WestConnex Rozelle Interchange

Operational Water Reuse Strategy

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Document Approval

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WestConnex

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Glossary of terms

Term/acronym	Definition
Asset	M4-M5 Link Rozelle Interchange Motorway; An interchange at Lilyfield and Rozelle, including a connection to the proposed future Western Harbour Tunnel and Beaches Link project
CoA	Minister's Conditions of Approval
CSSI	Critical State Significant Infrastructure
CWRS	Construction Water Reuse Strategy
CWUF	Continuously washed up-flow filters
DPIE	NSW Department of Planning, Industry & Environment, now NSW Department of Planning and Environment
EIS	WestConnex M4-M5 Link Environmental Impact Statement
EPA	NSW Environment Protection Authority
MOC	Motorway Operations Centre
NSW	New South Wales
O&M	Operation and Management
O&M Contractor	A contractor engaged by the operator to maintain the asset
OWRS	Operational Water Reuse Strategy, this document
REMM	Revised environmental management measure (from the Submissions and Preferred Infrastructure Report)
Solute	A substance dissolved in another substance. In the context of reverse osmosis, solute comprises the compounds and ions with a small volume of process water that cannot pass through the semi-permeable membranes. The solute is the waste stream of the reverse osmosis process.
Strategy	This document
TfNSW	Transport for New South Wales, the Proponent for the Rozelle Interchange project Transport for New South Wales has engaged the Project Company to deliver the Rozelle Interchange project.

1 Introduction

1.1 Purpose

The purpose of the Operational Water Reuse Strategy (OWRS, this Strategy) is to identify and evaluate the options for reuse of collected stormwater and groundwater during operational phase of WestConnex M4-M5 Link Stage 2 Rozelle Interchange (the Project) in accordance with the Condition of Approval (CoA) E198.

The purpose of the OWRS is to address the requirements of the CoA, including:

- Evaluate water reuse options,
- Identify and detail the preferred re-use options,
- Identify a timeframe for the implementation of the preferred reuse options, and
- Assess and mitigate public health risks.

A separate Construction Water Reuse Strategy (CWRS) was prepared for the construction phase of the project, in accordance with CoA E198, and was approved by the Department of Planning, Industry and Environment (DPIE) on 21 June 2020.

2 Asset description

The WCX M4-M5 Link project will be constructed and opened to traffic in two stages:

- Stage 1: M4-M5 Link Mainline tunnels
- Stage 2: Rozelle Interchange

This Strategy addresses Stage 2 Rozelle Interchange.

2.1 Location

Figure 2-1 shows the location and key features of the Asset.

