Operational Water Reuse Strategy

M4-M5 Link Mainline Tunnels

February 2021

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Glossary/Abbreviations

Abbreviation	Expanded text
ASBJV	Acciona Samsung Bouygues Joint Venture (formerly LSBJV)
CDA	Chemical Delivery Area
CoA	Condition of Approval
CSSI	Critical State Significant Infrastructure
CWRS	Construction Water Reuse Strategy
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
ENSO	El Nino-Southern Oscillation
EPL	Environment Protection Licence
ER	Environmental Representative
GMP	Groundwater Management Plan
GWMP	Groundwater Monitoring Program
IOD	Indian Ocean Dipole
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
Kl	Kilolitre
LSBJV	Lendlease Samsung Bouygues Joint Venture
ML	Megalitre
MOCs	Motorway Operations Complexes
NSW	New South Wales
OWRS	Operational Water Reuse Strategy
Project, the	M4-M5 Link Mainline Tunnels
PRVF	Parramatta Road Ventilation Facility
REMMs	Revised Environmental Management Measures
RO	Reverse Osmosis
SMP	Sustainability Management Plan
TfNSW	Transport for NSW
WCX	WestConnex
WTP	Water Treatment Plant

Contents

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Approval and authorisation

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Version Control

Revision	Date	Description
Rev 0	02/10/20	Draft for WCX, TfNSW review
Rev 1	24/11/20	WCX and TfNSW comments addressed.
Rev 2	27/11/20	Typo error rectified
Rev 3	16/12/20	WCX and TfNSW comments addressed.
Rev 4	26/02/2021	DPIE comments addressed. Updated Ops WTP layout included in Figure 2

Internal review

	Name	Position	Date	Signed/Authorised
Author	[redacted]	Snr Environmental Coordinator	26/2/21	[redacted]
Review		Environment and Sustainability Manager	26/2/21	
Authorised		Project Director	26/2/21	

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 the WestConnex M4-M5 Link Mainline Tunnels (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 the preferred re-use options;
- Identify a timeframe for the implementation of the preferred reuse options.

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 24 June 2019.

1.2 Project Description

WestConnex (WCX) is one the NSW Government's key infrastructure projects which aims to ease congestion, create jobs and connect communities. The 33-kilometre WCX Motorway will link Sydney's west and south-west with the Sydney Central Business District, Sydney Airport and Port Botany (refer to). It comprises of four stages including: M4 Widening (Stage 1a); M4 East (Stage 1b); New M5 (Stage 2), and M4-M5 Link (Stage 3).

WCX is one component of an integrated solution to meet Sydney's growing transport and infrastructure needs and is consistent with NSW Government transport and planning policies and strategies. The project was declared by Ministerial Order to be State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (CSSI), under Section 5.12 (4) and Section 5.13 (previously referred to as 115U(4) and 115V prior to the amendment of the Environmental Planning and Assessment Act 1979 (EP&A Act)) as well as under clause 16 of the State Environmental Planning Policy (State and Regional Development) 2011.

The proponent for the project was Roads and Maritime Services (Roads and Maritime) who commissioned WCX Transurban to deliver WestConnex. On 1 December 2019, Roads and Maritime were dissolved, with all Roads and Maritime's functions, assets, rights and liabilities being transferred to Transport for NSW (TfNSW). TfNSW are now considered the Proponent.

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

Key features of the M4-M5 Link Tunnel include:

- Twin mainline motorway tunnels between the M4 East at Haberfield and the M8 (formerly known as New M5) at St Peters. Each tunnel would be around 7.5 kilometres long and accommodates up to four lanes of traffic in each direction.
- Entry and exit ramp connections between the mainline tunnels and the Wattle Street Interchange at Haberfield (constructed as part of the M4 East project)

- Entry and exit ramp connections between the mainline tunnels and the St Peters Interchange at St Peters (constructed as part of the New M5 project)
- Provision of tunnel stubs for future underground connection of mainline tunnels to the Rozelle Interchange and Iron Cove Link
- St Peters Interchange Facility (Campbell Road) (refer to Figure 1) including a substation to supply electricity to the tunnel; an operational water treatment plant; ventilation facility and outlets; offices; workshop and parking for employees.

