capacity. This includes new pumps within the bulk water pumping station, further upgrades to the WRP and two additional sewage pumping stations (SPS3 and SPS4). The most prominent change would be to decommission the interim reservoir site and establish the permanent reservoir site at Hill 800. A new potable top-up line from the bulk water pumping station to the WRP would also be constructed to provide potable top-up to the recycled water system.

Figure 5.4 demonstrates how the infrastructure elements would be staged from Stage 1 of the Project through to ultimate development.

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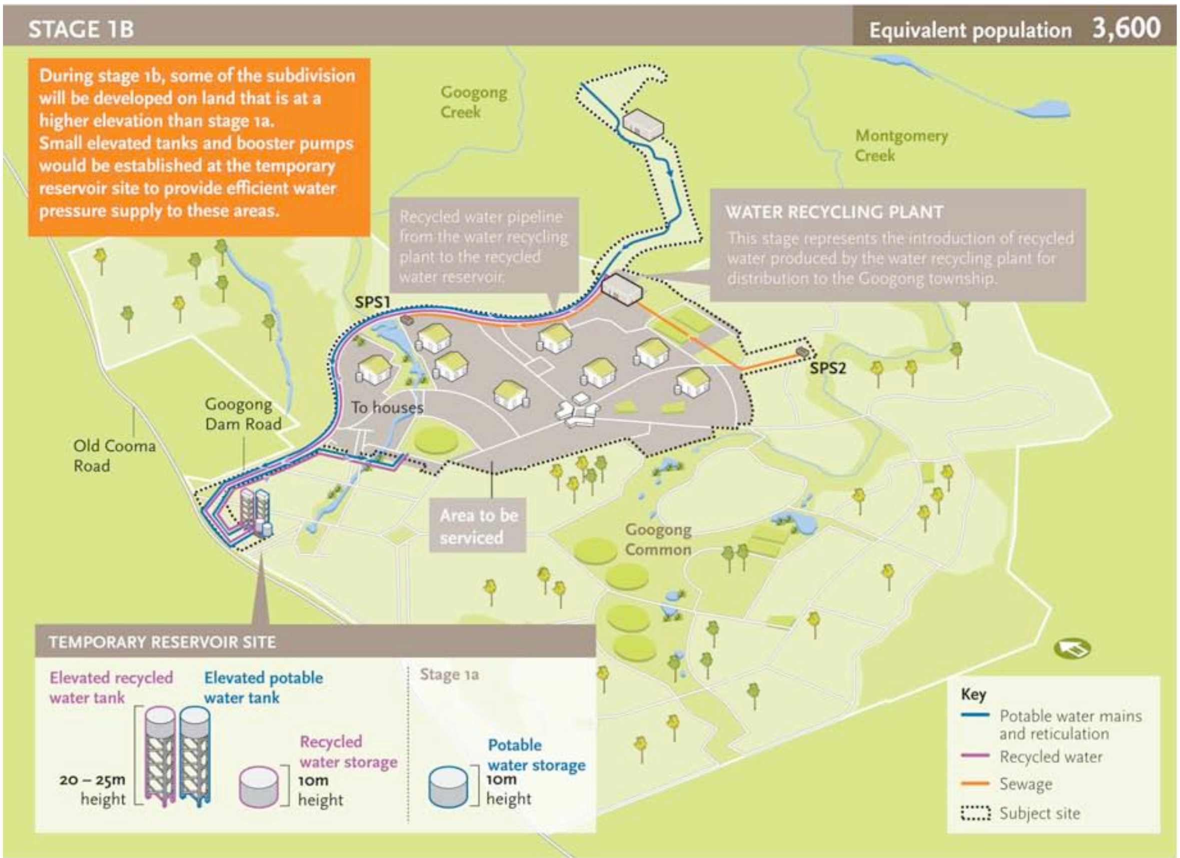
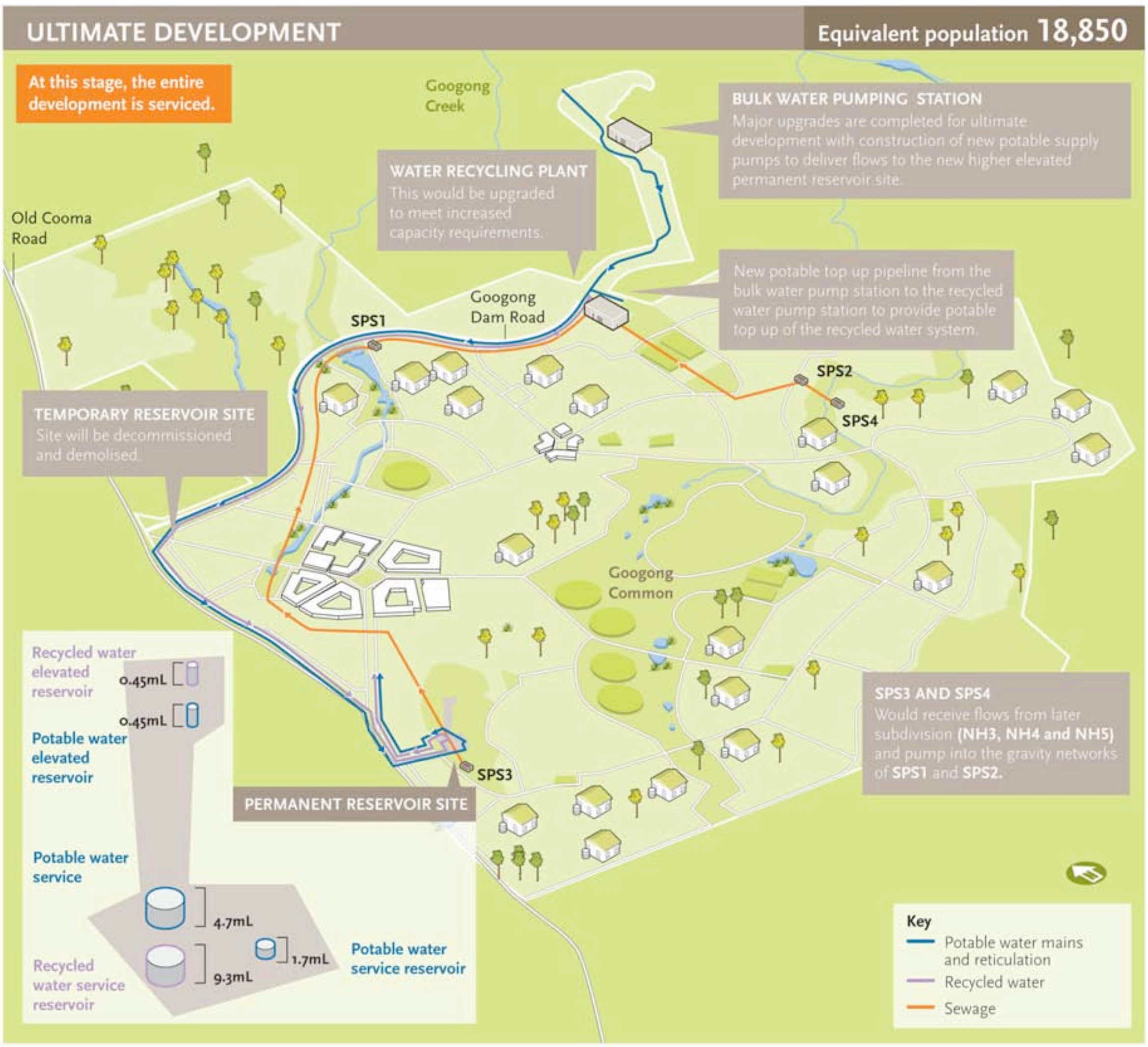
[1] *Note that the design EP for the Stage 1b WRP is 4,700, but the design EP for the Stage 1b network (reservoirs, bulk water pumping station., pipelines etc) is 3600. Therefore, the maximum design EP for the system is 3600.*

Figure 5.4 Staging of the Stage 1 infrastructure elements





5.3 Detailed description of the key elements of the Project

This section details each of the Project's key elements and how they contribute to the overall water cycle. Details regarding how each of the components would be staged are also provided and should be read in conjunction with Figure 5.4. Further details concerning these components are in Appendix B.

5.3.1 Potable water system

All of the key components of the potable water supply system, including the relevant stage of construction, are outlined in Table 5.1. Construction staging is based on the release of about 150–350 dwellings per annum, commencing with Stage 1 of the Project.

Table 5.1 Outline of the components within the potable water system

Potable water component	Major elements	Description	Staging
Bulk water supply	Bulk water connection.	Off-take and isolation valve arrangement from existing 1800mm diameter ACTEW water main.	Stage 1 of the Project
	Bulk water pumping station	Pumping station configured to deliver flows to: • Potable water reservoir. • WRP clear water tank for top-up of recycled water system.	Stage 1 of the Project – the bulk water pumping station would be upgraded over time to provide more capacity to meet the potable water demand of the growing community.
Potable water transfer mains	Potable rising main	Pipeline from bulk water pumping station to interim potable reservoirs.	Stage 1 of the Project
	Extension of potable rising main.	Extension of pipeline to permanent reservoir site.	Ultimate development
	Potable top-up of recycled water main.	Pipeline from bulk water pumping station to WRP clear water tank for top-up.	Ultimate development
Interim reservoirs	Interim potable reservoir.	One interim 1.1ML reservoir.	Stage 1 of the Project
	Interim potable reservoir elevated tanks and booster pumps.	One small elevated reservoir and booster pumps to supply development in higher regions of the subject site.	Stage 1 of the Project
Permanent reservoirs	Permanent potable reservoirs.	Permanent potable reservoirs sized for ultimate development, located further along Old Cooma Road.	Ultimate development
	High-level potable reservoirs and pumping station.	Small high-level potable reservoirs and booster pumping stations to supply the local high-level zone.	Ultimate development
Water re-chlorination	Re-chlorination at interim reservoir site.	Located at interim reservoir site, re-chlorination facility to top-up chlorine residual in stored water to meet guideline requirements.	Stage 1 of the Project
	Re-chlorination at permanent reservoir site.	Located at permanent reservoir site, re-chlorination facility to top-up chlorine residual in stored water to meet guideline requirements.	Ultimate development
Mains pipework	Potable water distribution mains.	Potable water supply piped from service reservoirs to reticulation system supply zones.	Stage 1 of the Project
	Extension of potable water distribution mains.	Extension of potable water supply piped from service reservoirs to reticulation system supply zones.	Ultimate development

The bulk water off-take location

A water supply for the Googong township would require a connection to the existing Queanbeyan and ACT bulk water network via the existing ACTEW DN1800 main pipeline (ie a pipeline with a diameter of 1800mm), which connects to both the Stromlo and Googong water treatment plants. Following a series of technical discussions with ActewAGL representatives, a site has been agreed for a new connection to the DN1800 main. This location is about 170m downslope from the existing Googong water treatment plant site.

