Decision Report

Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade (December 2025)

Sydney WATER

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1 Introduction

The proposal involves upgrading the wastewater treatment process at Quakers Hill Water Resource Recovery Facility (WRRF) by increasing treatment capacity and improving treatment performance through:

- modifying and adding wastewater treatment processes at Quakers Hill WRRF
- constructing a new 500 mm diameter brine pipeline about 8 km long between the WRRF and our existing wastewater network in Seven Hills.

All infrastructure except the brine pipeline will be located within the existing Quakers Hill WRRF site. The WRRF site at 240 Quakers Road (Lot 1, DP 1029672) is owned by Sydney Water. The brine pipeline will be built primarily on public land, with some sections tunnelled beneath private properties. The proposal is in the Blacktown Local Government Area (LGA).

The objectives of the proposal are to:

- service growth and support the NSW Government's housing strategy
- protect waterway health through continued environment protection licence (EPL) compliance within Breakfast Creek and the Sackville 2 subzone of the Hawkesbury Nepean River catchment.

Sydney Water placed the Quakers Hill WRRF Advanced Treatment Upgrade Review of Environmental Factors (REF) on public exhibition from 7 October to 21 October 2025. Community and stakeholders were invited to comment.

This decision report:

- outlines our consideration of 2 submissions received during public exhibition
- identifies if proposal changes and/or new mitigation measures are needed to address the comments raised
- recommends whether Sydney Water should proceed with the proposal.

Following approval of the REF, Sydney Water has completed further analysis of growth forecasts and Environment Protection Licence (EPL) compliance. As a result, staged delivery of the advanced water treatment plant (AWTP) is proposed. Section 4 describes and justifies the change. The change has been driven by analysis of growth forecasts and EPL compliance modelling. However, it also has benefits including:

- saving capital expenditure which can be used for other priority Sydney Water projects in the short-term
- allowing design of future stages to suit the next roll out of EPL and Hawkesbury Nepean Nutrient Framework limits.

Section 5 includes additional assessment of the proposal change.

1.1 Summary of the original proposal

The key elements of the original proposal described in the REF are listed in Table 1-1 and shown in Figure 1-1.

Table 1-1 Summary of the proposal detailed in the REF

Aspect	Key proposal elements
Existing modifications and ancillary infrastructure	Infilling two existing Intermittently Decanted Aerated Lagoons (IDALs), and modifying existing treatment plant components such as tanks, pumps, chemical storage, site services, electrical and automation components. The nature of modification required depends on the asset, but could include retrofitting connections, cut-ins, reuse, demolition, or the addition of structures. Ancillary infrastructure will also be built to support the secondary wastewater treatment upgrade and AWTP. This includes connecting pipelines, valves and isolation points, safety equipment, electricity cables, utility conduits, site lighting and internal roads.
Secondary wastewater treatment	Building and installing new infrastructure to expand and upgrade the existing secondary wastewater treatment. New infrastructure will include bioreactors, pumps, screens, odour control units and buildings such as a switch room and blower room.
Advanced water treatment	Constructing an advanced water treatment plant (AWTP). New infrastructure will include buildings for ultrafiltration, reverse osmosis, enhanced treatment, a switch room, a workshop and a laboratory, as well as a range of outside structures such as tanks and pumps.
Brine pipeline	Installing about 8 km of new pipeline between the WRRF and the Northern Suburbs Ocean Outfall Sewer (NSOOS) in Seven Hills, to transport brine produced by the new AWTP. The brine pipeline will mainly be underground. A new barometric loop, about 12 m high and 2.5 m wide, at Billy Goat Hill Reserve in Blacktown will be the main above-ground infrastructure outside the Quakers Hill WRRF.