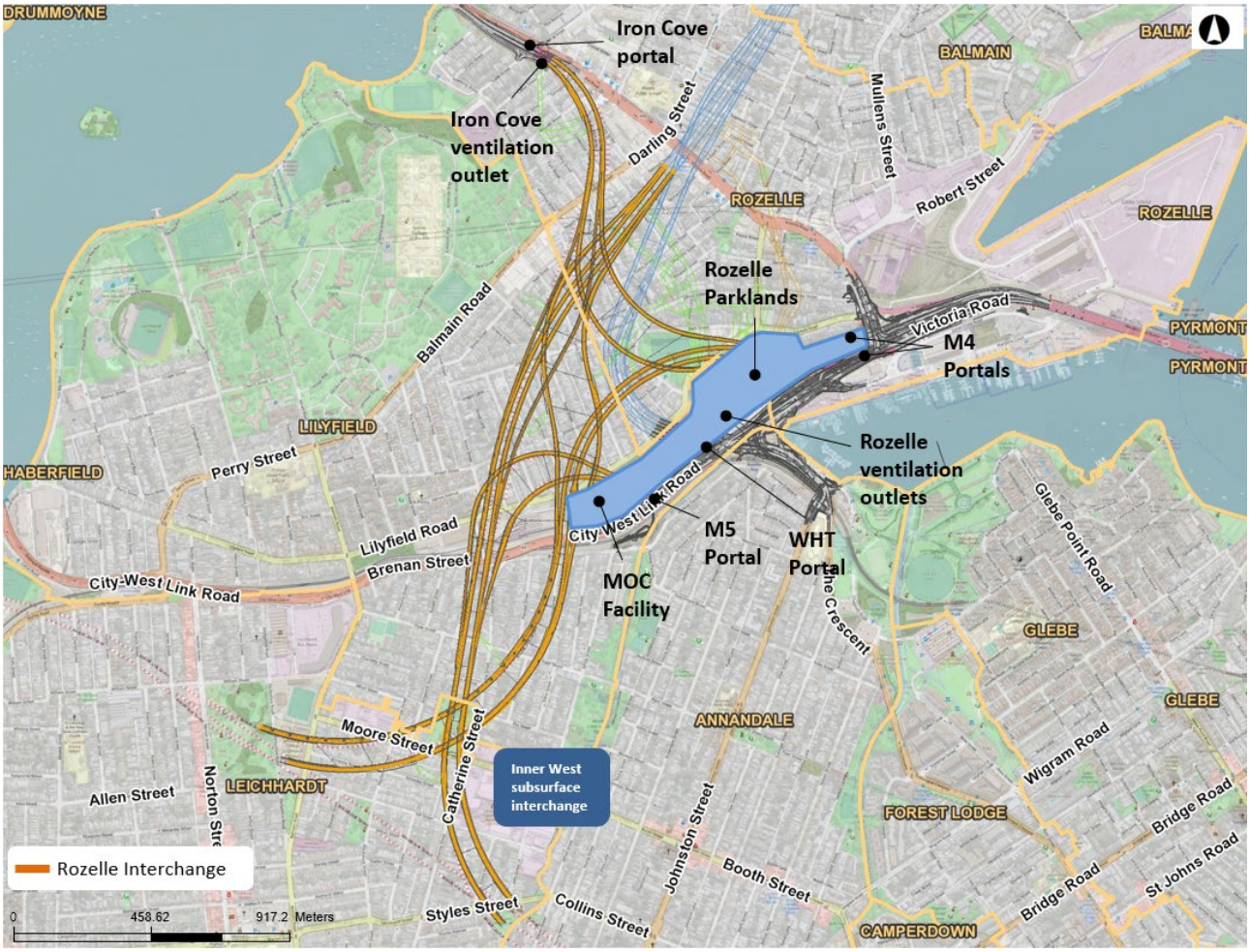

Figure 2-1: Key features of the Asset under the approved project

2.2 Asset components

The Asset comprises the new interchange at Rozelle. A summary of the Asset components is included in Table 2-1. The key facilities are further described in the following sub-sections.

Table 2-1: Key Asset components

Asset	Location
Interchanges (including on and off ramp tunnels)	• City West Link M5 portals • City West Link Western Harbour Tunnel portals • M4-Anzac dive portals • Iron Cove link dive portals • M4-M5 Link Eastbound on-ramp • M4-M5 Link Eastbound off-ramp • M4-M5 Link Westbound on-ramp • M4-M5 Link Westbound off-ramp
Road upgrades	• Victoria Road • City West Link • Johnston St, Annandale • The Crescent, Annandale
Motorway Operation Complex	Two motorway operations complexes: ▪ Rozelle west (MOC2 or Rozelle Interchange Facilities Area), and ▪ Iron Cove Link (MOC4 or Iron Cove Ventilation Facility).
Mainline Tunnel	Mainline connections between the New M4 and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
Tunnel ventilation system	• The Rozelle ventilation facility • The Iron Cove Link ventilation facility
Tunnel support systems and services	• Electricity substations • Fire pump rooms and tanks • Water treatment facilities and pump station • Low point sump for detention of stormwater, groundwater inflows and/or spills in the tunnel • Fire and life safety systems including emergency evacuation infrastructure
Off-road shared use path	• Pedestrian and Cycle paths throughout the Rozelle Parkland • Pedestrian and Cycle paths adjacent to Victoria Road, Rozelle
Intelligent transport systems	• Tolling equipment • Gantries • Equipment shelters • Substations • Cameras • Cabling and conduits • Traffic control systems
Environmental and amenity controls	• Planting and landscape treatments • Water quality basins
Stormwater drainage	• Longitudinal drains (pits and pipes) • Cross drains (culverts)
Road furniture	• Lighting • Signage • Furniture
Utilities	• Power • Communications • Cables and conduits

2.3 Motorway Operational Ancillary Infrastructure

The M4-M5 Link Rozelle Interchange includes the following operational ancillary infrastructure:

- Operational management control systems and incident and emergency response infrastructure
- Tunnel ventilation systems and facilities
- Drainage and water treatment facilities
- Utilities
- Roadside furniture and lighting.

Most operational ancillary infrastructure is established in one main Motorway Operations Centre (MOC) and other operational facilities. The O&M Contractor will operate and maintain the MOC.

2.3.1 Motorway Operations Centre

The Motorway Operations Centre (MOC) (referred to as MOC2 in the EIS documentation) is located on the western side of the Rozelle Parklands. The O&M Contractor will operate and maintain the MOC and Maintenance Facility.

Figure 2-2 Motorway Operations Centre

The operational features of the Motorway Operations Centre and Maintenance Facility are included in Table 2-2.

Table 2-2: Motorway Operations Centre infrastructure and equipment

Aspect	Infrastructure / equipment
Infrastructure and equipment	• Fire Pump Room • Fire Water Tank • Substation • Communications Building • RIC Office/workshop/garage • WHT office/store • WHT Bulk Supply Substation • RIC Water Treatment Plant • Bulk Store
Access	• Access road off Lilyfield Road and via Sydney Light Rail depot. • 24 hours per day • O&M Contractor vehicles.