Bulk water pumping station

The layout of the bulk water pumping station is shown in Figure 5.5. The bulk water pumping station would connect to the existing ACTEW DN1800 pipeline and would be located adjacent to the existing Googong water treatment plant site within Commonwealth Land (Googong Foreshores). Access would be provided through the Googong water treatment plant site for construction and operation.

The pumps would be fully automated and controlled by a program logic controller, triggered by reservoir levels. The program logic controller would be capable of monitoring and controlling associated equipment, including operational alarms. In the event of a power failure, the bulk water pumping station would have ability for an emergency generator to be connected of sufficient capacity to complete operation.

Potable water rising mains

Potable water from the bulk water pumping station would be transferred to:

- The temporary reservoirs during Stage 1 of the Project – Potable water would be delivered via a DN225 potable rising main, which would be extended at ultimate development to flow to the permanent low-level potable water reservoirs.
- The WRP clear-water tank – Potable water would be delivered via a DN375 recycled-water pipeline to top-up recycled water at the plant. This pipeline would not be required until ultimate development, as sufficient capacity is available in the potable supply main during Stage 1 of the Project to allow top-up at the interim reservoirs.

Potable water reservoirs

There would be two potable reservoir sites directly related to the staging of the Project.

Throughout Stage 1 of the Project, interim potable reservoirs would be sited about 100m from Old Cooma Road at Hill 765 (at RL 765) in the north west of the study area. Figure 5.6 shows the Hill 765 landscape.

At Stage 1a, the subdivisions would be supplied potable water only, from a single potable reservoir. These early subdivisions would be constructed with both potable and recycled water reticulation systems, but both systems would be supplied from the potable water reservoir.

At Stage 1b, in order to reach areas with slightly higher ground elevations it may be necessary to construct booster pumps and small, elevated storage tanks to supply the higher pressure network in these areas. Ongoing discussions with Queanbeyan City Council are being conducted in relation to the possibility of installing the elevated storage tanks. Figure 5.8 shows the proposed layout of the interim reservoir site (including the locations of the recycled water reservoirs (see Section 5.3.4 for more detail).

Figure 5.5 Layout and staging of the bulk water pumping station

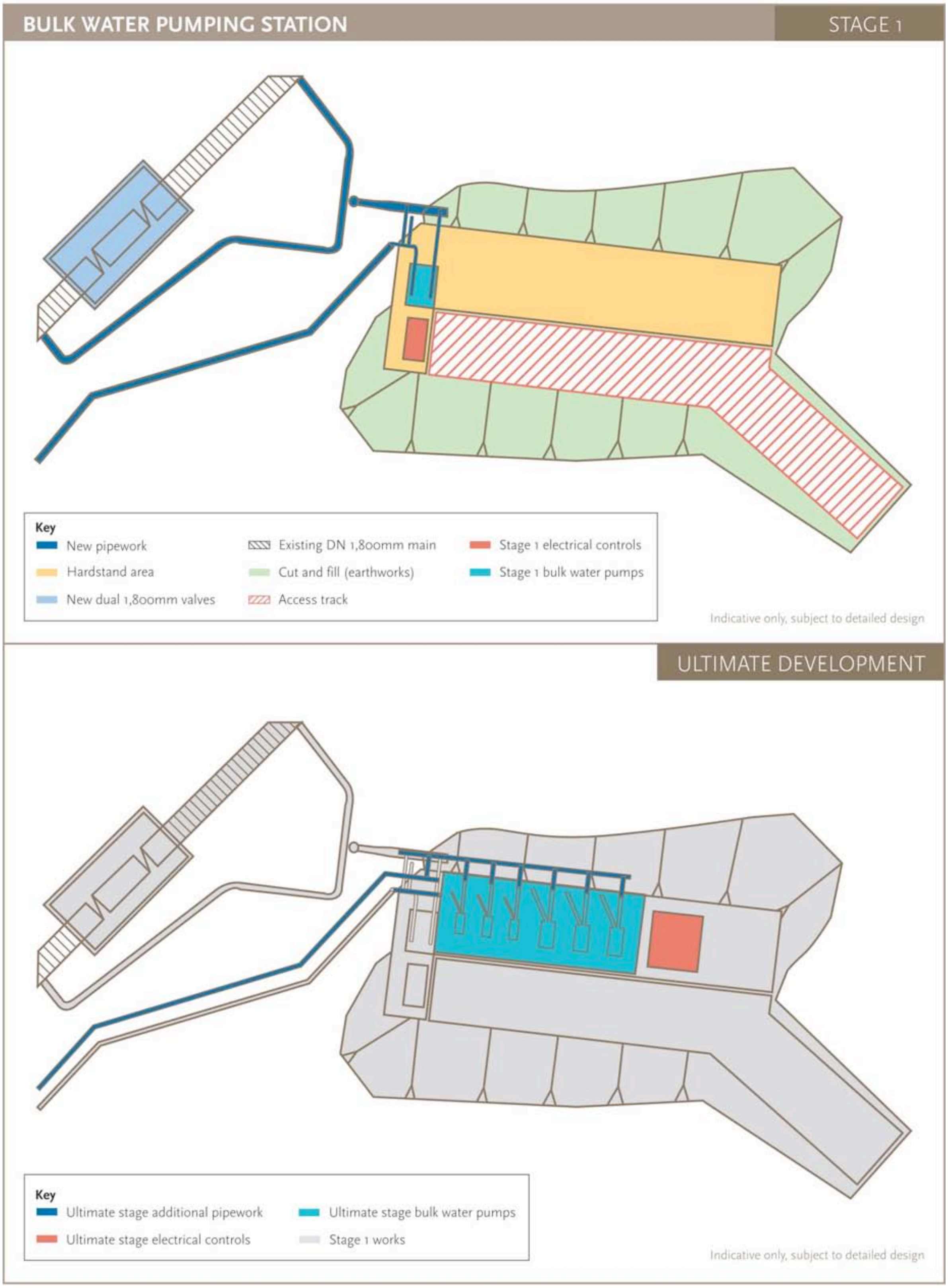
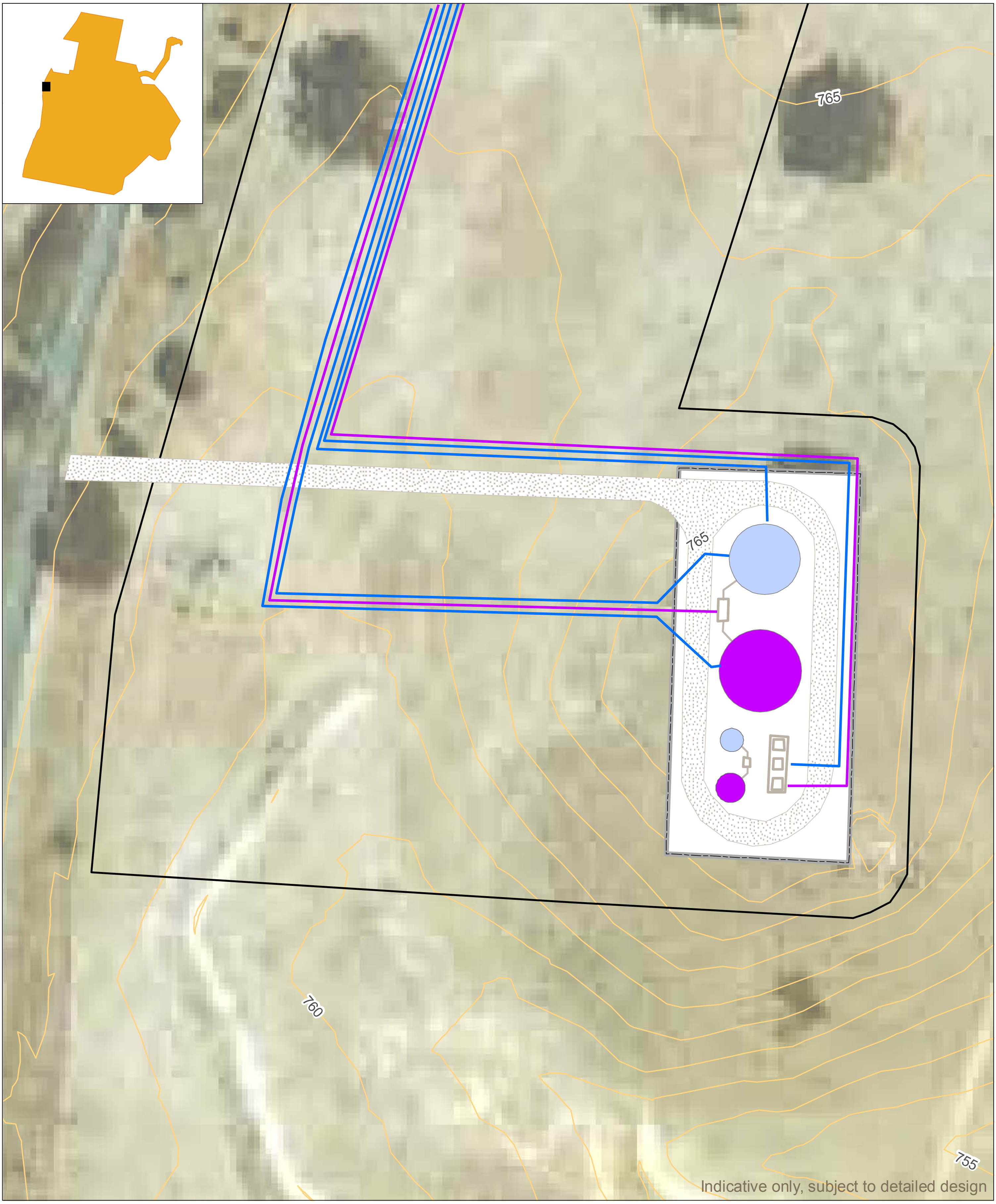


Figure 5.6 Landscape of the proposed temporary reservoir site (located at Hill 765)

At ultimate development, permanent potable water reservoirs would be sited alongside the recycled water reservoirs at Hill 800, located off Old Cooma Road in the south west of the study area (Figure 5.7 shows the Hill 800 landscape). The reservoirs would allow for the potable storage to meet daily demand fluctuations, provide adequate residual head, and reserve storage in the event of loss of supply from the potable water transfer system.

Scour and overflow pipework from the reservoir would discharge to the stormwater drainage system in the area. Figure 5.9 shows the detailed sizing and locations of the reservoirs.