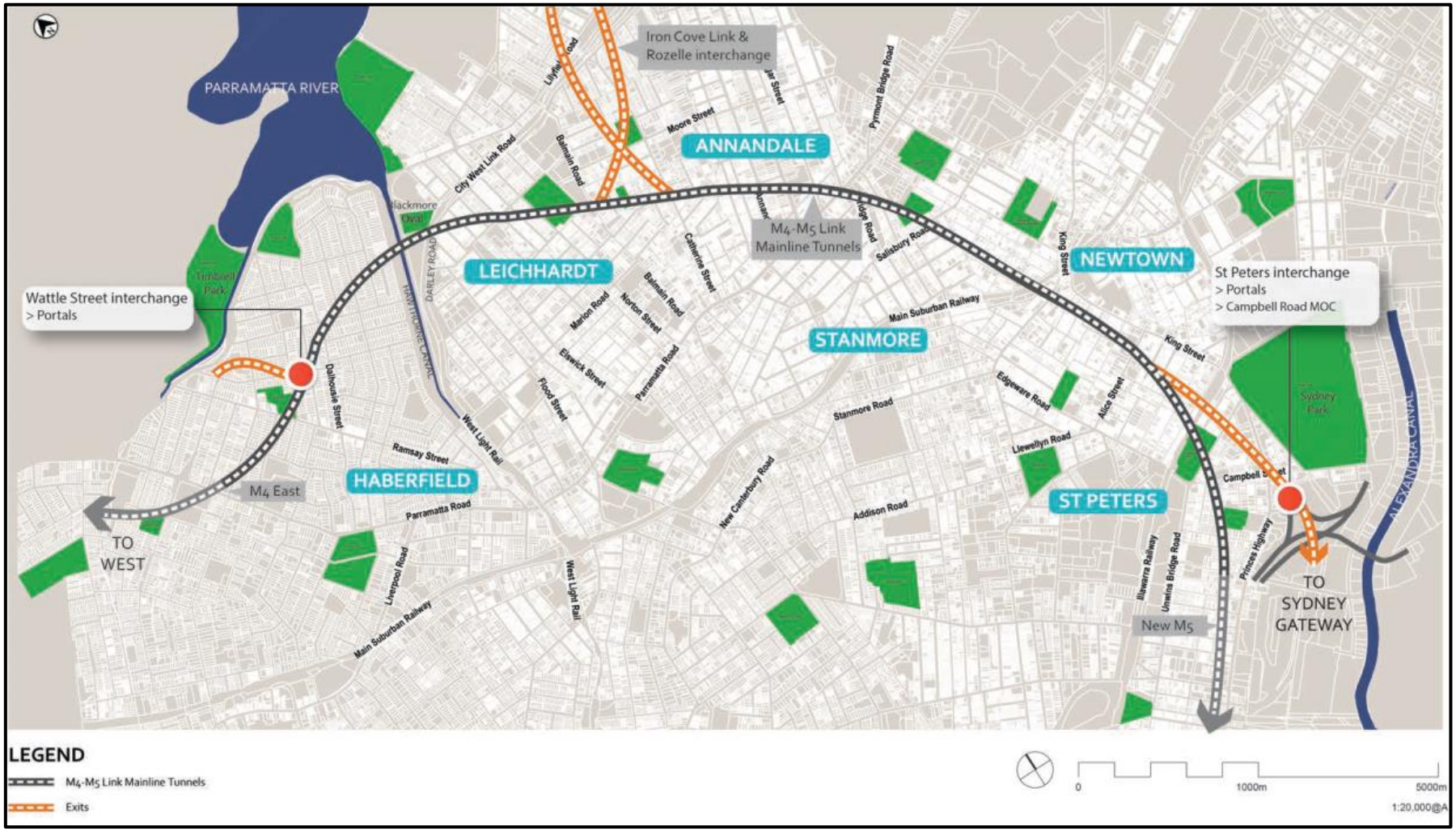

Figure 1 - M4-M5 Link Tunnel Overview

1.3 Scope

This OWRS addresses the water use requirements and reuse options for the operation phase of the Project, whilst also taking into account external factors which will impact the viability of each reuse option. It is focused on the reuse of groundwater and stormwater collected within the asset boundaries, and outlines the following information:

- Where and how water will be reused;
- Predicted volume of water to be reused;
- If any treatment is required;
- Licences and approval required;
- Timeframe for implementation;
- Public health risks and management.

This Strategy does not consider:

- Treatment and reuse of sewerage;
- Construction water reuse.

The OWRS will be submitted to the Secretary for approval at least six (6) months prior to the commencement of operation of the tunnel, as per CoA E198.

1.4 Operational Water Use and Reuse Requirements

1.4.1 The Environmental Impact Statement

Section 5.10.2 of the M4-M5 Link Environmental Impact Statement (EIS) estimated that the operation of the tunnel (including the Rozelle Interchange) would require approximately four megalitres (ML) of water per annum, for the purposes of:

1. Maintenance activities
2. Fire testing and suppression
3. Office use purposes at MOCs

Preference for the reuse of treated groundwater over discharge, is outlined in the EIS section 27.2.11. Suggested reuse opportunities include the use of the treated groundwater for landscape irrigation.

1.4.2 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 1.4-1.