2.3.2 Rozelle ventilation facility and outlets

The Rozelle ventilation facility is located within the Rozelle Parklands, adjacent to City West Link at Rozelle. There are other operational assets situated within underground caverns, located beneath the Rozelle Parklands. The O&M Contractor will operate and maintain the ventilation facility.

The operational features of the Rozelle ventilation facility are included in Table 2-3.

Table 2-3: Rozelle ventilation facility infrastructure and equipment

Aspect	Infrastructure / equipment
Equipment	• Ventilation exhaust outlets • Fresh air supply intakes • Electrical substations • Ventilation fans
Access	• Vehicle access to the facility is via a maintenance bay or through the tunnel • 24 hours per day • O&M Contractor vehicles

Figure 2-3 Rozelle ventilation outlets, fields, and vegetated shared user bridge

2.3.3 Iron Cove operational and ventilation facilities

The Iron Cove ventilation and operational facility is located on Victoria Rd, Rozelle. The O&M Contractor will operate and maintain the Iron Cove ventilation facility.

The operational features of the Iron Cove ventilation facility is included in Table 2-4.

Table 2-4: Parramatta Road ventilation facility infrastructure and equipment

Aspect	Infrastructure / equipment
Equipment	• Ventilation exhaust outlet • Switch room • High Voltage regulators • Alternative Operational Motorway Control System • Service and maintenance bay
Access	• General surface vehicle access is provided via Toelle Street, Rozelle • 24 hours per day • O&M Contractor vehicles

Figure 2-4: Iron Cove operational and ventilation facility

3 Environmental Requirements

3.1 Conditions of Approval

An OWRS is required by the project CoA E198. A description of compliance with the requirements of this CoA is provided in Table 4-1: Relevant conditions of approval.

Table 3-1: Relevant conditions of approval

CoA	Relevant requirement	Reference
A1	The CSSI must be carried out in accordance with the terms of this approval and generally in accordance with the description of the CSSI in the WestConnex M4-M5 Link Environmental Impact Statement – Volumes 1A-C and 2A-J (dated August 2017) (the EIS) as amended by:	Section 3.2
	the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (dated January 2018) (the SPIR);	Section 3.3
	the WestConnex M4-M5 Link Mainline Tunnel Modification Report (dated September 2018) (Modification 1 Report) as amended by the WestConnex M4-M5 Link Mainline Tunnel Modification Response to Submissions (dated November 2018) (Modification 1 RtS);	This report does not contain requirements relevant to this Strategy.
	the WestConnex M4-M5 Link Rozelle Interchange Iron Cove Ventilation Underground Modification Report (dated November 2019) as amended by the WestConnex M4-M5 Link Rozelle Interchange Iron Cove Ventilation Underground Modification Response to Submissions Report (dated March 2020); and	These reports do not contain requirements relevant to this Strategy.
	the WestConnex M4-M5 Link Rozelle Interchange Glebe Island Construction Ancillary Facility Modification Report (dated June 2020).	This report does not contain requirements relevant to this Strategy.
	the WestConnex M4-M5 Link Rozelle Interchange The Crescent overpass and active transport links Modification report (dated August 2019) (Modification 2 Report) as amended by the (i) WestConnex M45-M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Design amendment report (dated April 2020) (Modification 2 Amendment Report), (ii) WestConnex M45- M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Response to Submissions Report (dated April 2020) (Modification 2 RtS), and (iii) WestConnex M45-M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Response to Submissions on the Design amendment report (dated June 2020) (Modification 2 Amendment RtS); and	These reports do not contain requirements relevant to this Strategy.
	the WestConnex M4-M5 Link Rozelle Interchange Modification Request Letter (dated October 2020).	This letter does not contain requirements relevant to this Strategy.

CoA	Relevant requirement	Reference
E198	The Proponent must prepare a Water Reuse Strategy which sets out options for the reuse of collected storm water and groundwater during construction and operation of the Critical State Significant Infrastructure (CSSI). The Water Reuse Strategy must include, but not be limited to:	This Strategy
	(a) evaluation of reuse options	Section 4.2
	(b) details of the preferred reuse option(s), including volumes of water to be reused, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required; and	Section 4.3
	(c) a time frame for the implementation of the preferred reuse option(s).	Section 4.4
	The Water Reuse Strategy must consider public health risks from water recycling and must be managed to avoid misuse of recycled water as potable. The Water Reuse Strategy must be undertaken following best practice and advice sought from relevant agencies as required.	Section 5
	Justification must be provided in the event that it is concluded that no reuse options prevail.	Section 6

3.2 Environmental Impact Statement

This section identifies sections from the EIS relevant to operational water reuse.

EIS Table 27-3 assesses project consistency with the WestConnex Sustainability Framework objectives and targets. Table 3-2 addresses how the Project has complied with CoA A1 by designing the asset generally in accordance with the description of the CSSI in the WestConnex M4-M5 Link Environmental Impact Statement.