Figure 5.7 Landscape of the proposed permanent reservoir site (located on Hill 800)



Googong Environmental Assessment

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Drawing no. 08003g_ea_fig05-8

Source Brown Consulting, MWH

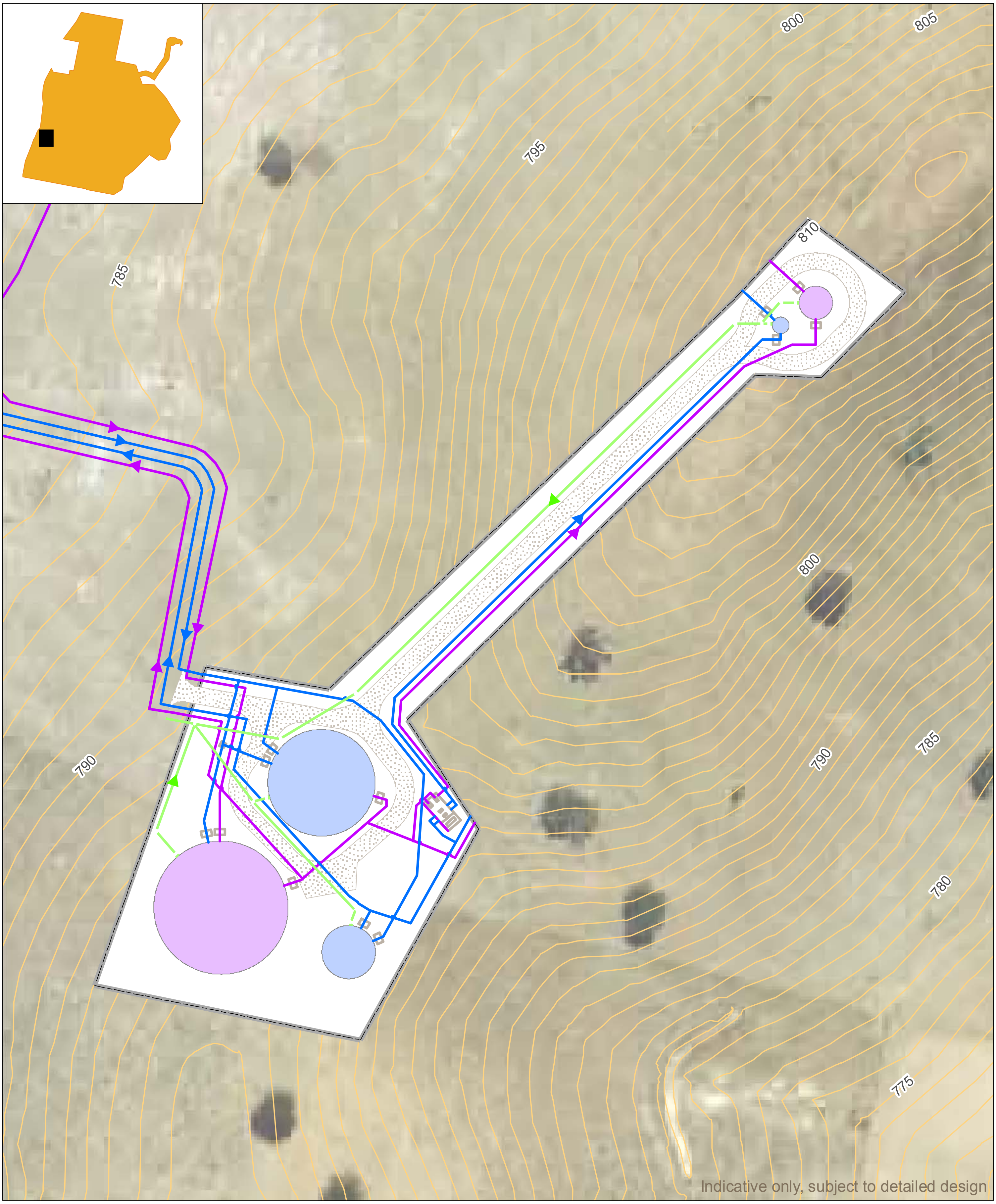
Potable water mains
Recycled water mains
Ancillary infrastructure
Fence
1m elevation contour
Recycled water reservoir
Potable water reservoir
Road
Subject site

1:850

0 5 10 15 20m

Figure 5.8 Temporary reservoir site layout

Manidis Roberts



Googong Environmental Assessment

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Drawing no. 08003g_ea_fig05-9

Source Brown Consulting, MWH

Potable water mains
Recycled water mains
Stormwater drainage
Ancillary infrastructure
Fence
1m elevation contour
Potable water reservoir
Recycled water reservoir
Road

1:1,500

0 10 20 30 40m

Figure 5.9 Permanent reservoir site layout

Manidis Roberts

Secondary water conditioning

Potable water transferred through long transfer and storage systems often requires secondary conditioning in the network, to establish an appropriate level of residual chlorine specified in the *Australian Drinking Water Guidelines* of the Australian National Health and Medical Research Council.

It is proposed that a facility would dose sodium hypochlorite to maintain residual chlorine at target levels. Sodium hypochlorite was selected as it is already used in the drinking water system. Two dosing points would be provided – the first on the inlet pipeline to the reservoirs (related to both the temporary and permanent reservoir sites), and the second associated with the permanent high-level reservoir pumps. Submersible mixers would also be installed in the reservoirs to ensure appropriate mixing.

For the chemical dosing facility, two chemical storage tanks are proposed for all the dosing points (both potable and recycled water) at the temporary reservoir site during Stage 1 of the Project and then transferred to the permanent reservoir site at ultimate development. Each tank would hold a volume of 15m^3 and the chemical dosing unit would contain pumps for all dosing points. A typical unit is shown in Figure 5.10.

Figure 5.10 Typical chlorine dosing unit for potable water distribution systems

5.3.2 Sewerage system

The main components of the sewerage system are listed in Table 5.2. Sewerage infrastructure sizing would be primarily based on guidelines published by the Water Services Association of Australia (WSAA) as well as the collection system operating licence conditions for sewage containment.

Table 5.2 Main components of the proposed sewerage system

Sewage system component	Major elements	Description	Staging
SPS1	Pumping station	Located within the northern part of the subject site, adjacent to Googong Dam Road. The pumping station is an underground, concrete well structure with submersible sewage pumps. Emergency storage would be provided for pump/power failure. Staging of pumps and emergency storage would be compatible with WRP capacity and catchment size.	Stage 1 of the Project
	Rising main	800m long, DN225 buried pipeline from SPS1 to WRP inlet works.	Stage 1 of the Project
SPS2	Pumping station	Description as per SPS1. SPS2 would be located within the eastern part of the subject site.	Stage 1 of the Project
	SPS2 rising main	860m long, DN200 buried pipeline from SPS2 to WRP inlet works.	Stage 1 of the Project
SPS3	SPS3	Description as per SPS1. SPS3 would be located within the south of the study area adjacent to Old Cooma Road.	Ultimate development
	SPS3 rising main	800m long, DN225 buried pipeline that would connect to the SPS1 system.	Ultimate development
SPS4	SPS4	Description as per SPS1. SPS4 would be located to the south east of the study area.	Ultimate development
	SPS4 rising main	800m long, DN225 buried pipeline that would connect to the SPS2 system.	Ultimate development

Stage 1 of the Project sewerage system

Stage 1 of the Project would require the construction of two sewage pumping stations (SPS1 and SPS2); their locations are shown in Figure 5.3. Sewage from NH1A would flow in a gravity sewerage system to SPS1 and SPS2, and be pumped directly to the WRP.

It is anticipated that neither SPS1 nor SPS2 would operate (as a pumping station) during Stage 1a until sewage from an equivalent population of around 150 EP is being generated. This volume is required to ensure that the WRP has sufficient biological loading to operate effectively. During Stage 1a, sewage would be collected in the concrete well structure of SPS1 and regularly tankered away for treatment at an operational sewage treatment facility in the region. The frequency of this removal by tanker would depend on the connected population during Stage 1a; it is expected to build up to a maximum of three trips per day immediately prior to SPS1 commencing pumping flows to the WRP.

The rising main routes from SPS1 and SPS2 to the WRP are shown in Figure 5.3. The routes are based on preliminary road layouts and may need to be revised during detailed design once road locations are finalised. Rising mains would generally be located within the road verge. The depth of cover to the sewage rising mains and trench, as well as bedding details, would be in accordance with WSA 04 Code or as agreed with Queanbeyan City Council. The overall required minimum trench depth would be 1100mm. The dimensions of the mains for SPS1 and SPS2 are shown in Table 5.2. Manual air valves and scour valve arrangements would be provided in accordance with WSA 04. (For more detail, see Appendix 1 of Appendix B – drawing number A1081402-SK101).

Sewerage system at ultimate development

At ultimate development, SPS3 and SPS4 would receive flows from neighbourhoods 3, 4 and 5 (NH3, NH4 and NH5) and pump into the gravity networks upstream of SPS1 and SPS2. SPS1 and SPS2 have been designed to cater for these significant additional flows at the ultimate stage of development. It is possible (but unlikely) that additional sewage pumping stations may also be required, depending on the urban layout adopted in the future.

Each sewage pumping station has been designed to operate effectively during emergency events. For example, they would have wet wells (SPS1 would have an emergency volume of 655m^3 while SPS2's would be 560m^3) and emergency overflow structures.

Sewage pumping stations receiving flows from local gravity catchments do not normally require mechanical odour control. Therefore, SPS1 and SPS2 would be normally ventilated with a standard 12-metre-high DN150 ventilation stack, connected to the wet well. However, if complaints become a problem in future years, measures can be put in place to connect a future odour control system. The sewage pumping stations have been designed so they can be adapted for these purposes.

5.3.3 Water recycling plant

The WRP would treat the sewage to a quality suitable for non-potable urban re-use within the Googong township. Recycled water would be re-used for toilet flushing, washing machines and irrigation. Non-potable urban re-use is discussed further in Section 7.5.1.