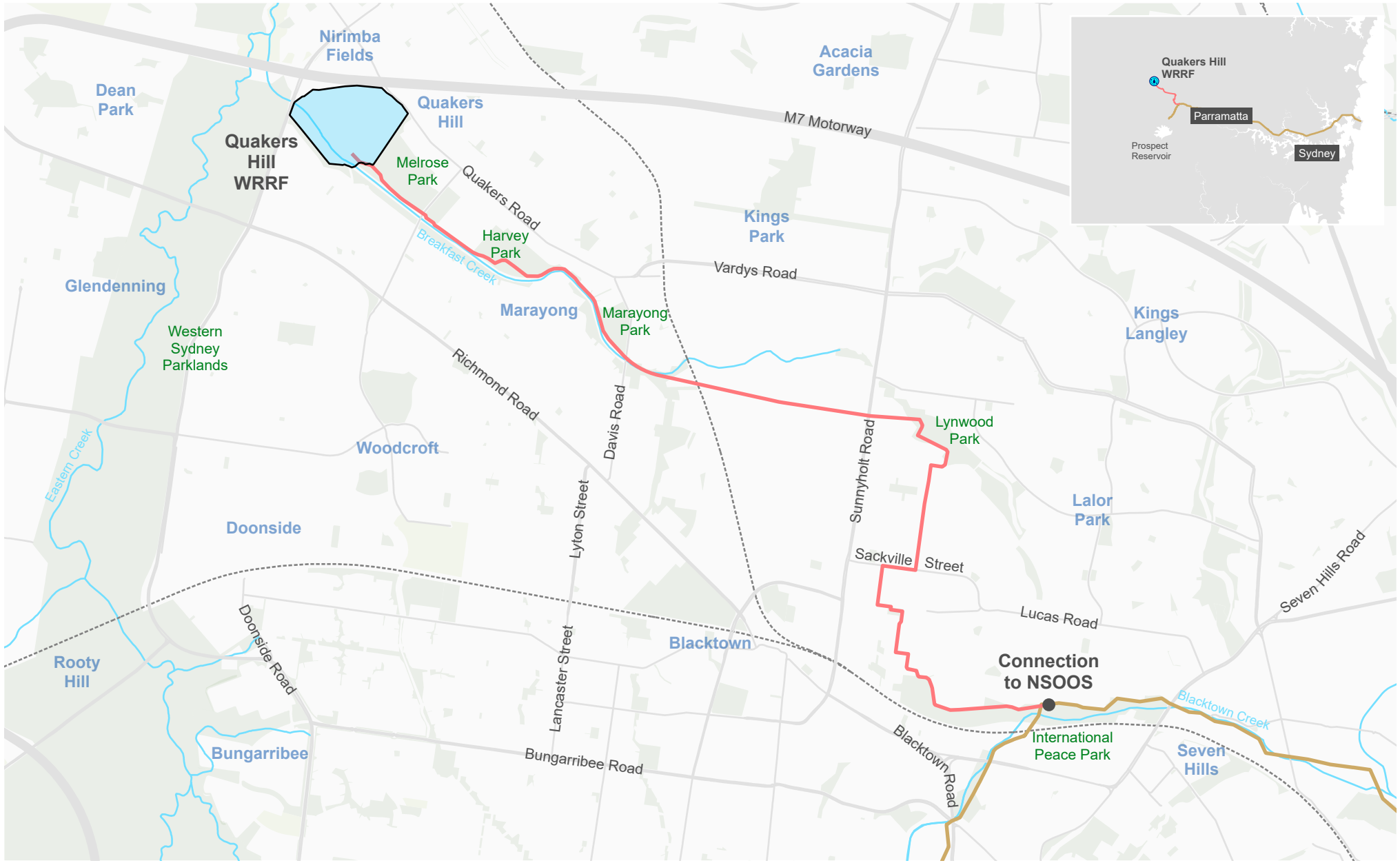

Figure 1-1 Proposal location

Data sources: State of NSW (Spatial Services), NSW Department of Planning and Environment
Basemap: MetroMap 2025
Scale: 1:35,000 @ A4
GDA2020 MGA Zone 56

2 Consultation

This section summarises Sydney Water's consultation with community members and stakeholders.

2.1 Proposal development and REF preparation

Community and stakeholder engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in our activities.

Stakeholders were identified during preparation of the REF. These included special interest groups and government agencies, such as those to be consulted in accordance with the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP). Meetings have been held with these stakeholders since March 2024. Details of the consultation carried out up to September 2025 and the key outcomes are provided in section 4 of the REF.

Engagement with community members specifically for the proposal has been ongoing since 29 September 2025, when letterbox drops were undertaken providing information about the REF public exhibition. Prior community engagement regarding the proposal was combined with another Sydney Water project, 'Securing our water supply – Quakers Hill to Prospect'. This previous campaign of community engagement started in August 2024.