Table 1.4-1 Compliance with CoA E198

CoA E198 Requirement	Reference	How Addressed
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 document	This OWRS has been prepared in accordance with this condition and describes the options for reuse of potable water, stormwater and ground water during the operational phase. The CWRS has previously been prepared and was approved in June 2019.
(a) evaluation of reuse options	Section 3.2	This Strategy evaluates each reuse option. The evaluation is summarised primarily in Section 3.2.
(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 3.2	This OWRS has been prepared to address the details listed in this condition, where required.
(c) a time frame for the implementation of the preferred reuse option(s).	Section 3	Preferred options are embedded into the design of water infrastructure, and therefore will be implemented from the commencement of and for the duration of operation.
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 1.55 Section 3.1.2 Section 3.2	Details regarding how ASBJV propose the public health risks are to be managed during the operation of the tunnel are described in this OWRS.
Justification must be provided in the event that it is concluded that no reuse options prevail.	N/A	Preferred reuse options have been outlined as described in this plan.

CoA E198 Requirement	Reference	How Addressed
A copy of the Water Reuse Strategy must be submitted to the Secretary for approval prior to commencement of tunnelling works. Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction and operational phases of the SSI. Where a separate Strategy is prepared for the operation of the SSI, this must be submitted to the Secretary for approval at least six months prior to the commencement of operation of the SSI.	Section 1.3	The CWRS was prepared and submitted in accordance with this condition in June 2019. This OWRS will be submitted in accordance of this condition.

1.4.3 Revised Environmental Mitigation Measures

In addition to the requirements of the CoA E198, this strategy has also been prepared in consideration of the revised environmental management measures (REMMs) outlined within the M4-M5 Link Tunnels Submissions and preferred infrastructure report (released 5th February 2018) refer to Table 1.4-2.

Table 1.4-2 - Revised Environmental Management Measures

REMM Reference	Requirement	Where Addressed
OpRW3	Opportunities to reuse treated groundwater during project operation will be considered in preference to discharge to receiving waterbodies. This could include irrigation of landscaped areas within the project footprint such as new open spaces at Rozelle Interchange.	The viability of reusing treated groundwater during the operation of the tunnel is outlined in Section 3. Note: The OWRS does not consider the reuse of treated groundwater for irrigation of the landscaped areas at the Rozelle Interchange. This evaluation will be included in the Rozelle Interchange OWRS.
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.	Section 3.1.3 describes why potable water must be used for the deluge system as opposed to raw or treated wastewater from the tunnel drainage system. Section 3.2 explains how the fire suppression tanks will not require topping up after the monthly pump tests are conducted.

1.5 Operation Objectives and Targets

1.5.1 Operational WTP Specification

CoA E187 and REMMs OSW16 outlines that the Operational WTP discharge criteria must comply with the ANZECC (2000) 95 per cent species protection level and a 99 per cent protection level for contaminants that bioaccumulate (refer to Table 1.5-1) unless other discharge criteria are agreed in consultation with relevant stakeholders including EPA, DPI Water and Sydney Water. Discharge criteria for iron during operation must comply with the ANZECC (2000) recreational water quality criteria.

Table 1.5-1 Operational WTP Discharge Criteria

Parameter	Unit	Required Water Quality (ANZECC)	Anticipated Tunnel Groundwater Quality * (first 30 years)
pH	pH unit	6.5 to 8.5	4.5 – 8.5
Turbidity	NTU	0.5 to 10	N/A
Total Dissolved Solids	mg/L	N/A	4,000 – 6,300
Electrical Conductivity	µS/cm	<50,000	6,000 – 9,400
Suspended Solids	mg/L	<50	4,000
Cadmium	mg/L	<0.0007	0 – 0.0002
Chromium (II+VI) [Cr(III) / Cr(VI)]	mg/L	<0.027 / 0.0044	0 – 0.01
Copper	mg/L	<0.0013	0 – 0.01
Lead	mg/L	<0.0044	0 – 0.01
Manganese	mg/L	<1.9	0 – 0.8
Mercury	mg/L	<0.0001	0 – 0.0001
Nickel	mg/L	<0.07	0 – 0.02
Zinc	mg/L	<0.015	0 – 0.1
Iron	mg/L	<0.3	20 - 30
Ammonia as N	mg/L	<0.91	20 - 40

* Prior to treatment by the Operational Water Treatment Plant and discharge to stormwater

1.5.2 Operation Groundwater Inflow

CoA E190, REMMs GW2 and section 19.4 of the EIS specifies that measures will be implemented to limit the operational groundwater inflows into each tunnel to no greater than one litre per second across any given kilometre (1L/s/km).

1.5.3 Operation Sustainability Objectives

In line with the WestConnex Sustainability Strategy and Policy, water-related sustainability objectives include:

- Implement processes to monitor and minimise material, energy and water use throughout the project life cycle
- Efficient resource use (energy, water, materials), avoiding and reducing waste and pollution
- Identify opportunities to reduce water use (in particular potable water use) and reuse water (e.g. rainwater, groundwater) during construction and operation.
- Reuse, recycle and reclaim water (e.g. storm water, wastewater, tunnel-inflow water) generated/collected.