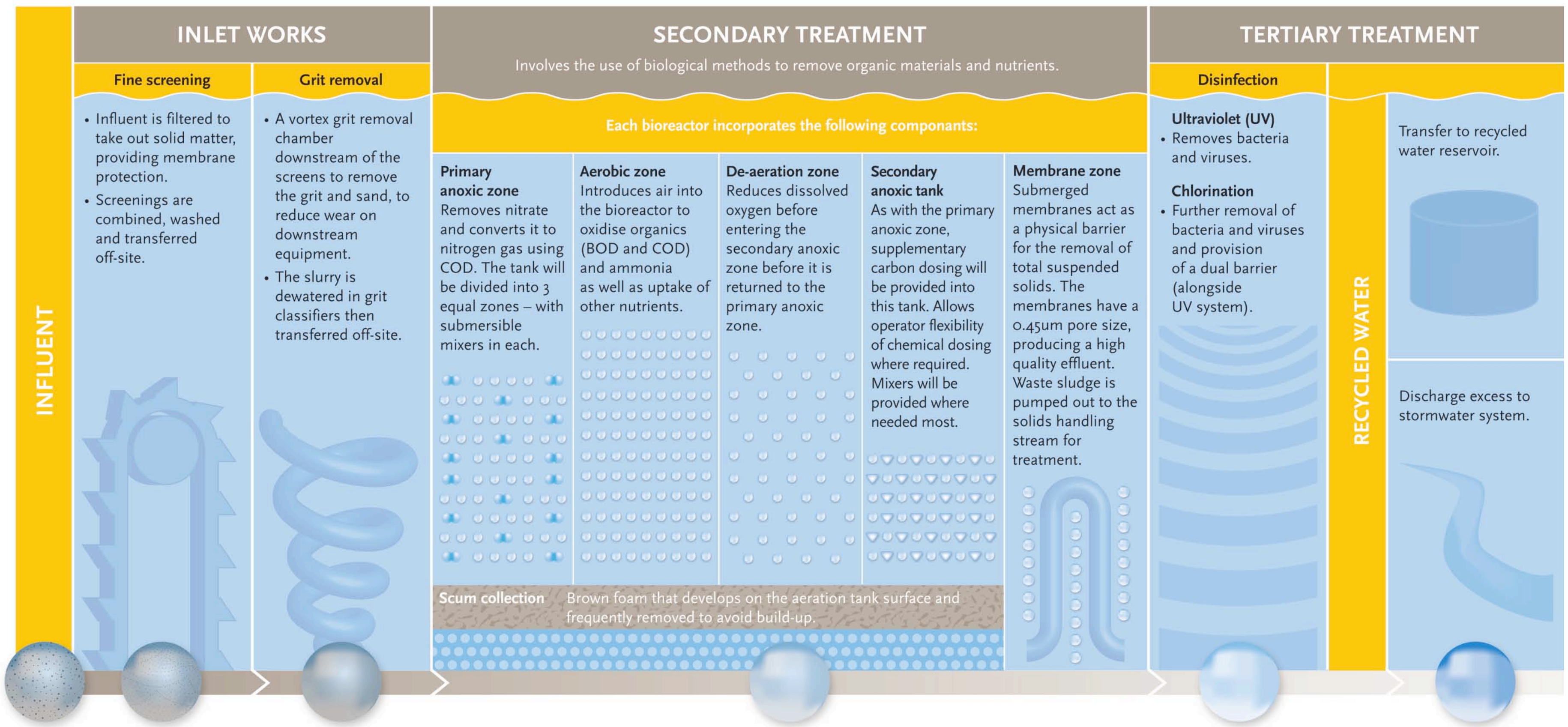
Overview of the WRP process

The water recycling process would involve three key steps:

- Inlet works (grit removal) – Sewage would flow to the inlet works from the sewage pumping station rising mains. The inlet works would remove grit using fine mesh screens.
- Secondary treatment – The flow would pass through a number of membrane bioreactors. These would remove organic material, nutrients (nitrogen and phosphorus) and suspended solids from the flow using membrane filtration. The design includes biological phosphorus removal to limit the overall requirement for added chemicals.
- Tertiary treatment – The flow would be disinfected with ultraviolet (UV) radiation followed by chlorination. It would then be transferred to the recycled water reservoir for re-use.

This process is shown in Figure 5.11 and described in more detail in the following sections.

Figure 5.11 Water recycling plant treatment process



Inlet works

The purpose of the inlet works is to remove gross solids from the incoming sewage. It would comprise the following equipment:

- 6mm screens.
- 1mm screens.
- Vortex grit removal.
- Screenings and grit handling and washing.

The sewage flowing into the WRP would be discharged into a covered, elevated inlet chamber and would gravitate to the inlet works. Ferric sulphate would be dosed into the inlet chamber to reduce hydrogen sulphide for odour control.

The fine screens would remove solids within the sewage, providing membrane protection (the management of the solids is discussed later in this section). Screenings would be combined, washed and transferred into self-contained bins positioned at ground level, before being transported off site.

Secondary treatment

Secondary treatment processes involve the use of biological methods to remove organic materials (biological oxygen demand (BOD) and chemical oxygen demand (COD)) and nutrients such as nitrogen and phosphorus, as well as total suspended solids (TSS).

The Googong WRP would use membrane bioreactors. These have been designed with additional capabilities to facilitate both biological nitrogen removal and biological phosphorus removal.

The membrane bioreactors would incorporate the following components (refer to Volume 2 of Appendix B for drawings relating to these elements):

- Distribution chamber at the inlet to the tank.
- Anaerobic zone to allow for phosphorus removal, which is aided by chemical removal through ferric sulphate dosing.
- Anoxic zone to convert nitrate into nitrogen gas, which dissipates into the atmosphere.
- Aeration zone to remove: biological and chemical oxygen demand, and oxidation of ammonia.
- Membrane tank for the microfiltration of bioreactor effluent.

The final zone in the bioreactor would contain submerged membranes that act as a physical barrier to remove total suspended solids. The membranes have 0.45µm pore size and therefore produce a high quality effluent.

One bioreactor tank and two membrane tanks would be provided in Stage 1 and four bioreactor tanks and four membrane tanks would be provided in the ultimate development. The tanks would be covered and air extracted and treated to prevent odour emissions.

Aeration for the aerobic zone would be provided in the form of submerged fine bubble diffusers positioned on the floor of the tank.

Disinfection

The effluent from the membrane bioreactors would be disinfected to further remove human pathogens to ensure that the water is suitable for recycling and release into the local environment. Two forms of disinfection would be used, as determined under the *Australian Recycled Water Guidelines* –

chlorination and UV disinfection. The UV lamps would treat 100 per cent of the flow. The UV system would be in place from Stage 1 of the Project and expanded progressively as required.

Residual chlorine would be maintained to prevent bacterial and algal regrowth within the recycled water reservoirs and pipework.

Pipelines that would transport recycled water from the WRP to the temporary reservoirs (during Stage 1 of the Project) and the permanent reservoirs (at ultimate stage) would be established with plug-flow characteristics. This would allow for sodium hypochlorite to be dosed into the effluent downstream of the UV treatment to maintain the required residual chlorine concentration throughout the transfer pipeline, allowing for adequate disinfection.

Chemicals

Several chemicals would be utilised at the WRP:

- Ferric sulphate – to control odours and remove chemical phosphorus[2].
- Magnesium hydroxide – to increase alkalinity to aid the biological processes that occur within the bioreactor.
- Sodium hypochlorite – to disinfect the secondary effluent and clean the submerged membranes.
- Citric acid – to clean the submerged membranes.
- Acetic acid – a supplementary carbon source to assist the biological processes within the bioreactor.

The above chemicals would be stored on site in sealed storage tanks located, together with dosing pumps, in a centralised, bunded facility at the WRP. This roofed facility would be housed together with an adjacent bunded tanker delivery area. Chemical storage tanks would be sized for a minimum of 28 days storage. Appendix K details the specific chemical storage quantities, and Section 13.5.5 details the risk assessment of chemical storage.

Solids management

The treatment process separates the incoming flow into liquids and solids.

Screenings and grit would be collected in self-contained bins in the inlet works building and would be removed from the site via these bins.

Solids produced as waste sludge from the bioreactor processes would be thickened and digested in an aerobic digester, which would reduce the volatile solids and bacteria in order to ensure the product is suitable for re-use. Digested sludge would be pumped to a centrifuge, located in a dedicated room in the plant building. It would then be taken to an off-loading conveyor, from the centrifuge to a sealed storage bin. The bin would be collected by standard 10m^3 skip truck for removal from the site. It is estimated that sludge collection and removal activities would involve about two truck movements each week at ultimate development.

The concept design for the Project has been based on treating biosolids to Grade B classification, as upgrading the WRP to produce Grade A material would represent a significant additional cost, with no appreciable gain. Grade B treated biosolids would be able to be used in agricultural and forestry applications, which are common in the region. It is assumed that there would be no major contaminants in the sewage from the catchment and, therefore, only pathogen removal has been included in the design.

[2] *Phosphorous removal is achieved using a combination of biological process and chemical addition.*

Odour control

Due to the close proximity of the WRP to residential areas and the subsequent potential to generate odour complaints, odour extraction and treatment facilities would be implemented. A detailed odour assessment is provided in Appendix I.

The WRP would be equipped with a centralised odour control facility comprising biological trickling filters (each 3m in diameter and 8m high), activated carbon filters (each 3m in diameter and 5m high), two extraction fans (with acoustic hoods). Treated air would be discharged via an exhaust stack. All units would be mounted on a bunded reinforced concrete slab.

To ensure the WRP complies with the NSW DECCW requirements, a number of areas of the plant require coverage and odour control. They are summarised in Table 5.3.

Table 5.3 WRP components to be covered for odour control

WRP area to be covered	Typical equipment
Preliminary treatment area	• Receiving chambers for discharging rising mains. • Screens. • Bin for screenings handling and storage. • Grit classifier and storage bin.
Secondary treatment plant anoxic and anaerobic zones	• Biological reactors.
Secondary treatment plant membrane tank	• Membrane tanks.
Sludge digesters	• Aerobic digesters.
Sludge dewatering and thickening	• Rotary drum thickener. • Dewatering centrifuge or belt filter press.
Sludge storage	• Covered sludge storage bin.

WRP capacity to treat wet and dry weather flows

The WRP has been sized to treat both dry and wet weather flows. An allowance for infiltration has been factored through adoption of a conservative wet weather/dry weather flow ratio (refer to Chapter 2 of Appendix B). It is anticipated that implementation of a reduced infiltration sewage collection system would ensure that the WRP is able to fully treat all wet weather flows throughout its operation. This design feature negates the need to incorporate a separate wet weather flow bypass system in the plant.

Emergency bypass system

The WRP would incorporate an emergency overflow facility located at the distribution chamber upstream of the bioreactors. Plant overflows (comprising screened and de-gritted sewage) would be conveyed via buried pipeline to the first-flush tank. When this tank is full, the overflow would be discharged to the stormwater management system (Montgomery Creek catchment). Figure 7.2 shows the water cycle infrastructure (such as the WRP and sewage pumping stations) in relation to their location within local drainage catchments. The emergency storage volume is defined as four hours at peak dry weather flow. However, as the capacity of the WRP would be constructed ahead of development requirements, there would be generally more than four hours peak dry weather flow emergency storage provided in the system.

Staging of the WRP

Construction of the WRP would be conducted in stages to match the growing needs of the Googong township. During Stage 1a of the Project, permanent inlet works would not be necessary given the flows received by the WRP. In this instance, a smaller, temporary inlet would be operational, mounted on a platform, above the scaled-down bioreactor tank. The full-scale inlet works would be required as part of Stage 1b upgrade, accommodating the first full-scale bioreactor.