Table 3-2 Operational water statements from EIS

Reference	Statement from EIS	Reference & how addressed
Table 27-3	Water efficiency measures would be implemented with a focus on achieving water savings and targeting water recycling and reuse	• A combination of 5 and 4 star WELS rating fixtures have been installed in bathrooms and kitchens in asset buildings. • Water sensitive urban design has been used to specify plants that do not require irrigation for most of the Project. Three areas of the parklands will be irrigated; ▪ Planter boxes on the shared user path bridge connecting the Rozelle Bay Light Rail Station with the Project parklands. ▪ Vegetated green wall panels on the ventilation outlets ▪ Playing fields. Irrigation for these areas will be connected to treated tunnel water suitable for irrigation. • Water drawn from fire water tanks during pump testing for in tunnel hydrant and deluge systems is designed to recirculate back into the tanks. • Water treatment plant media filters will be designed with continuously washed up-flow filters utilising treated groundwater to clean the media filters.
Table 27-3	The extent to which non-potable water can be used during the project would be reviewed and refined during detailed design	• A 20,000L rainwater tank will be installed at the MOC to supply non-potable water for toilets. This tank can also be tapped by the O&M Contractor for activities such as tunnel wall washing. • Treated tunnel water will be used to supply irrigation water for the Project. • Water treatment plant media filters will be designed with continuously washed up-flow filters utilising treated groundwater to clean the media filters.
Table 27-3	Opportunities to reuse treated groundwater during project operation would be considered in preference to discharge to the stormwater system or receiving waterbodies. This could include irrigation of landscaped areas within the project such as the new open space at the Rozelle interchange.	• A tunnel water treatment system will be installed and connected to the parkland irrigation tanks (170,000L) with the potential to supply treated water to areas of the new open space at Rozelle requiring irrigation. • Water treatment plant media filters will be designed with continuously washed up-flow filters utilising treated groundwater to clean the media filters.

3.3 Submissions and Preferred Infrastructure Report

This section identifies revised environmental mitigation measures (REMMs) from the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report, January 2018. Table 3-3 lists relevant REMMs to operational water and how the area addressed in this Strategy.

Table 3-3 Operational water revised environmental mitigation measures

Reference	Revised Environmental Mitigation Measure	Reference & how addressed
OpRW3	Opportunities to reuse treated groundwater during project operation will be considered in preference to discharge receiving waterbodies. This could include irrigation of landscaped areas within the project footprint such as new open spaces at the Rozelle interchange.	• A groundwater treatment system will be installed and connected to the parkland irrigation tanks (170,000L) with the potential to supply treated water to areas of the new open space at Rozelle requiring irrigation. • Water treatment plant media filters will be designed with continuously washed up-flow filters utilising treated groundwater to clean the media filters.

Reference	Revised Environmental Mitigation Measure	Reference & how addressed
OpRW4	In order to reduce demand on local water supplies, options will be investigated to provide water for the deluge system from wastewater produced through the tunnel drainage system, where it meets appropriate quality parameters.	Rozelle interchange, similar to all major Sydney tunnel infrastructure, uses large header tanks to store water for the fire deluge and hydrant systems. These tanks can be filled over time at flowrates that don't reduce local water supply. The large capacity of the tanks allows large volumes of water to be used in the event of a fire without the fire suppression water flowrate being restricted by local supply. Whilst the issue identified in this REMM does not exist, consistent with the REMM the Project has investigated the option of using wastewater for tunnel fire suppression. The water does not meet the parameters required to maintain the system in a fit state for public safety in the event of a fire in accordance with AS 2118.3—2010 Automatic fire sprinkler systems Part 3: Deluge systems and AS 2419 Fire hydrant installations

4 Reuse Options

4.1 Operational Water Uses

To evaluate reuse options water uses for the Project have been identified. The following water uses are required for the asset operation;

- Drinking water
  - Drinking water fountains in the parklands
  - Drinking / cooking water in asset buildings
- Motorway control centre kitchen
  - Sink
  - Dishwasher
- Bathrooms
  - Toilets & urinals
  - Basin taps
  - Showers
  - Cleaners tap
- Parkland irrigation
  - Planter boxes on the shared user path bridge connecting the Rozelle Bay Light Rail Station with the Project parklands
  - Vegetated green wall panels on the Rozelle ventilation outlets
  - Playing fields
- Fire suppression
  - Fire hydrant system
  - Fire deluge system
- Cleaning
  - Tunnel architectural panel washing
  - Operational water treatment plant media filters

4.2 Evaluation of Reuse Options

Sustainability design workshops were held for all material design packages. Amongst numerous sustainability issues evaluated these workshops considered opportunities to reduce resource usage including water. Evaluation of reuse options for each operational water use is considered in Table 4-1.