1.5.4 Associated Plans and Reference Documents

- WestConnex M4-M5 Link Environmental Impact Statement (EIS)
- WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR)
- M4-M5 Link Mainline Tunnels Operational Environmental Management Plan (OEMP)
- M4-M5 Link Mainline Tunnels Sustainability Strategy
- M4-M5 Link Mainline Tunnels Groundwater Management Plan (GMP) for the OEMP
- M4-M5 Link Mainline Tunnels Groundwater Monitoring Program (GWMP) for the Operations Phase
- M4-M5 Link Mainline Tunnels Surface Water Monitoring Program for the Operations Phase
- M4-M5 Link Mainline Tunnels Urban Design and Landscape Management Plan
- Environment Protection Licence (EPL).

1.5.5 Best Practice and Advice

This Strategy has considered water use practices and advice from similar infrastructure projects in NSW such as the M4 East and the M8 projects. Advice from relevant agencies and other projects will be sought as required during the implementation of this Strategy.

Other factors such as economic feasibility; plant manufacturer and water quality specifications will require ongoing consideration.

2 Operational Phase Water Sources

The sources of water to be used throughout the operational phase of the tunnel can be classified into three categories: potable water; groundwater and stormwater. The volume of water used, recycled and discharged from the Operational WTP will be monitored and recorded throughout the life of the tunnel. The various uses of these three water types is described below.

2.1 Potable Water

As per Section 5.10.2 of the EIS the potable water supply to the MOCs will be from the Sydney Water mains feed and be used for domestic uses. The workshop and amenities building will be supplied potable water from the Sydney Water Corporations main water supply. The anticipated monthly consumption of potable water is 25kL. This is based upon the monthly usage of potable water for the site offices and crib sheds used during the construction phase of the project.

Washing down of plant and equipment; flushing of the tunnel drainage system and cleaning of the reflective panels will all involve the use of potable water. The anticipated volume of potable water used for these activities is subjective to the person washing the plant and equipment, and it being the responsibility of the operations and maintenance teams to determine the frequency of flushing to prevent any sludge build up.

Watering of the landscaped areas will also involve the use of potable water. As per the landscape maintenance design a total of 238.35kL is required to promote plant establishment during the maintenance period. It should be noted however, that the total volume is subject to the amount of replanting required and the intensity of the weather during the establishment period. The suitability of 'treated groundwater' for the above activities has been explored and is outlined in section 3.2.

In addition to office uses, potable water will be required for use during the operational phase of the tunnel for the dilution and mixing of the chemicals involved with the treatment of 'wastewater' or groundwater; permanent building air conditioning units; the safety eye wash, and shower. Sanitary drainage has been provided to the following buildings: the ventilation building; the workshop and the amenities building. Tundishes have been provided as required to collect mechanical heating, ventilation and air conditioning (MVAC) condensation and discharge from the low voltage (LV) room, high voltage (HV) rooms, UPS room and mobile room. The system drains via gravity to the Sydney Water Corporation sewer infrastructure network.

Prior to the handover of the tunnel for the operations phase, the two fire suppression tanks at Haberfield and the two tanks at St Peters Interchange are required to be filled with potable mains water, 4.402ML.

At the end of the first year of operation the same tanks are required to be drained, maintenance undertaken and serviced. Thereafter the tanks will be required to be refilled with potable water once more. This maintenance activity is required to be carried out every 10 years for the life of the tunnel and is estimated to use a total of 44.02ML over 100 years.

The fire deluge system is required to be tested on an annual basis and will use 0.024ML per test and will need to be replaced. This test is required to be carried out to ensure that the working capability of the deluge system. Overall, the fire suppression system is anticipated to use 55.248ML of potable mains water during the 100 years of tunnel operation.

Nonetheless it is important to note that within the permanent design of the fire suppression system there is an opportunity to save on potable water consumption.

The anticipated volume of water which will be saved over the lifetime of the tunnel operation and how this will be achieved according to the permanent design of the project, is further explained in section 3.2.

2.2 Groundwater

Similar to the construction phase of the tunnel, groundwater is anticipated to make its way from the water table into the tunnel during the operation phase and will be managed by the permanent design features such as strip drains; no-fines concrete; in-ground drainage; the low point sump and the operational WTP. No fines concrete allows the groundwater to pass underneath the permanent concrete pavement and drains into slotted drainpipes, eventually making its way into the in-ground drainpipes.