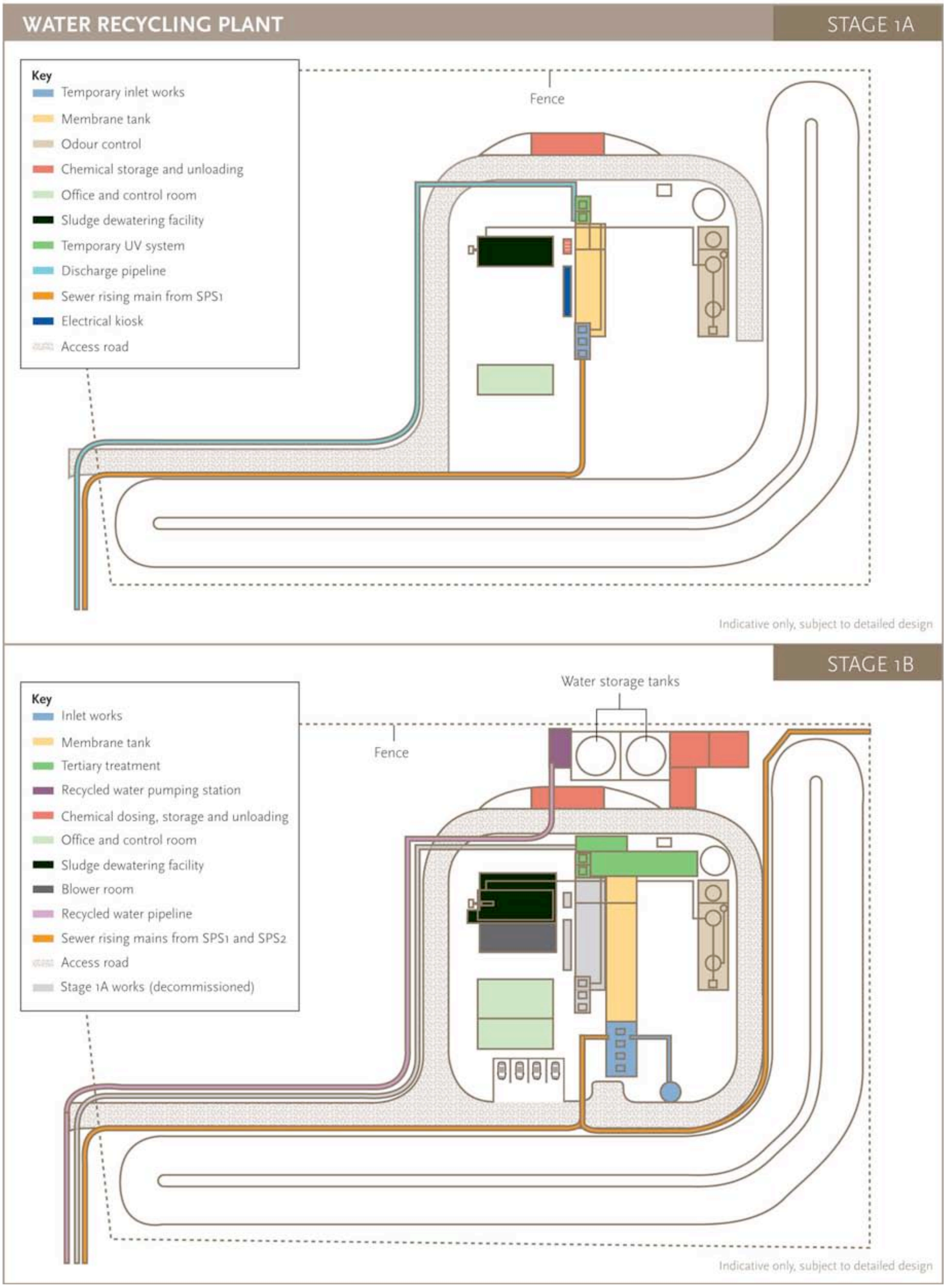
By ultimate development, there would be four full-size bioreactors operating in parallel to meet the ultimate capacity, and other facilities would be expanded such as the odour control system permeate pumps, chemical dosing, UV disinfection system and site services.

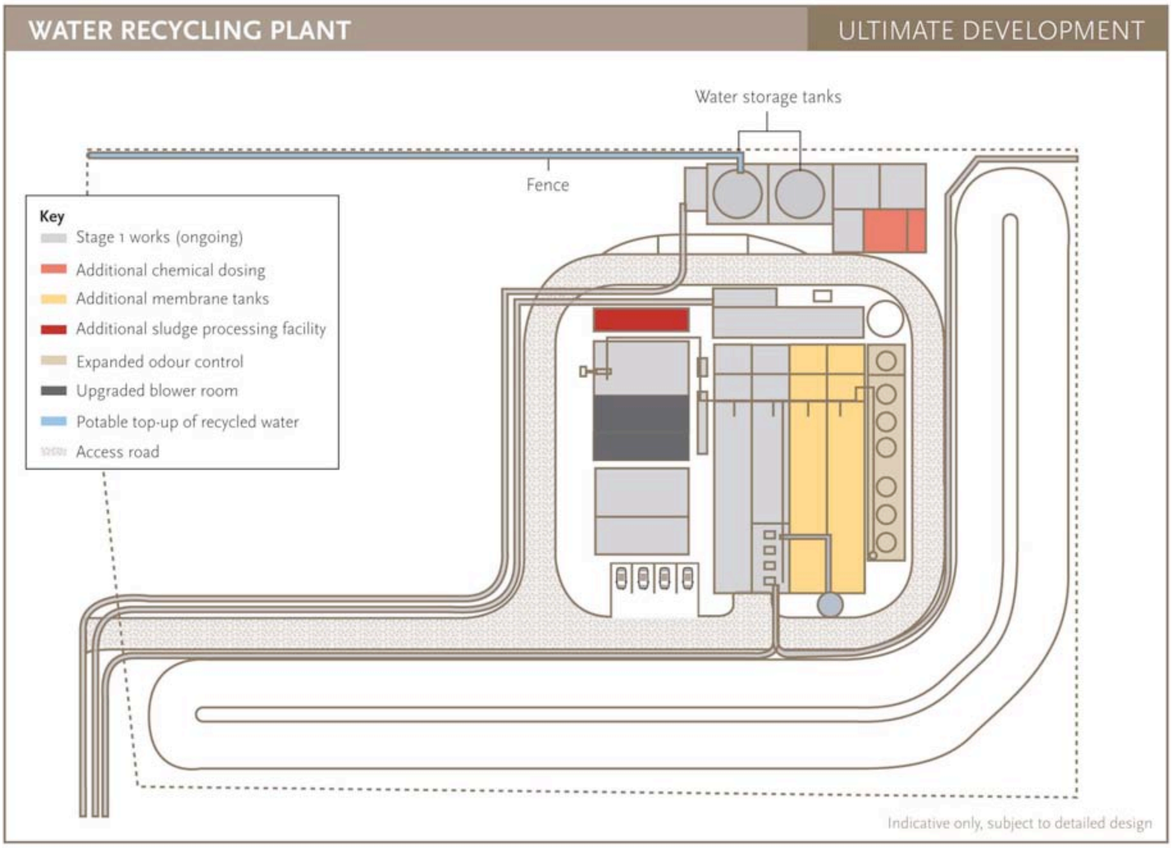
Table 5.4 lists the process units required to cater for Stage 1 of the Project and at ultimate development. The layout of the WRP and its staging from Stage 1 to ultimate development is shown in Figure 5.12. Appendix B presents further detail on the layout.

Table 5.4 Process units required at Stage 1 of the Project and ultimate development

Process unit	Stage 1 of the Project	Ultimate development
Design EP	4,700	18,850
6mm screens	Temporary construction above first tank during Stage 1a and then fitted for ultimate development at Stage 1b.	
1mm screens	Temporary construction above MBR during Stage 1a and then fitted for ultimate development at Stage 1b.	
Grit removal	1 tank	2 tanks
Bioreactors	1 full size bioreactor tank	4 full-size bioreactor tanks
Bioreactor aeration	3 blowers	6 blowers
Membrane tanks	2 tanks	4 tanks
UV disinfection	4 units	7 units
Chemical storage and dosing	Chemical dosing facility constructed	Ultimate construction
Odour control	1 bio-trickling filter 1 carbon filter	2 bio-trickling filters 3 carbon filters
First-flush system	All constructed in Stage 1	All constructed in Stage 1 of the Project.
Service water system	All constructed in Stage 1	All constructed in Stage 1 of the Project.
Clear-water tank	180m^3 tank constructed in Stage 1	All constructed in Stage 1 of the Project.
Foul-water tank	180m^3 tank constructed in Stage 1	All constructed in Stage 1 of the Project.
Sludge thickener	1 unit constructed in Stage 1	All constructed in Stage 1 of the Project.
Aerobic digesters	Half-scale digester	Full-size digester staged
Centrifuge	1 unit constructed in Stage 1	All constructed in Stage 1 of the Project.

Figure 5.12 Water recycling plant layout and staging





5.3.4 Recycled water system

A recycled water network would be provided for the Googong township, which, in many ways, would mirror the potable water system detailed in Section 5.3.1. Recycled water would be used to supply mostly external demands such as garden watering, but would also be used as 'top-up' supply to washing machine cold water and toilets. An outline of the all components of the recycled water system is shown in Table 5.5.

Table 5.5 Outline of all components of the recycled water system

Recycled water system component	Major elements	Description	Staging
Recycled water pump station	Recycled water pump station	Dry mounted pumps located at the WRP, drawing water from the recycled water tank.	Stage 1 of the Project
	Potable water top-up of recycled water system	Supplied in a dedicated main from the bulk water pumping station, discharging to the WRP recycled water tank to meet occasional shortfalls in recycled water production to meet demand.	Ultimate development

Recycled water system component	Major elements	Description	Staging
Recycled water delivery main	Recycled water rising main	Pipeline from recycled water pumping station to recycled water reservoirs.	Pipeline to the temporary reservoir site in Stage 1 of the Project and to the Permanent reservoir site at ultimate development.
	Environmental release	Pipeline off-take from recycled water supply main releasing flows to stormwater pond system.	Stage 1 of the Project
Temporary recycled water reservoirs	Temporary recycled water reservoirs	Recycled water temporary reservoirs, located at temporary site along Old Cooma Road.	Stage 1 of the Project
	Temporary reservoir elevated tanks and booster pumps	Recycled water elevated tanks and booster pumps to supply minimum pressure required to elevated parts of the subdivision.	Stage 1 of the Project
Permanent recycled water reservoirs	Permanent recycled water reservoirs	Permanent recycled water reservoirs sized at ultimate development demand, located at saddle feature further along Old Cooma Road.	Ultimate development
	High-level recycled water reservoirs and pumping station	Small high level recycled water reservoirs and booster pumping stations to supply local high level zone.	Ultimate development
Recycled water re-chlorination	Re-chlorination facility	Located at both reservoir sites, re-chlorination facility to top-up chlorine residual in stored water to meet guideline requirements.	Stage 1 of the Project
Distribution system	Recycled water outlet mains and distribution system	Recycled water supply from service reservoirs to reticulation system supply zones.	Stage 1 of the project

Recycled water pumping stations

Two recycled water pumping stations would be required:

- A recycled water pumping station would be constructed at the WRP (refer to Figure 5.1) to pump the recycled water to both the temporary recycled water reservoirs (at Hill 765) during Stage 1 of the Project and to the permanent recycled reservoirs (at Hill 800) at ultimate development. Water in excess of the recycled water requirements would be released into the stormwater system. The water balance report (Appendix C) provides details of recycled water demand, supply and discharge.
- At ultimate development, a second high-level zone recycled water pumping station would be required to pump recycled water from the low-level recycled water reservoirs, via a delivery main, to the high-level zone recycled water reservoir at Hill 800.