Table 4-1 Evaluation of reuse options

Water Use	Reuse opportunity	Evaluation considerations	Approximate reuse quantity & proportion
Drinking water	-	Evaluation of drinking water reuse options did not identify opportunities that ensured long term safety for the community and asset operators.	Nil
MOC Kitchen	-	Evaluation of kitchen water reuse options did not identify opportunities that ensured long term safety for the asset operators.	Nil
MOC Bathroom	Toilets & urinals	Two reuse options were assessed for water supply to toilets and urinals; • Use of treated tunnel water – This was discounted by operational stakeholders due to the lack of examples where his had been done safely and effectively in operational infrastructure. • Rainwater harvesting from the MOC roof - This opportunity has been taken up and a harvesting system designed to capture, store and pump rainwater to toilets and urinals. Mains water was assessed to provide the safest supply option for direct contact uses such as basins and showers.	Reuse quantity is based the motorway control centre being operated at design capacity. It is understood the O&M Contractor may utilise other WestConnex control centre facilities which would significantly reduce the number of staff at the Rozelle MOC and therefore the water demand. 283,000L per annum. 100% reuse (average Sydney rainfall) This is further reduced to 158,500L per annum with the installation of high efficiency toilets and urinals that have been identified in the sustainability in design workshops and incorporated into the asset design.100% reuse.
Parkland irrigation	Water supply for; • Planter boxes on the shared user path bridge connecting	Typically for Sydney tunnel assets, tunnel groundwater and stormwater are treated to a level suitable for discharge to the environment. However, this treated water is commonly unsuitable for other uses such as irrigation due to elevated salt content (naturally occurring in groundwater) which is incompatible with plant survival	The plant has been sized to supply all the irrigation water for asset, modelled at 6,000,000L per annum in an average rainfall

Water Use	Reuse opportunity	Evaluation considerations	Approximate reuse quantity & proportion
	the Rozelle Bay Light Rail Station with the Project parklands • Vegetated green wall panels on the Rozelle ventilation outlets • Playing fields	and naturally occurring dissolved metals such as iron and manganese which can block pipework, inhibit plant growth / survival and cause staining on paths, structures and tree trucks. Reverse osmosis was the only technology identified to further polish treated tunnel water to irrigation standards. Further treatment / polishing of treated tunnel water through a reverse osmosis system for the full volume of treated tunnel water is not advisable due to; • Removal of salts from the solute (treated water) which then discharges to marine environments will cause water pollution resulting in potential flora and fauna death around the discharge zone. • Extremely high quantities of energy are required to push all the treated water through the reverse osmosis membranes. • In most locations there is no capacity to discharge the volume of solute (water and filtered components trapped by the membranes) generated by the process, rendering the process unfeasible. Options were considered to mitigate these limitations with consideration given to the water uses and demand for the asset. A process has been designed to work around the above constraints; 1 In an average rainfall year (rainfall determines irrigation demand) approximately 0.8% of the treated tunnel water will be pumped from the operational water treatment plant discharge line to a small reverse osmosis plant. 2 A very small reverse osmosis plant with capacity to treat 2,500L per hour has been installed to polish the treated tunnel water, removing most salts and metals, but leaving enough to simulate Sydney mains water. 3 The small size of the reverse osmosis plant avoids the issues of excessive energy demand and solute disposal. The small capacity of the plant is balanced by situating it next to 170,000L irrigation water storage tanks that act as a buffer, allowing the tanks to partially drain quickly to meet the intermittent irrigation flow rates while slowly filling over the periods when the irrigation system is not watering the fields etc, with appropriate demand management. 4 Utilising discharge water from the operational treatment plant that has already been chemically treated and passed through media filters ensures a high quality of feed water for the reverse osmosis plant, minimising; a the number of membranes required, b energy to reverse the osmotic gradient and c maintenance from fouling of the membranes. 5 The small volume of solute, approximately 15% of the reverse osmosis plant flow rate is blended with the relatively high volume of treated water from the operational water treatment plant as it discharges to the environment. As the water processed came from the operational	year and 12,000,000 in a low rainfall year. 100% reuse. There is capacity for additional supply for future identified uses such as irrigation of adjacent council playing fields or public amenities. Space has been allowed for in the treatment room for additional membranes and pumps to upscale the plant for significant future demand should this process prove strongly beneficial.