Community consultation activities during the proposal development included:

- setting up a free community information line (1800 172 263), Sydney Water website and email
- distributing a community update brochure within and around the proposal's impact area (and placing it on the Sydney Water website)
- holding meetings with community members who may have infrastructure located on their property to discuss the planning process
- door-knocking of properties within and near to the brine pipeline impact area. The purpose was to discuss the proposal with residents potentially affected by construction activities and new infrastructure
- running community information sessions to explain the proposal, the approval process and anticipated delivery timeframe.

2.2 REF public exhibition

The REF was on public exhibition on the Sydney Water website from 7 to 21 October 2025 (Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade REF). A summary document was also made available on the Sydney Water website. The proposal website provided information and encouraged readers to lodge submissions via an online feedback form, linked to a proposal-specific Sydney Water email account.

About 2 weeks before REF public exhibition, we mailed a 4-page notification about the proposal directly to nearby residents.. A total of 11,174 notices were distributed. The notice informed residents about the exhibition and community information sessions, and how to make submissions on the REF.

Community information sessions were held during the public exhibition period on:

- 8 October 2025, on the corner of Flushcombe Road and Main Street between 2.30pm – 6.00pm
- 11 October 2025, on the corner of Muru Way and Main Street between 9.30am – 2.30pm.

Both community consultation sessions were well attended, with about 103 conversations regarding the proposal. Information materials included:

- printed copies of the REF summary document
- information display panels
- project map.

Conversations about the proposal were largely positive, with support expressed for the high quality of water and curiosity around water education and literacy. No negative comments relating to the proposal were received.

Copies of the REF were distributed by email directly to stakeholders including:

- Blacktown City Council
- NSW Environment Protection Authority (EPA).

The deadline for submissions was 21 October 2025.

2.3 Submissions

Two email submissions were received during the REF public exhibition. One was from Blacktown City Council and the other from the EPA. Section 3 provides Sydney Water's response to these submissions. No calls or letters were received regarding the proposal during the REF public exhibition period.

2.4 Future consultation

We are committed to engaging with the community and stakeholders. Sydney Water staff and contractors will consult throughout detailed design, construction, and operation. This will ensure that the community and stakeholders remain informed and that we understand their comments and concerns.

We will revise and implement the Community and Stakeholder Engagement Plan (CSEP) for future phases of the proposal, in line with our community and stakeholder engagement policy.

The contractor, in consultation with Sydney Water, will keep the community informed throughout construction as well as manage issues and complaints. After commissioning, our standard policies and procedures for customer and community relations will apply.

3 Submissions

This decision report responds to 2 submissions received on the proposal. The submissions are provided in full in Appendix A and are considered below. The relevant text from each submission has been reproduced exactly as it was provided to Sydney Water. In accordance with the *Privacy and Personal Information Protection Act 1998*, addresses have been omitted.

Sydney Water considers that the matters raised in these submissions can be effectively managed without any changes to proposal scope or the need for additional mitigation measures.

3.1 Blacktown City Council

Table 3-1 summarises the comments raised in Blacktown City Council's submission and Sydney Water's response.

Table 3-1 Comments raised in Blacktown City Council submissions and our response

Submission	Sydney Water response
Council supports Sydney Water continuing to consult with us on the design details and construction program. Council also advises Sydney Water to provide detailed documentation and Work-as-Executed (WAE) plans of the proposed works for our future reference. Ensure that Sydney Water restores the existing sites to their original condition and provides routine maintenance, including mowing and cleaning of the fenced compound area.	Once construction of the proposal is completed and Works-as-Executed plans are available, Sydney Water will provide these to Council. Sydney Water is committed to restoring affected land outside of its premises to original condition, as outlined in the mitigation measures in Table 6-46 in the REF. These measures include the development and implementation of a Restoration Plan. The Restoration Plan would include specific commitments to remove all equipment and materials from site, repair / replace pavements with new, and replace street trees, vegetation and turf removed during construction where possible (or otherwise identify other opportunities to reduce impacts on landscape character and visual amenity of streets). We will also maintain compounds in public areas during construction to a clean and tidy state, before restoration starts. It is expected that future maintenance of public land will be undertaken by Council.
Council welcomes Sydney Water's contribution to tree offsets and site restoration where possible. Proposed contributions may also include: • Tree planting along the shared path	A mitigation measure in Table 6-29 of the REF requires the offsetting of any vegetation impacts from the proposal in accordance with the Sydney Water *Biodiversity Offset Guide.* Sydney Water's Biodiversity Offset Guide requires consultation with landowners such as Council.