Recycled water mains

All recycled mains would be based on Googong design standards detailed in Appendix C and in accordance with the WSAA code *WSA 03 Water Supply Code (V2.3)* and the *Supplement to WSA 03 Code for Dual Water Supply Systems*. Recycled water mains would generally be located within the road verge. The depth of cover to the mains would be in accordance with *WSA 03 Water Supply Code (V2.3)*. There would typically be a minimum cover depth of 600mm.

Ductile iron cement lined pipe, class PN20, would be used as it is approved by ACTEW for the given pipe diameter (up to 750mm) and is in common industry use. Polyethylene, DN110 PE100 would also be used. An outlet distribution main would be constructed from the first stage reservoir along Old Cooma Road and Googong Dam Road into NH1A. Plastic pipes would not be used in locations where the design pressure may exceed 120m head.

Recycled water reservoirs

Recycled water reservoirs are required to store the recycled water before domestic re-use. They are required to be located on elevated ground so that water can be pumped to the reservoirs and then gravity fed to the Googong township on demand.

Reservoir construction would be staged to meet the demands of the Googong township. During Stage 1a, there would be no recycled water reservoirs. During Stage 1b, a 2.1-megalitre interim recycled water reservoir and a 0.15-megalitre elevated recycled water tank would be constructed at the interim site adjacent to Old Cooma Road alongside the potable water interim reservoirs at Hill 765.

At ultimate development, the permanent recycled water reservoirs would be located at Hill 800. There would be a 9.3-megalitre reservoir and a 0.45-megalitre high-level zone reservoir. A layout diagram of the reservoir site (for both potable and recycled water) is shown in Figure 5.9. A typical reservoir with a 10m diameter is shown in Figure 5.13.

Figure 5.13 A typical recycled water reservoir (10m diameter)

5.4 Stormwater elements and design

Brown Consulting has developed a stormwater management strategy for Googong Creek (see Appendix M). The stormwater management strategy does not form part of the Project in terms of approvals sought under Part 3A, but it is described in this EA to show how it would connect with all aspects of the integrated water cycle.

5.4.1 Objectives of water-sensitive urban design

The objective of the stormwater design is to restore the indigenous drainage habitats, including the natural drainage system in Montgomery Creek. This would be achieved by the use of water-sensitive urban design features. These features would manage the quantity and quality of stormwater runoff within the Googong township and mitigate potential impacts of the development, such as:

- Reduced stormwater quality.
- Damage to riparian zones.
- Modified hydrological regimes.
- Damage to the surrounding environment due to peak stormwater flows and flooding.
- Construction phase impacts.
- Other impacts identified through MUSIC modelling.

The key objectives of the Googong stormwater management strategy are to:

- Reduce one-in-three-month stormwater peak runoff flow to existing pre-development levels with release of captured flow over a period of one to three days.
- Reduce five-year ARI and 100-year ARI stormwater peak runoff flows to predevelopment levels.
- Ensure that residential land is flood-free for the 100-year ARI storm event, and to provide safe evacuation routes.
- Maintain the existing hydrological regime for stream-forming flows, with respect to peak and duration of the flow.
- Reduce the unmitigated post-development average annual stormwater pollutant export load of:
  - Gross pollutants (greater than 5mm) by 90 per cent.
  - Suspended solids by 85 per cent.
  - Total phosphorus by 65 per cent.
  - Total nitrogen by 45 per cent.
- Maximise the efficient use of land by integrating stormwater management strategies into public open space and roadways.

The proposed stormwater management strategy incorporates the following measures to manage and mitigate the impacts of the proposed Googong township:

- Roof water runoff harvesting and re-use for non-potable water uses.
- Minimum amount of impervious area on the site.

- Stormwater treatment facilities such as gross pollutant traps, bio-retention swales and basins and wetlands.
- Stormwater detention systems.
- Flood risk management using flood planning levels.
- Construction mitigation measures, which include erosion and sediment control strategies.
- Possible inclusion of overland stormwater storage and re-use.

Hydrological, hydraulic and water quality modelling was undertaken to support this proposed stormwater management strategy (see Appendix C). The results of the modelling show that this strategy would effectively mitigate the impacts of Googong township at the site, protect the downstream riparian environment and allow for stormwater quality and quantity targets to be met.

5.4.2 Googong township stormwater design overview

The proposed stormwater layout for Googong Creek incorporates four basins located within the existing Googong Creek and tributaries in the north west of the study area. An outlet structure from the WRP would discharge upstream of basin 4, located close to Old Cooma Road (the approximate discharge point is represented in Figure 5.2). The discharge upstream of basin four would also include stormwater from the upper catchment including areas to the west of Old Cooma Road.

The stormwater system is designed to capture runoff from the Googong township and direct it into the basins by overland flow paths using roads and a series of swales. Swales would be planted with Monaro grasslands where appropriate for hydrology and scour protection. All basins would filter the incoming stormwater using gross pollutant traps that would be typically placed in-line with the drainage system prior to discharge into the basin to capture litter, debris, coarse sediment, oils and greases.

All basins would follow the creek line and eventually lead to basin 1 (with a volume of 20,900m^3), which would be located at the northern point of Googong Dam Road. The flow would eventually be discharged into the Queanbeyan River via Googong Creek.

The basins would be used to limit post-development changes in flow rate and flow duration. They would thereby provide protection of the receiving terrestrial and aquatic environments of the Googong Creek floodplain and limit the potential erosion of the channel bed and bank.

5.5 Phases of Stage 1 of the Project

5.5.1 Pre-construction activities

Pre-construction activities would include:

- Remediation of contaminated sites.
- Identification of the locations of existing underground services.
- Surveys and commencement of monitoring for particular environmental issues as detailed in this EA.
- Other minor surveys to finalise alignment of underground infrastructure.
- Identification of appropriate environmental management controls (including exclusion fencing) for construction activities.

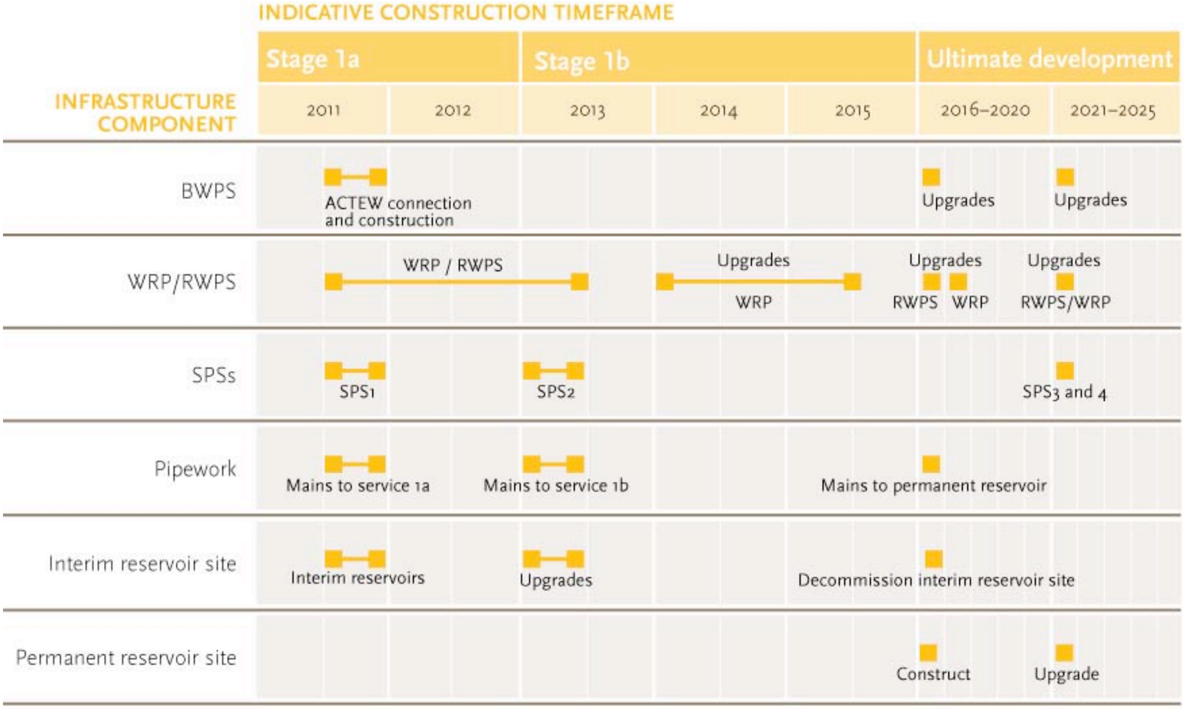
5.5.2 Construction

Timing and duration

The expected dates for key activities are:

- Mid 2011 – start of site activities for Stage 1 of the Project.
- Late 2011 – completion of elements critical to the launch of the NH1A subdivision.
- Early 2013 – completion of Stage 1 of the WRP.

Figure 5.14 Indicative construction timing



Trenching for pipelines

For Stage 1 of the Project, construction works would involve the laying of all pipelines associated with the water cycle project such as sewage rising mains, bulk water rising main, and recycled water rising mains. Table 5.6 outlines the distance of pipes required.

Table 5.6 Distance of pipelines required for Stage 1 of the Project

Type of pipe	Approximate distance required for Stage 1 of the Project
Potable	4,950m
Recycled	3,600m
Sewerage	1,500m

For the installation of all mains during Stage 1 of the Project, the following activities would entail:

- Where required, erection of temporary fencing and installation of temporary gates to define the construction corridor.
- Construction of alternative property access, where required by agreement with the landowner.
- Installation of environmental control measures including erosion and sediment control.
- Clearing and stockpiling of existing vegetation. This would be carried out to provide safe access for vehicular movement, trenching and other construction activities. The corridor that would need to be cleared adjacent to Googong Dam Road would be up to 20m wide. The corridor that would need to be cleared adjacent to Old Cooma Road would be up to 35m wide. The width of the two cleared corridors would involve an electrical easement of 10m in width and a services corridor 7.5m in width. The services corridor would include all water cycle supply infrastructure. Figure 5.15 outlines the layout of the easements required both along Googong Dam Road and Old Cooma Road and also shows the format of the infrastructure within the trench.
- Removal and stockpiling of topsoil. The topsoil would be stockpiled on site at designated spoil stockpile sites, located to the south west of the subject site (refer to Figure 5.16 for potential spoil stockpile locations).
- Construction of a level bench for pipe-laying. This may involve cut-and-fill construction and rock surfacing.
- Trench excavation, installation of pipe, placement and compaction of material. Surplus spoil would be removed and stored at the spoil stockpile locations on site, as required for re-use. Trench excavation in rock would require a rock saw and excavator with rock breaker.
- Reinstatement. This would involve reinstatement of final ground levels, replacement of topsoil, replanting and removal of temporary works such as fences, gates, sedimentation ponds, etc.