Refer to section 1.5.2 for maximum groundwater inflow rate.The installation and commissioning of a permanent operational WTP is included in M4-M5 Link Tunnels project and is located at the St Peters Interchange, south of the workshop and ventilation facility. The St Peters Operation WTP will treat the minor flow wastewater collected within the tunnel's two low point sumps (LPS) (located at St Peters and near Haberfield) prior to discharge into the Campbell Road drainage network and then to the Alexandria Canal. As the northern (Haberfield) LPS begins to fill up, the water is transferred to the southern (St Peters) LPS, and then into the balance tank at the WTP. The minor flow sumps installed in the tunnel are sized for groundwater flow, a 1-year ARI rainfall event and a 50m3 tanker spillage all concurrently without overflowing into the high flow sump. As per EIS section 5.10.3 water that is classified as wastewater includes stormwater that enters the tunnels via the on and off ramp portals; washdown water; water from the annual fire deluge testing, and fire hydrant water.

Section 3.2 evaluates the various options for treated ground water and wastewater reuse during the operation phase.

The high flow sumps are constructed to contain 20 minutes of the fire suppression system in operation, with the designed maximum deluge system zones and three hydrants operating concurrently.

2.3 Stormwater

The St Peters Interchange facility is considerably constrained for area and has been designed around the space requirements for the operational WTP, access requirements for staff and maintenance vehicles, and maintenance activities at the facility (ie. maintenance of ventilation fans or the removal of the substation transformers on skids).

Stormwater runoff from the car park and workshop facility drains via a pit and pipe network into the existing drainage infrastructure constructed as part of the NewM5 contract and flows into the operational water quality treatment earth basin (9.SWB.02) (constructed originally by the New M5 and augmented by ASBJV). The rainwater collected from the Ventilation building roof will also be connected to the same NewM5 drainage system. Drainage from the New M5 On-Ramp into the Campbell Road tunnel portal will be collected in the New M5 gateway pump station and will not be connected to the WTP.

Spill containment has been provided in the WTP around the chemical delivery area (CDA) in the form of a bunded bay. The bay provides access for a rigid delivery vehicle to pick up / deliver to the chemical stores and will contain approximately 9000L of spill. This is in accordance with the Sydney Water Guidelines Chemical Dosing Unit Standard Specification (ACP0002 29.102018). All chemical dosing lines on site have double containment and leak detection. A stop valve has been provided downstream of the CDA to contain spills prior to entering the main line drainage. Any spill captured in the bunded area will be treated on-site or removed for off-site disposal.

In addition to the bunded CDA, a water quality tank is installed to capture the first flush runoff from the WTP and immediately adjacent surrounds (ARI 1-year, 36m3). The water held in this first flush tank is pumped to the WTP at approximately 5L/s for treatment prior to release. Whilst a clean water diversion channel (constructed under the NewM5 contract) has been installed to intercept external surface flows and prevent them from entering the facility.

The viability of stormwater retention and reuse during the operation phase of the tunnel has been investigated and is outlined in section 3.2.

3 Evaluation and Selection of Preferred Water Reuse Options

3.1 Considerations for Water Reuse

3.1.1 NSW drought and Climate Change

It is noted in the EIS Appendix X 'Climate Change Risk Assessment Framework' that rainfall in Australia is highly variable, spatially and temporally, being influence by local processes such as the El Nino-Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). Studies indicate a decline in the average rainfall of 10 to 20 per cent in south-eastern Australia between April to September. The decline, which in some areas can be seen throughout the entire century, corresponds with increasing greenhouse gases and ozone depletion causing changes in the frequency and impact of the ENSO and IOD.

Considering this context, ASBJV throughout the design of the project was committed to promoting the reduction of potable water consumption and identifying opportunities to reuse water.

3.1.2 Public health risks

Section 2.1, describes the recycling of water as part of the maintenance regime for the fire suppression system. At the time of this strategy being written, it was the only activity anticipated to involve the reuse of water. The fire deluge system is not accessible to the public and therefore does not pose a public health risk. There will be no risk of the public misusing recycled water as potable water.

3.1.3 Quality and Australian Standards

As per the Australian Standard, AS 2419.1: 2017 potential water sources in a fire suppression system (ie. includes both fire hydrants and the fire deluge system) can include reticulated water supply system; river, reservoir, lake, dam or sea; or stored rainwater. The water quality however is required to be compatible with the materials of the fire hydrant system, and suitable for the long-term operation of the system as well as for human contact (includes drinking).Therefore, to prevent corrosion from occurring and to reduce the risk of a reduction in the design life of the system, the fire suppression tanks must be filled with potable water.

AS 2419.1: 2017 also states that where an on-site water storage tank(s) is part of the fire hydrant system, the system shall be designed so that water used for commissioning and maintenance testing is capable of being returned to the water storage tank(s).