Submission	Sydney Water response
• Removal of the existing post and rail fencing and replacement with tree planting along the park frontage at Billy Goat Reserve to improve accessibility • Supply and installation of park seating along the new easement area for community use *Please contact Blacktown City Council's Recreation Planning and Design team to confirm the proposed locations.* It is agreed that any easements should not exclude public access to public land. Additionally, new Sydney Water easements should not prevent future embellishment works within the easement areas, such as tree planting, pathway construction, or the installation of park furniture. Sydney Water should consider pipeline depth and materials that enable future park embellishment works to be carried out within the easements. These easements should not restrict minor landscape works such as tree planting, pathway and park furniture in the future.	Mitigation measures in Table 6-46 require the implementation of a Restoration Plan as discussed above. We will continue to engage with Council on opportunities for biodiversity offsets on Council land. There are currently no new Sydney Water easements proposed for assets outside of the Quakers Hill WRRF. Sydney Water must be consulted on embellishment works directly over pipelines. Details on the approvals required to build or dig near our pipeline assets can be found on the 'Building over or next to assets webpage' (https://www.sydneywater.com.au/plumbing-building-developing/building/building-over-or-next-to-assets.html) and in the supporting '*Technical guidelines: Building over and adjacent to pipe assets*'. In choosing suitable species for replanting near our pipelines, the mitigation measure in Table 6-29 of the REF requires referral to the '*Which trees can damage wastewater pipes?*' on Sydney Water's website https://www.sydneywater.com.au/plumbing-building-developing/plumbing/wastewater-blockages.html#trees. This document would also be relevant for any future planting proposed by Council.
A minimum offset ratio of 2:1 should apply to any tree removals, meaning two new trees must be planted for every tree removed as a minimum. For offset tree planting, Sydney Water must ensure that all trees are planted in a minimum 100-litre container size and are subject to a 12-month maintenance period to ensure successful establishment. The final planting locations, species selection, and associated details are to be discussed and agreed upon with Council. Blacktown City Council also requests confirmation of the total number of trees proposed for removal, as well as the number and location of replacement trees to be planted under this project, for data collection and record-keeping purposes.	Formal offsets are not required for this project under the Biodiversity Conservation Act 2016 (BC Act), so Sydney Water's non-statutory Biodiversity Offset Guide will be followed. Table 6-27 of the REF outlines Sydney Water's offset requirements for impacts to different types of biodiversity features. This includes offset ratios (for moderate impact > 0.01 ha) of: • 3:1 - Threatened Ecological Communities • 2:1 - Non-threatened native vegetation (e.g. native remnant, riparian or planted native vegetation) • 1:1 - tree removal (non-locally native or exotic tree). The Biodiversity Offset Guide requires offsets to be maintained for a defined period (at least 18

Submission	Sydney Water response
	months) to ensure successful establishment, weeding and plant replacement as needed. Another mitigation measure included in Table 6-29 of the REF requires the tracking of vegetation clearing in accordance with SWEMS0015.26, which captures a requirement to record: • total number of trees or total PCT area removed • the tree species or PCT cleared • if the vegetation is exotic, invasive, non-local natives or local native species. Sydney Water is unable to confirm the total number of trees proposed for removal at this time, or the number of replacement trees. We will continue to engage with Council during the detailed design and construction and share these details, once known. We will discuss and agree the location and species selection with Council in advance of any planting on Council land.
The metallic surface of the barometric loop may reflect heat and glare onto surrounding properties. Sydney Water should consider applying a protective coating or using alternative materials that minimise heat absorption and reflection. The structure should be designed to be robust and unclimbable, eliminating the need for additional fencing, which can increase visual clutter and maintenance requirements. New tree planting and screen planting should be incorporated in this area to provide shade, visual screening, and enhance overall amenity. Removal of the existing post and rail fencing and replacement with tree planting along the park frontage at Billy Goat Reserve to improve accessibility.	Sydney Water has discussed the potential for different design finishes for the barometric loop that could enhance the visual aesthetic through reducing reflection and glare from the structure. A mitigation measure in Table 6-46 of the REF includes potential impacts to mitigate visual impacts, including: • implementing screen planting including trees along the road corridor or adjacent the barometric loop • using a light-coloured non-reflective finish • considering the use of public art as part of the barometric loop design to improve visual amenity and interest. The structure would be designed to be unclimbable where possible. However, fencing around the structure is also essential for both the safety of the public and to deter vandalism. Sydney Water would be responsible for maintaining the fence.