Alternatives to trenching, such as thrust boring or directional drilling, would be considered at later stages of the project if impacts of trenching in particular areas would be significant.

5.5.3 Watercourse crossings during trenching

Watercourse crossings would be constructed using standard open-cut construction. This technique is most suited to dry or low-flow conditions. The banks of the watercourses would be graded to enable a suitable slope for trench excavators. Watercourse bed and bank material, and trench spoil, would be stockpiled separately.

Construction of water cycle project elements

A general construction footprint and access area would be established for water cycle project elements related to Stage 1 of the Project. Table 5.7 outlines the general area of each site and Figure 5.16 shows their respective locations.

Figure 5.15 Layout of the easement corridors along Googong Dam Road and Old Cooma Road

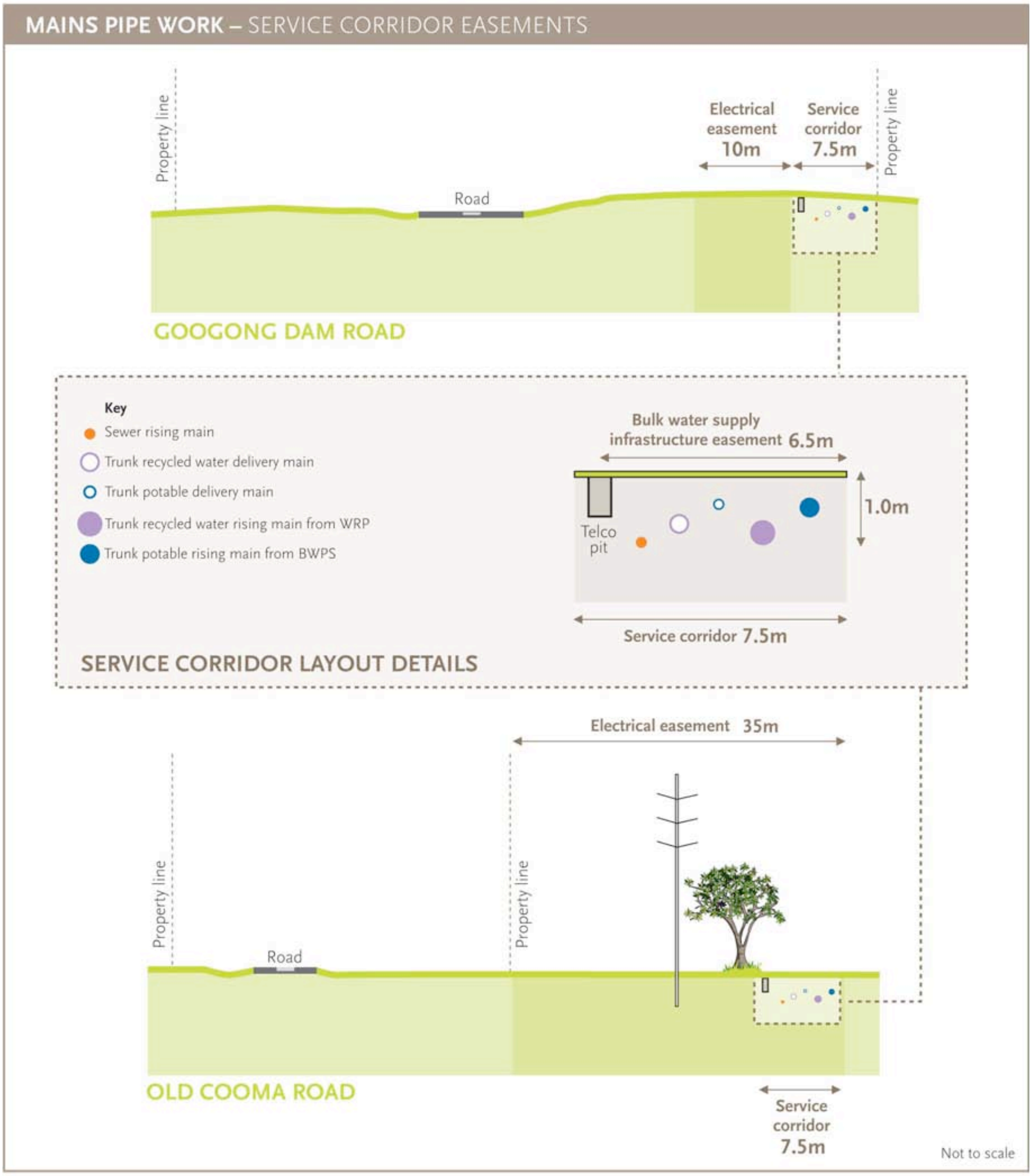
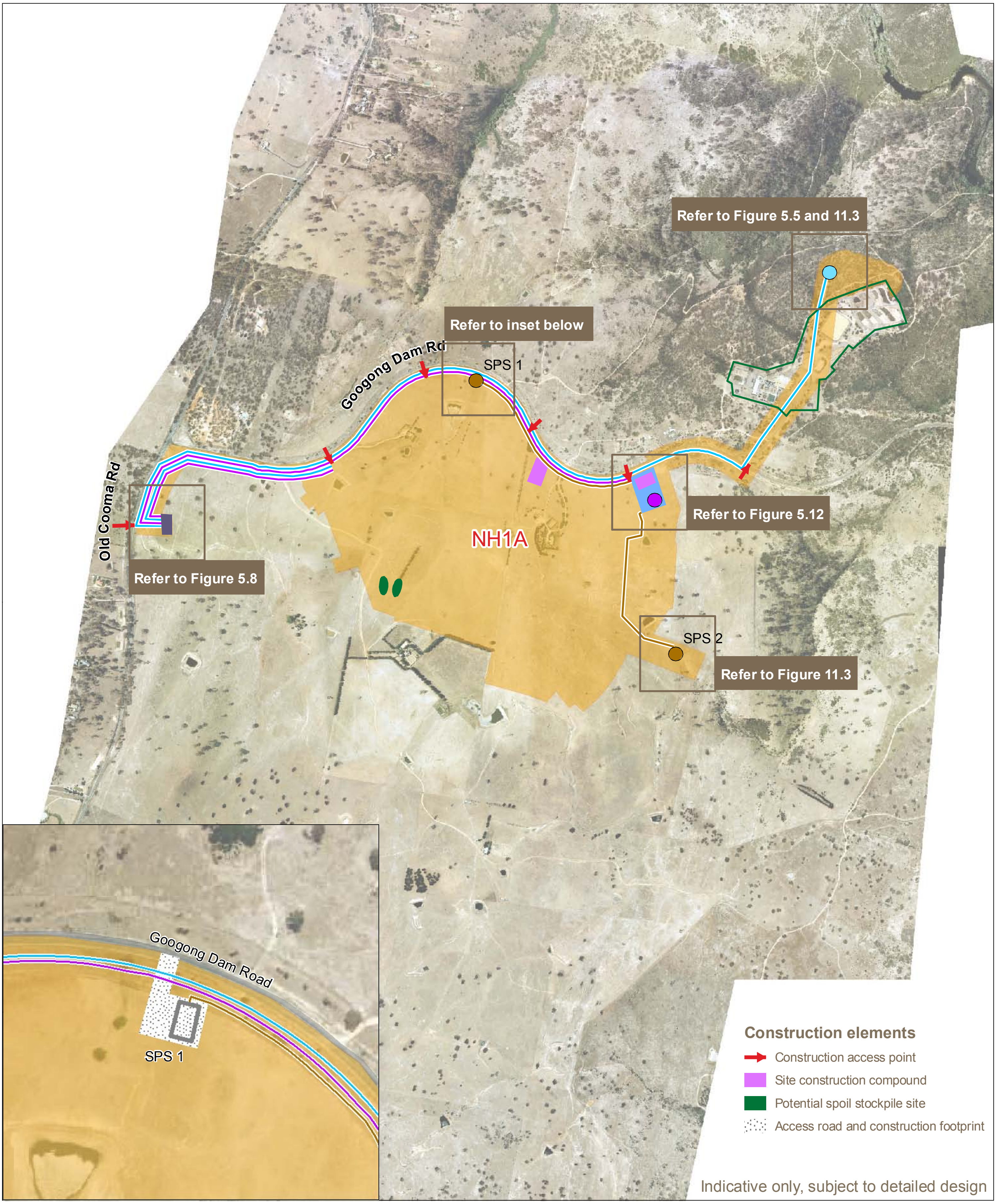


Table 5.7 Approximate site area required for water cycle project elements

Water cycle project element	Area of approximate construction footprint
Bulk water pumping station site	0.45ha
WRP site	1.58ha
Interim reservoir site	0.19ha
SPS sites	0.08ha

The general requirements and construction sequence of the interim reservoirs, bulk water pumping station, sewage pumping stations and WRP would be as follows (locations of these elements are shown in Figure 5.16):

- Clearing of vegetation and topsoil at the site. Topsoil would be stockpiled on site at designated spoil stockpile sites, located to the south west of the subject site. Works would be undertaken by tracked excavator and material moved by truck.
- Establishment of site construction compound, and fencing. The main site construction compound would be established to the north of the subject site, off Googong Dam Road. It would have an area of 600m^2. Access to the compound would be from the closest construction access point (refer to Figure 5.16). These facilities would cater for about 20–40 people and comprise of portable buildings, parking facilities, and storage containers. The compound would be constructed on a hardstanding surface that would be cleared and grubbed. The site would be secured with access-proof fencing. Depending on the arrangement, electricity, sewerage, telecommunications and water supplies would be installed. Specific details of the facility and timeframe for establishment would be provided prior to construction.
- Formation of the access roads. This would involve excavation to grade as required, importation and placement of appropriate fill for the road. The locations of the proposed access roads are shown in Figure 5.16. Trucks and other vehicles would generally use Old Cooma Rd north of the site and Googong Dam Rd to enter the access roads. Site laydown and temporary car park areas would be provided on site.
- Bulk excavation to create a level platform area for the structure. This would likely include excavation in rock material. Fill material would be placed to extend and form the required platform area.
- Formation of a binding layer. A thin concrete binding layer would be placed over the surface of the ground to seal the surface of the excavation and provide a clean level surface suitable for structural concrete. Concrete would be delivered to work sites by truck and, where possible, discharged directly from the chute of the truck into the excavation.
- Formation of a hardstand area. A crushed granular material hardstand area would be created around each structure for maintenance vehicles.
- Placement of steel reinforcement for base slabs. This would involve placing, fixing and tying steel reinforcement bars.
- Placement of structural concrete. This would involve installing ‘shutters’ to support the structural concrete walls or suspended slabs. Shutters are typically constructed on site from sheets of wood, which are assembled to suit the requirements of each structure. Reservoir construction would involve the use of bolted steel panels, constructed at ground level in circular layers.
- Construction of all potable water, recycled water, drainage and chemical dosing pipework (inlet/outlet pipes and access holes) and overflow structures, followed by mechanical and electrical fit-out.