Water Use	Reuse opportunity	Evaluation considerations	Approximate reuse quantity & proportion
		treatment plant discharge that meets discharge specifications the total amount of metals etc in the tiny volume of solute when blended with the large volume of operational treatment plant discharge water ensures the total discharge is still compliant and avoids environmental harm. 6 The process has the benefit of providing a consistent supply irrigation water. Irrigation demand is highest during dry spells and droughts, when other reuse options such as captured rainwater or treated stormwater are not available. 7 The semi-permeable membranes in the reverse osmosis process treat the irrigation water to levels suitable for irrigation of public spaces. The process has bene designed consistent with Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, National Health and Medical Research Council Australian Guidelines for Water Recycling Stormwater Harvesting and Reuse 2009. 8 The system is designed with a mains water connection to the irrigation water storage tanks to accommodate contingencies such as prolonged maintenance or water supply issues from the operational water treatment plant.	
Fire suppression	• Fire hydrant system • Fire deluge system	Water entering the asset fire suppression system must be of a quality to ensure compliance with AS 2118.3—2010 Automatic fire sprinkler systems Part 3: Deluge systems and AS 2419 Fire hydrant installations. Reliable operation of the fire suppression systems in the asset is a critical aspect of the design. Whilst no stormwater / groundwater reuse options were identified that meet the critical design demands of the system recirculation capability has been designed into the system to minimise wastage and maximise water reuse. Reverse osmosis is unsuitable for fire suppression for this asset for three reasons; 1. The cost of a plant to produce the quality and quantity of water at a standard for circulation in the fire suppression system is not reasonable, relative to the quantity of water demanded. 2. There is insufficient source water (groundwater and stormwater) flow rate to charge the fire suppression tanks at the required rate in the event of a tunnel fire. 3. If there was sufficient source water (groundwater and stormwater) to charge the fire suppression tanks at the required rate in the event of a tunnel fire the size of the reverse osmosis plant would be so large as to be unfeasible. There would be nowhere to dispose of the solute generated by the plant. It is not feasible or reasonable to build a new deep ocean outlet from Rozelle to discharge the solute. Water drawn from fire water tanks during pump testing for in tunnel hydrant and deluge systems is designed to recirculate back into the tanks. Water used for deluge testing or actual firefighting that exits the contained system onto the roadway will be tested for treatment compatibility at the contaminated water holding tanks and either treated using the operational water treatment plant or tankered off-site to a licenced liquid waste facility.	9,000L per annum. 100% reuse for fire system pump tests.

Water Use	Reuse opportunity	Evaluation considerations	Approximate reuse quantity & proportion
Cleaning	• Tunnel architectural panel washing	The tunnel architectural panels are an off-white colour and provide reflectance of the overhead tunnel lighting, reducing the energy required to meet the specification lumen rating for the roadway. The panels require periodic cleaning with a truck mounted cleaner to remove soot and fine debris. As the Rozelle Interchange asset will form part of the WestConnex network the O&M Contractor may bring a tunnel wall washing truck from any part of the asset. There is the potential to run a pump line from the tunnel wall washing truck to the 20,000 rainwater tank at the Rozelle MOC, although this is not it's primary intent.	Water quantities will be dictated by the water efficiency of the O&M Contractors cleaning equipment used and frequency of cleaning.
	• Operational water treatment plant media filter washing	The operational water treatment plant used to treat tunnel water prior to discharge to the environment uses media filters to trap sediment that may not have been removed during the clarifier settlement treatment phase. Sediment trapped by the media filters needs to be regularly removed to prevent the filters blocking. Options considered included traditional backflushing and continuously washed up-flow filters. Backflushing involves taking the media filter offline; requiring either the water treatment plant to stop processing or installing additional diversion filters that can take the filtration load whilst the media filter is being backwashed. Additionally either a large tank is required to store clean treated water for backwashing or a connection to the mains can be used to supply clean water for washing. The Project has evaluated the issues associated with traditional backwash and sought to avoid these issues of redundancy and space constraints by implementing continuously washed up-flow media filters. This system will use treated tunnel water to continuously wash the media filters.	8,500,000L per annum assuming a tunnel groundwater inflow rate of 50% of condition of approval E190 requiring inflow not to exceed 1L/s/km. 100% reuse. 17,000,000L per annum if groundwater inflows at the rate of 1L/s/km in condition of approval E190. 100% reuse.

4.3 Details of preferred reuse options

Details of the preferred reuse options, including volumes of water to be reused, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required are addressed in Table 4-2;