Submission	Sydney Water response
Sydney Water is to provide evidence of support from both local residents and Blacktown City Council for the proposed works. (*Sydney Water notes this comment is in reference to the REF statement that there was general support from Blacktown City Council and residents for painting the barometric loop once it is built or considering opportunities for incorporating public art to reduce visual amenity impacts*).	Representatives from our community engagement team completed door-knocking in the proposal impact area to canvass opinions on the proposal, particularly regarding the barometric loop at Billy Goat Hill Reserve. Nearby residents expressed support for the project and provided their views on the barometric loop. One resident actively welcomed its installation, confirming this would address their dissatisfaction with plans for a basketball court to be installed in its place. Another expressed concerns about vandalism but welcomed suggestions of painting the structure or adding a mural to make it more visually appealing. Sydney Water met with Council on 5 February, 26 February and 16 April 2025 and discussed the barometric loop. Minutes from the 5 February meeting note that Blacktown City Council were receptive to suggestions to integrate the barometric loop within the landscape through painting, public art, etc. Council also expressed the proposal should try not to exclude any open space activities. The minutes of the 16 April meeting note further discussion on the opportunities for painting the barometric loop and the various options explored by Sydney Water, and engagement undertaken with the local community.

3.2 NSW Environment Protection Authority

Table 3-2 summarises the comments raised in the EPA's submission and how we have addressed their comments.

Table 3-2 Comments raised in the EPA's submissions and our response

Submission	Sydney Water response
Operations	
While it is stated that the proposal is expected to result in an overall improvement of waterway health and ecology, the EPA notes that the proposal will increase the impervious areas discharging runoff to Breakfast Creek potentially increasing pollutant loads to the creek, and	Sydney Water confirms we are considering the items listed in the EPA's submission. These measures are included in section 6.3.4.2 of the REF and will be further considered during detailed design.

Submission	Sydney Water response
that Sydney Water is considering the following to mitigate this: • incorporating a first flush system in the AWTP; and/or • a water quality basin; and/or • a gross pollutant trap with cartridge filtration. The options chosen are expected to reduce impacts to existing levels.	
The EPA notes that the Sackville 2 Subzone (under the Hawkesbury Nepean Nutrient Management Framework) is modelled to continue to exceed the Phosphorus nutrient load limit for the Hawkesbury Nepean River from Sydney Water's wastewater treatment plants. Quakers Hill WRRF is compliant with its EPL discharge limits and the EPA understands that Sydney Water is currently investigating opportunities to reduce nutrients at Riverstone WRRF as well as to obtain nutrient load offsets through bank remediation projects. The EPA will continue to engage with Sydney Water on this important regulatory framework.	Sydney Water confirms the EPA's understanding that we are exploring opportunities to reduce nutrient loads and concentrations at other WRRFs in the Sackville 2 Subzone (such as Riverstone WRRF) and considering obtaining nutrient load offsets through bank remediation. Sydney Water will continue to consult with the EPA on this framework.
The EPA notes that in the modelled results for median water quality, all indicators are expected to be lower than existing releases, except for total suspended solids, total iron, and filtered aluminium which are elevated due to the need for lime dosing of the reverse osmosis permeate to reduce total phosphorus and meet EPL discharge concentration limits. While some modelled indicators exceeded the guideline values, concentrations are below prescribed EPL limits.	Sydney Water confirms the EPA's interpretation of the results presented in the REF is correct. This is also captured in a mitigation measure in Table 6-12 of the REF. This measure requires Sydney Water to maintain treated water release quality in compliance with the EPL and to continue water quality monitoring in accordance with the conditions of the EPL.
The EPA notes that during operation of the upgrade, solids will be concentrated and transferred to St Marys WRRF for biogas production. Biogas derived from anaerobic digestion of wastewater treatment is considered an Eligible Waste Fuel. Please consider if Sydney Water will need to apply for a resource recovery and exemption in accordance with Part 4 of the Eligible Waste Fuel Guidelines (https://www.epa.nsw.gov.au/sites/default/files/22p3822-eligible-waste-fuels.pdf).	The process of concentrating solids and transferring them from Quakers Hill WRRF to St Marys WRRF occurs under existing operating conditions. Therefore, the operation of St Marys WRRF will remain unchanged as a result of the proposal. St Marys WRRF operates a cogeneration facility that uses biogas produced from anaerobic digestion to fuel a combined heat and power system. The facility operates under EPL 1729, which includes condition P1.4 requiring air emission