Googong Environmental Assessment

Proponent CIC Australia

Date 20 August 2010

Drawing no. 08003g_ea_fig05-16

Source Brown Consulting, MWH

- Bulk water pumping station
- Recycled water pumping station
- Sewage pumping station
- Potable water mains
- Recycled water mains
- Sewage mains
- Existing ACTEW Googong water treatment plant site
- Water recycling plant
- Interim reservoir area
- Subject site

1:20,000

0 150 300 450 600m

Figure 5.16 Stage 1 of the Project – construction

Maunsell Roberts

Construction equipment

Machinery to be used during the construction phase of Stage 1 of the Project is typical for the construction of water cycle infrastructure and would includes:

- Bulldozer, excavator, backhoe, kerb slip-form machine, paver, roller and grader.
- Excavator-mounted rock-hammer, plate compactors and vibrating plate compactors, and drill rig.
- Survey equipment.
- Trucks and utility vehicles.
- Concrete pump, dewatering pumps and water cart.
- Cranes, scaffolding.
- Powered hand tools.

5.5.4 Commissioning

Commissioning activities undertaken in compliance with an agreed commissioning plan would include period of system proving or/and testing. No significant impacts are expected during the commissioning period.

The commissioning arrangements for the WRP Stage 1 facilities are anticipated to involve:

- Transporting sewage off site with a tanker to an existing sewage treatment plant until an equivalent population of 150 is reached. It is proposed that sewage would initially be collected from the wet well at SPS1.
- Commissioning the WRP with sewage once a population of 150 EP has been reached. It is envisaged that wet commissioning would be undertaken for one month prior to transfer of sewage to the WRP to ensure that all treatment processes are operating reliably and in accordance with the design intent.

5.5.5 Operation

The operating philosophy of all infrastructure elements is, where relevant, to be consistent with operations of Queanbeyan City Council (as the local water and wastewater authority) and ACTEW/ActewAGL. This includes detailed telemetry and alarm systems on infrastructure elements.

Operation and maintenance of reservoirs

Routine maintenance is expected to consist of the following:

- A spot check on pH and residual chlorine by an operator to ensure compliance with the required standards – to be undertaken fortnightly.
- External condition inspections of the reservoirs, to be undertaken monthly.
- A manual opening and closing check of all valves, actuated or otherwise, greater than 100mm diameter, to be undertaken on a quarterly or four-monthly basis.
- An internal condition inspection of each reservoir by a diver. A vacuum pipe would be used to remove sediment from the reservoirs to reduce unnecessary discharge of water to the environment, to be undertaken annually.
- External painting of the reservoir, to be undertaken on a five-year cycle (approximately).

To facilitate routine maintenance on the reservoirs, separate inlets from the WRP and top-up bulk water pumping station mains would be constructed. Each reservoir can then be filled and emptied in isolation, while the other is taken offline for maintenance.

Operation and maintenance of sewage pumping stations

Maintenance is expected to consist of the following:

- General pump inspections – to be undertaken on a monthly or bi-monthly basis, or as specified by the pump manufacturer.
- Inspection of the pumps for oil, wearing and general condition (pumps would be lifted out and hosed down at the sewage pumping station; oil would be changed), to be undertaken annually.
- A visual inspection of the wet well and emergency storage area – to be undertaken at least annually. Washdown of the emergency storage area would be done at the same time. These works would need to be undertaken during periods of low flow, and the incoming sewage would be pumped out from the inlet manhole to a tanker and removed for treatment.

Operation and maintenance of sewage rising mains

Maintenance is expected to consist of the following:

- Maintenance staff would inspect the sewage rising mains and conduct routine maintenance activities – to be undertaken periodically.
- Along the sewage rising main routes, maintenance crew would inspect all accessible assets and any above-ground infrastructure – to be undertaken about every six to 12 months. (During the first years of operation, the maintenance crew may drive along the whole route on a monthly basis.)

Maintenance schedules and activities would be detailed in commissioning and operational plans.

Operation and maintenance of the WRP

The WRP would operate automatically. The general requirements are as follows:

- All systems would be controlled by Supervisory Control and Data Acquisition (SCADA). Minimal operator intervention is required.
- Membranes would be cleaned about once per week. This involves an automatic procedure which ‘backpulses’ a small amount of sodium hypochlorite and citric acid.
- All mechanical equipment would need routine maintenance.
- Instrumentation would need regular calibration.
- An operator would control chemical deliveries, and solids removal off-site.

Recycled water treatment and supply

The design of the WRP has taken into account relevant effluent quality criteria. As effluent from the WRP would be used for non-potable uses as well as being discharged to the environment when demand is low, recycled water and discharge to the environment criteria apply. Performance criteria for the WRP are listed in Table 5.8 and detailed in Appendix B. The WRP would need to meet the requirements of an Environmental Protection Licence issued by DECCW under the *Protection of the Environment Operations Act 1997*.

It is standard for wastewater parameters to have a 50th percentile and a 90th percentile limit specified within the Environmental Protection Licence; therefore, these have been provided in Table 5.8 below. In the case of the Googong WRP, it is thought that the percentiles provided are sufficient, given the high level of treatment, and lack of high toxicity parameters.

Table 5.8 Proposed effluent consent conditions

Parameter	Recycled water	Discharge to the environment (based on 50th %ile)	Discharge to the environment (based on 90th %ile)
BOD	-	<5mg/L	<10mg/L
Suspended solids	-	<10mg/L	<20mg/L
Total nitrogen	-	<10mg/L	<15mg/L
Total dissolved Solids	-	650mg/L	700mg/L
Total phosphorus	-	<0.2mg/L	<0.5mg/L
Faecal coliforms	< 1 cfu/100ml	-	-
Total coliforms	< 10 cfu/100ml (95%ile)	-	-
Virus	< 1 cell/50L	-	-
Parasites	< 1 cyst/50L	-	-
Turbidity	< 2 NTU	-	-
pH	6.5–8.0	-	-
Colour	< 15 TCU	-	-
Free chlorine residual	< 0.5mg/L	-	-

Recycled water discharge

The overriding objective when considering recycled water discharges is to minimise the impact of discharges on the Queanbeyan River. To this aim, the volume of discharge would be considerably reduced by re-using recycled water within the Googong township.

An initial recycled water scheme assessment determined the maximum use of recycled water on site considering the storage capability (of recycled water) across the Googong township. A further assessment (Appendix D), remodelled and refined the recycled water scheme, ensuring an acceptable impact on soils and groundwater, in the context of revised and updated storage capability information. Based on the modelling results for soil, vegetation and groundwater impacts, management options for excess recycled water were proposed, incorporating water-sensitive urban design and the stormwater management system. The management of excess recycled water discharges via the stormwater system would moderate the flow rates eventually entering the Queanbeyan River and result in improved downstream water quality.

The proposed discharge route for recycled water is via the recycled water main (between the WRP and reservoir) at the western edge of the Googong township to the stormwater management system. The recycled water would join stormwater flows collected and retained throughout various areas of the township, with any excesses flowing to Googong Creek, and eventually to the Queanbeyan River. The likely frequency and volumes of discharge of recycled water to the stormwater system are considered in the water balance report presented in Appendix C.

Irrigation areas

Irrigation to establish vegetation

Open spaces that are not permanently irrigated would nevertheless require suitable volumes of water for the establishment of vegetation stabilisation. Generally, these areas include street verges and would have a single depth of water applied over a two-month period regardless of the location or vegetation type.

For NH1A, at the completion of Stage 1 of the Project, the amount of land that would require establishment levels of irrigation water total about 17.4 hectares. At ultimate development, 82.8 hectares of land would require establishment levels of irrigation water.

Infrastructure required for the non-permanent irrigation areas or establishment areas such as verges can either include a polyethylene pipe system laid on the surface – which would include sprinkler heads directly on the main – or the irrigation could be applied to the surface directly from a water cart. It would be expected that, given the temporary nature of this activity, connection of the temporary surface polypipe system to the recycled water main would be via a mobile hydrant standpipe.

Permanent irrigation areas

Permanent irrigation areas within the Googong township would be mainly the open space areas such as sporting fields, neighbourhood parks and civic spaces. Within NH1A (Stage 1 of the Project), 13.48 hectares would be permanently irrigated. At ultimate development, about 44.91 hectares would be permanently irrigated.

The recycled water reticulation network would pass all allotments and be able to serve all open space areas by conventional service tie connections to the recycled water mains. The infrastructure would include pumps at the source and underground water mains within the open space or road reserve.

The significant permanent irrigation water mains are proposed within the Googong Common, which would be in the centre of the Googong township (refer to Figure 1.3). It would deliver water to certain recreational reserves landing the Common. The location of this main is less of a constraint to the urban layout and hence the length could alter significantly once the design of the Googong Common is certain. However, being located wholly within open space, design and construction of this pipeline would be less problematic and pose less of an encumbrance on urban/landscape design than the Googong Avenue temporary main.

Irrigation application rates

Application of water for irrigation of open space modelled in this report is on average 568mm per annum for playing fields; 418mm per annum for parks, verges and other open space; and 459mm per annum for high-value streetscape/garden beds and planters that mainly occur within the civic spaces.

Irrigation water would not be applied to land constantly all year round; irrigation would be highest in the summer months and zero in the winter months. Adopted temporal patterns of monthly irrigation application depths for the respective classes for the entire Googong township are presented in Table 5.9. At the completion of Stage 1 of the Project, the monthly irrigation demands would be consistent in each year from that point onwards. These rates are presented in Table 5.10.

Table 5.9 Average monthly irrigation depths to open spaces of the entire Googong township (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Playing fields	80	80	54	54	54	0	0	0	54	54	58	80
Parks, open space, verges	65	65	38	38	38	0	0	0	35	35	39	65
High-value streetscapes	73	73	40	40	40	0	0	0	40	40	40	73

Table 5.10 Average monthly irrigation demands for the completed Stage 1 of the Project (ML)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Demand	9.91	9.91	6.33	6.33	6.33	0	0	0	6.18	6.18	6.72	9.91	**67.79**

5.6 Cost estimate

A preliminary capital cost estimate has been developed for the Project. Table 5.11 shows the capital cost estimate, as well as the estimate for Stage 1 of the Project.

Table 5.11 Capital cost estimate

Element	Cost estimate ($M)
Stage 1 of the Project	36.5
Further stages of the Project	35
Project total	**71.5**