3.1.4 Water Balance

The balance of water quality and availability are the two essential factors influencing the decision of including water reuse options within the permanent design of the St Peters Interchange Facility

and the operation of the tunnel. Water supplied, consumed and recycled during operation phase of the tunnel, will follow the water cycle schematic as per Figure 2 below.

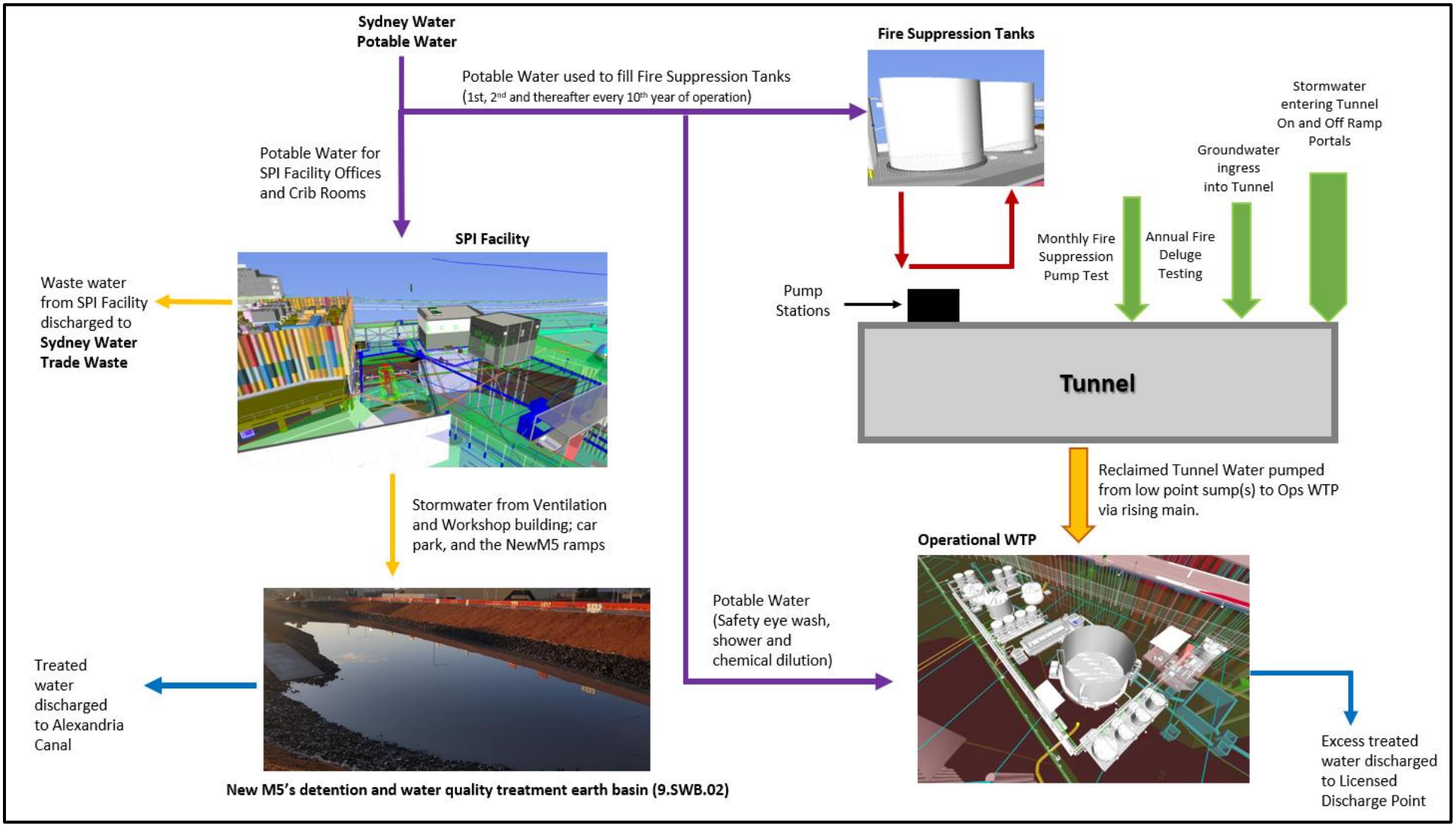

Figure 2 - Operation Phase Water Cycle

3.2 Evaluation of Reuse Options

During the design phase of the project, an Environmental and Sustainability compliance register was developed and embedded into the permanent design development process and workflow to ensure compliance with the Project's contract, CoAs (Conditions of Approval 1.4.2); REMMs (section 1.4.3) and RMS standards. Table 3.2-1 below details the water minimisation and reuse options that were discussed during this phase, and their evaluation taking into account the above consideration (section 3.1). As well as the estimated water consumption and reuse volume.

Note: during the operation of the tunnel it may become apparent that these strategies can be further improved. An example of this is outlined in Section 3.2: Table 5.