Table 4-2 Details of preferred reuse options

Preferred reuse option	Details	Estimated volumes to be reused	Proposed reuse locations and/or activities	Proposed treatment (if required)	Additional licences or approvals that may be required
Rainwater for MOC bathroom toilets & urinals.	• Rainwater will be collected from the MOC roof. • Water will pass through leaf guards, coarse and fine mesh and a first flush process. • The rainwater will be stored in a 20,000L tank on the side of the MOC building. • A pump systems will supply the captured rainwater to toilet and urinal cisterns in the MOC bathroom.	Reuse quantity is based the motorway control centre being operated at design capacity. It is understood the O&M Contractor may utilise other WestConnex control centre facilities which would significantly reduce the number of staff at the Rozelle MOC and therefore the water demand. 283,000L per annum. 100% reuse (average Sydney rainfall) This is further reduced to 158,500L per annum with the installation of high efficiency toilets and urinals that have been identified in the sustainability in design workshops and incorporated into the asset design.	Location: Rozelle MOC, see Figure 2-2 Motorway Operations Centre.	Filtration prior to storage.	The system has been designed in accordance with AS3500 Plumbing and Drainage. No additional licences or approvals will be required.
Desalinated treated tunnel water for parkland irrigation.	• In an average rainfall year (rainfall determines irrigation demand) approximately 0.8% of the treated tunnel water will be pumped from the operational water treatment plant discharge line to a small reverse osmosis plant. • A very small reverse osmosis plant with capacity to treat 2,500L per hour will be installed to polish the treated tunnel water, removing most salts and metals, but leaving enough to simulate Sydney mains water.	The plant has been sized to supply all the irrigation water for asset, modelled at 6,000,000L per annum in an average rainfall year and 12,000,000L in a low rainfall year. There is capacity for additional supply for future identified uses such as irrigation of adjacent council playing fields or public amenities. Space has been provided in the treatment room for additional	Locations: • Planter boxes on the shared user path bridge connecting the Rozelle Bay Light Rail Station with the Project parklands • Vegetated green wall panels on the Rozelle ventilation outlets	A very small fraction of treated tunnel water will be intercepted prior to discharge to the environment and pumped to through a small reverse osmosis treatment plant. • Utilising discharge water from the operational treatment plant that has already been chemically treated and passed through media filters ensures a high quality of feed water for the reverse osmosis plant, minimising;	Solute from the process will be assessed in a operational environmental protection licence application along with all other discharge from the operational treatment plant. The semi-permeable membranes in the reverse osmosis process treat the irrigation water to levels suitable for

Preferred reuse option	Details	Estimated volumes to be reused	Proposed reuse locations and/or activities	Proposed treatment (if required)	Additional licences or approvals that may be required
	• The small capacity of the plant is balanced by situating it next to 170,000L irrigation water storage tanks that act as a buffer, allowing the tanks to partially drain quickly to meet the intermittent irrigation flow rates while slowly filling over the periods when the irrigation system is not watering the fields etc, with appropriate demand management. • The process has the benefit of providing a consistent supply irrigation water. Irrigation demand is highest during dry spells and droughts, when other reuse options such as captured rainwater or treated stormwater are not available. • The system is designed with a mains water connection to the irrigation water storage tanks to accommodate contingencies such as prolonged maintenance or water supply issues from the operational water treatment plant.	membranes and pumps to upscale the plant for future demand opportunities should this process prove strongly beneficial.	• New Rozelle parkland playing fields See Figure 2-3	– the number of membranes required, – energy to reverse the osmotic gradient and – maintenance from fouling of the membranes. • The small volume of solute, approximately 15% of the reverse osmosis plant flow rate is blended with the relatively high volume of treated water from the operational water treatment plant as it discharges to the environment. As the water processed came from the operational treatment plant discharge that meets discharge specifications the total amount of metals etc in the tiny volume of solute when blended with the large volume of operational treatment plant discharge water ensures the total discharge is still compliant and avoids environmental harm.	irrigation of public spaces. The process has been designed consistent with Guidelines for Water Recycling Stormwater Harvesting and Reuse 2009 developed by the combined Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, National Health and Medical Research Council Australian committee.

Preferred reuse option	Details	Estimated volumes to be reused	Proposed reuse locations and/or activities	Proposed treatment (if required)	Additional licences or approvals that may be required
Recirculation and capture of fire hydrant and deluge pump test water	• Water for asset fire systems is stored in multiple interconnected self-leveling tanks. • Water drawn from the tanks during pump testing is designed to recirculate back into the tanks enabling reuse.	9,000L per annum. 100% reuse for fire system pump tests.	Storage of water used for pump testing to be made available for reuse will be at the fire water storage tanks at the Rozelle MOC. See Figure 2-2. The reuse location will be throughout the hydrant and deluge ring circuit within the tunnels.	No treatment will be required.	No additional licences or approvals will be required. The system has been designed in accordance with AS 2118.3—2010 Automatic fire sprinkler systems Part 3: Deluge systems and AS 2419 Fire hydrant installations.
Operational water treatment plant media filter washing	• The operational water treatment plant multimedia filtration system features continuously washed up-flow filters (CWUF) installed for suspended solids/turbidity removal from the clarified water. • The CWUF filters are filled with filter sand during installation and come provided with an elevated access platform to reach the top of the filter. • The CWUF filter works on the upstream principle, raw water enters at the bottom of the filter and flows up through the sand bed where it is cleaned and then leaves through the outlet at the very top of the filter with solids remaining in the sand bed. • The contaminated sand is transported from the bottom of the cone by an air-lift pump to the sand washer at the top of the filter. Cleaning of the filter sand begins in the air-lift pump, in which the intense stirring action releases the dirt particles from the grains of sand. • The contaminated sand flows out of the pump outlet and drops down into	8,500,000L per annum assuming a tunnel groundwater inflow rate of 50% of condition of approval E190 requiring inflow not to exceed 1L/s/km. 100% reuse. 17,000,000L per annum if groundwater inflows at the rate of 1L/s/km in condition of approval E190. 100% reuse.	Location: Rozelle MOC, see Figure 2-2 Motorway Operations Centre.	The water used in the CWLF is physically and chemically treated by the operational water treatment plant.	No additional licences or approvals will be required, water recycled through the CWUF is recirculated through the operational water treatment plant for treatment and discharged in accordance with an operational environmental protection licence.