Table 3.2-1 Reuse Option(s) Evaluation for the M4-M5 Link Tunnel

<table>
<tr><th>Water Source</th><th>Reuse Options</th><th>Evaluation and Reasonable Considerations</th><th>Estimated Reuse Volume</th></tr>
<tr><td>Fire Suppression System – Water Recycling</td><td>Monthly Deluge and Hydrant Pump Test</td><td>As outlined in section 2.1 the maintenance regime of the Fire Suppression system over 100 years of operation will use 55.25ML of potable water. However, in line with AS 2419.1:2017 the system has been designed to return the potable water, required for the monthly deluge and hydrant pump test, back to the fire suppression tanks. Thus, offering the greatest opportunity to reuse water during the operation of the tunnel.

Each month the full water supply performance of the deluge pump is tested with a Ø250mm full flow annubar. The discharge again from the annubar is directed to the suppression tanks. Likewise, the hydrant system pump performance is measured once a month through a Ø150mm annubar test facility. The</td><td>
<table>
<tr><th colspan="6">Monthly Pump Test
Vol. of Water Recirculated</th></tr>
<tr><th>Monthly (ML)</th><th>1st Year</th><th>10th Year</th><th>25th Year</th><th>50th Year</th><th>100th Year</th></tr>
<tr><td>0.6</td><td>7.2</td><td>72</td><td>180</td><td>360</td><td>720</td></tr>
</table>
</td></tr>
</table>

Water Source	Reuse Options	Evaluation and Reasonable Considerations	Estimated Reuse Volume
		discharge again from the annubar is directed to the suppression tanks to allow recirculation of the water. During the first year of tunnel operation the estimated potable water usage (office and crib room use plus potable water required for the fire suppression tank's first and second refill) is greater than the volume of non-potable water reused during the monthly testing of the pumps. However, this changes and by the 10th year of operation it is predicted that 86% of water used in the maintenance of the fire suppression will be recycled. At 100 years, the percentage of non-potable water that has been used and recirculated back to the tanks increases to 90% (720ML) of total water used, whilst potable water accounts for only 10% (80.8ML).	
	Fire Detection	Other times water is recirculated back to the suppression tanks during the operation of the tunnel, includes when fire is detected inside of the tunnel. If the linear heat detector identifies fire in the tunnel, one of the two (closest) pump stations is activated whilst the tunnel operator is alerted. If the operator confirms the activation, or fails to confirm after 3 minutes, the deluge valve will be opened, and water will flow over the road pavement. If confirmed as negative, the pump will shut down. This system prevents the potential wastage of water. If a fire is detected in the tunnel, water can be supplied for a continuous 2 hours and to achieve this both pump stations (PRVF and SPI) will be required.	N/A

Water Source	Reuse Options	Evaluation and Reasonable Considerations	Estimated Reuse Volume
		Upon low level water alert at the operating pump station, a signal will be sent to the primary pump at the remote pump station to start via the Fire System. Both primary pumps will operate concurrently for a short duration of time. It is during this time excess water is recirculated back to the tanks via the pressure relief lines, thus preventing over-pressurisation of the system and excessive water loss. The contaminated water from the fire suppression will be tested after an event to determine if it can be treated via the WTP. Alternatively, the water may be contaminated to a level that the WTP cannot treat the water and would require disposal from either the LPS or the surface holding tank via tankers to licenced liquid waste disposal locations.	
Treated Groundwater – Operational WTP	Emergency Deluge System & Washing of Plant/Equipment	As previously outlined in section 2.1 and section 3.1.3 the permanent fire suppression system of the M4-M5 Link Tunnel has been designed in compliance against AS 2419.1:2017. As per the Australian Drinking Water Guidelines, EC should not exceed 937 µS/cm to ensure the potable water is palatable. If the EC exceeds 1,800 µS/cm, scaling and corrosion may start to form. Some materials used may be even more sensitive and start to corrode at a lower EC. The treated water from Operational WTP is forecasted to be highly saline (EC 6000-9400 µS/cm) due to infiltration of water from Hawthorne Canal (refer to Table 1.5-1).	N/A

		The only feasible solution to remove salt from influent streams is the inclusion of a Reverse Osmosis (RO) unit as part of the Operational WTP. This option was investigated however, it was determined to not be a reasonable solution. Reasons for this conclusion, include: (1) The anticipated EC of the groundwater is less than the discharge criteria for the Operations WTP, 50,000 µS/cm. (2) Whilst total dissolved solids (TDS) do not have to be removed from the treated groundwater prior to stormwater discharge, there is a limit for the TDS concentration in the by-product from the RO discharged to trade waste. Due to this limit and the anticipated high level of TDS, more than half of the water would be rejected and discharged to trade waste. (3) The RO process is not an efficient or sustainable solution as it also requires a high energy consumption. As a result, a media filtration system was identified as the most feasible and reasonable method of treatment for the tunnel wastewater. Although it does not reduce the salinity of the water. The water therefore is not suitable for reuse in the deluge system as it would have a negative impact on the pipework and other tunnel equipment and reduce the design life of the fire suppression system. For the same reason, the treated saline water is not suitable to flush the tunnel drainage system for the prevention of iron oxide build-up and removal of iron	