Preferred reuse option	Details	Estimated volumes to be reused	Proposed reuse locations and/or activities	Proposed treatment (if required)	Additional licences or approvals that may be required
	the washing labyrinth, where it is washed by a moderate flow of cleaned water. • The contaminants are entrained upwards to the washing water outlet. The grains of sand, which are heavier than the contaminants, drop down towards the sand bed which is thus in a constant state of downward movement through the filter. • The operation of the filter - both cleaning of the water and cleaning of the sand - is continuous and as a result, the filter never needs to be shut down which is highly important given the large flowrates. • The continuous backwashing of the CWUF filter system also reduces the need for a large treated water storage tank or mains water feed as feed water is used for backwashing of the filter system with the backwash wastes generated returned to the inlet balance tank for reprocessing. The continuous backwash cycle also eliminates large surges of raw water entering the balance tank.				

4.4 Time frame for the implementation of preferred reuse options

The following reuse options will be implemented prior to operation of the asset;

- Rainwater capture for MOC bathroom toilets & urinals.
- Desalination of treated tunnel water for parkland irrigation.
- Recirculation and capture of fire hydrant and deluge pump test water.
- Operational water treatment plant media filter washing.

5 Public health risks and agency advice

5.1 Public health risks

This Strategy has been developed to consider public health risks from water recycling and demonstrate how reused water will be managed to avoid misuse of recycled water as potable water. These issues are detailed in Table 5-1 Review of public health risks.

Table 5-1 Review of public health risks

Preferred reuse option	Public exposure	Measures to manage public health risks	Measures to avoid misuse of recycled water as potable
Rainwater for MOC bathroom toilets & urinals.	No, captured rainwater will be contained in a water tank at the MOC and in toilet and urinal cisterns.	• No public access • Rainwater contained in a water tank at the MOC and in toilet and urinal cisterns.	• Rainwater tank will only be connected to toilets and urinals in the MOC.
Desalinated treated tunnel water for parkland irrigation.	The public will not have access to the treatment system or irrigation water storage but secondary contact from irrigation is likely.	• No public access to the treatment system or irrigation water storage • Water will be filtered by semipermeable membranes to treat the water to a level suitable for irrigation of public spaces in accordance with Guidelines for Water Recycling Stormwater Harvesting and Reuse 2009 developed by the combined Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, National Health and Medical Research Council Australian committee.	• No public access to the treatment system or irrigation water storage • The irrigation tank will only be connected to the irrigation system. Water supply to parkland drinking water fountains, taps and amenities are on a sole connection system to the mains.
Recirculation and capture of fire hydrant and deluge pump test water	No, recirculated fire hydrant and deluge pump test water will be contained within the fire water storage tanks at the Rozelle MOC.	• No public access to the fire water storage tanks at the Rozelle MOC.	• No public access to the fire water storage tanks at the Rozelle MOC.
Operational water treatment plant media filter washing	No, treated tunnel water used for washing the media filters is contained with the operational water treatment plant at the Rozelle MOC.	• No public access to the operational water treatment plant.	• No public access to the operational water treatment plant.

5.2 Best practice and advice

The capture of rainwater for MOC bathroom toilets & urinals and recirculation and capture of fire hydrant and deluge pump test water is considered best practice in line with other recent major infrastructure in Sydney. Use of desalinated treated tunnel water for parkland irrigation and continuously washed up-flow media filters are considered industry leading initiatives with no known similar applications in infrastructure. These initiatives will provide valuable information for the optimisation of sustainability initiatives in future infrastructure projects.

The reuse of tunnel water for irrigation initiative and rainwater collection was communicated in a meeting with NSW Environment Protection Authority (EPA) on 3 November 2022. JHCPB sought feedback and requested information regarding any other initiatives that the EPA may be aware of which could be implemented at Rozelle Interchange.

The Western Parkland City Authority has reviewed the reuse of tunnel water for irrigation initiative and provided input into the design.

Transport for NSW has reviewed all initiatives as part of the design process.

6 Conclusion

This Operational Water Reuse Strategy has been developed in accordance with CoAE198 to detail the preferred operational water reuse options for WestConnex M4-M5 Link Stage 2 Rozelle Interchange. CoA E198 requires justification must be provided in the event that it is concluded that no reuse options prevail. As preferred reuse options have been identified and implemented this justification is not required.

These initiatives will provide valuable information for the optimisation of sustainability initiatives in future infrastructure projects.