Water Source	Reuse Options	Evaluation and Reasonable Considerations	Estimated Reuse Volume
		bacteria sludge. Wash down of plant and equipment, and to clean the reflective panels installed inside of the tunnel.	
	Landscape Irrigation	Select species have been specified from the UDLP planting schedule. Key features of these species include hardiness; low water use and maintenance, as well as their contribution to an integrated urban design outcome for landscaping providing continuity with the adjacent New M5 planting scheme. As stated above the EC of the WTP treated water is anticipated to range between 6000 and 9400 µS/cm. Whilst the plant species as part of the landscaping do have some tolerance for saline water, EC content higher than 2,500µS/cm is too high to avoid salt damage and stress. High salt levels not only will impact the plants health but also the integrity of the soil ie. crusting on the surface, reduced infiltration and restricted subsoil drainage and root development. Therefore, the reuse of the WTP's treated water for landscape irrigation is not a viable option due to the elevated salinity levels.	N/A

Water Source	Reuse Options	Evaluation and Reasonable Considerations	Estimated Reuse Volume
Stormwater	Washing of Plant / Equipment and Landscape Irrigation	The reuse of harvested rainfall during the operation of the St Peters Interchange facility presents three main challenges: (1) the reliability of supply; (2) the location of the rainwater tank(s) inside of the facility, (3) and human and environmental health risk. Stormwater is a highly variable water source and cannot be depended upon to consistently provide adequate volumes of water. As described above drought tolerant native plants have been selected as per the M4-M5 Urban Design and Landscape Plan (UDLP). As discussed in section 2.3, and highlighted in the M4-M5 Link Tunnels UDLP, the St Peters Interchange Facility is extremely constrained for space. Due to the constrained nature of the site, there is no space inside the facility that is available for rainwater tank(s). Dependent on where the stormwater has been collected from, the water can be contaminated with either metals, oils, grease and faecal coliforms These contaminants pose both a human and environmental health risk if the water was left untreated prior to washing down plant and equipment or for landscape irrigation purposes.	N/A

4 Monitoring and Reporting

4.1 The Operational Environmental Management Plan, Subplans and Monitoring Programs

Monitoring will be undertaken in accordance with the OEMP and the Surface Water Quality Plan and Monitoring Program, and the Groundwater Management Plan and Monitoring Program (CoA D1, D3 and D8). The information obtained from the monitoring will demonstrate how the operation of the M4-M5 Link Tunnel has performance regarding impact on the environment and surrounding local community.

As part of the Operational Groundwater Monitoring Program the daily volume of treated water discharged from the St Peters Interchange Operational WTP will be documented as well as the water quality test results of the treated water (CoA D11). This information will be collated and provided to Sydney Water every three months (CoA D11(f)) to demonstrate the Operational WTP compliance with its Environment Protection Licence (EPL) discharge criteria (refer to Table 1.5-1). The total volume of treated water discharged to Alexandria Canal is also to be reported on an annual basis to the DPIE for a minimum of five years (CoA D11(g)).

4.2 Annual Sustainability Report

Throughout the operations life the Tunnel Operator is to prepare an annual Sustainability Report which tracks the compliance of the tunnel's operating activities with sustainability commitments, objectives, targets and requirements. This document is to be made publicly available and is to be submitted within three months of the end of the yearly reporting period to senior management and the TfNSW representative at the time.

It is also noted that the Tunnel Operator must monitor and record during the operation of the tunnel:

(1) Volume of water consumed (potable and non-potable)

(2) Volume of water reused

(3) Volume of treated and harvested

5 Licences and Approvals

The St Peters Interchange Operational WTP will operate under an EPL. The operation of the WTP is considered to be a scheduled activity outlined in the Protection of the Environment Operations Act 1997 (POEO Act). Where required, a trade waste agreement may be set up with Sydney Water.

6 Conclusion

The Operational Water Reuse Strategy outlines how the permanent design of the M4-M5 Link Tunnel has incorporated features which will reduce the consumption of potable water throughout the life of the tunnel and promote the reuse of non-potable water. At the time of completion and handover of the project to the operational phase, the water reuse options will be in operation.

As per section 3.2 these features include:

- Water efficient fixtures and fitting in the St Peters Interchange workshop and amenities building;
- Recycling fire suppression water during the monthly deluge and fire hydrant pump testing; and
- Re-circulation of fire suppression water prior to Operator activation and changing of pump station during a fire inside the tunnel.