Submission	Sydney Water response
	monitoring from the cogeneration exhaust stacks. Biogas is listed as an eligible waste fuel under the EPA's *Eligible Waste Fuel Guidelines 2022.* However, the NSW *Energy from Waste Policy 2021* and *Protection of the Environment Operations (General) Regulation 2022* exclude biological processes, such as anaerobic digestion, from the definition of thermal treatment. These policies and guidelines apply only to thermally treated waste-derived materials. Therefore, it is understood that the *Eligible Waste Fuel Guidelines 2022* do not apply in this case, and a resource recovery and exemption is not required.
Construction	
The EPA notes that three sediment basins are proposed be installed during construction to collect sediment-laden runoff from the disturbed areas. The EPA recognises the efforts made by Sydney Water in selecting pipeline alignments to minimise impacts on human health and the environment.	Sydney Water confirms our proposed approach to sediment basins as noted in the EPA's submission. As outlined in Table 6-12 of the REF, the location and details of all water quality controls (including but not limited to temporary sediment basins) will be considered further during pre-construction to align with any detailed design changes. Any changes should achieve equivalent outcomes to those proposed in the REF.
The EPA notes and agrees that noise impacts expected to nearby sensitive receivers can be managed. Sydney Water proposes the following mitigation measures: • Select equipment with lowest possible noise emissions and use noise reduction features • Identify and address intrusive noise characteristics • Install noise barriers around noisy machinery where practicable • Identify where noisy work can be reduced • Provide advance notice to affected residents	Sydney Water confirms our proposed approach to managing noise impacts as noted in the EPA's submission. These mitigation measures are captured in Table 6-37 of the REF and will be included in the construction environmental management plan.

Submission	Sydney Water response
• Revise noise modelling before starting tunnelling • Justify all work occurring out of regular hours.	
The EPA notes and agrees that Sydney Water will prevent nuisance dust impacts to nearby sensitive receivers during construction through the following proposed mitigation measures: • Covering exposed areas • Modify or cease work in windy conditions as necessary • Modifications of site layout as necessary • Vegetate exposed areas • Cover transported waste • Limit speed on unsealed access routes • Apply odour suppressing agents.	Sydney Water confirms our proposed approach to managing dust impacts as noted in the EPA's submission. These mitigation measures are captured in Table 6-38 of the REF and will be included in the construction air quality management plan.
The EPA notes and agrees that to ensure odours from the upgraded plant do not materially differ from existing operations the facility would need to redirect emissions from the existing pump station vents via the new odour control unit. The EPA would appreciate being kept informed of decision making around this opportunity, acknowledging that it is not part of the proposal scope and instead is a separate operational project.	Sydney Water will keep the EPA informed of decision-making on odour control systems being progressed separately to the proposal.
Asbestos The EPA notes that there is a Waste Management Plan being prepared, additionally, there is planned to be infilling using material stockpiled at the site, some of which is known to contain asbestos. It is anticipated that a long-term environmental management plan for the management of this material will be necessary in these circumstances.	A mitigation measure is included in Table 6-3 of the REF to develop a Contaminated Land Management Plan (CLMP), specifically for the long-term management of asbestos containing material (used as fill for the proposal). The CLMP will be prepared in accordance with the EPA's Consultants reporting on contaminated land guidelines (2020) and the supporting practice note on preparing environmental management plans for contaminated land (2022). Another mitigation measure in Table 6-3 commits to preparing an asbestos management plan before works start, to manage asbestos containing material during construction.

4 Proposal changes

This section describes the changes made to the proposal described in the REF. The proposal changes described in this section have been identified from Sydney Water's further investigation and are not in response to the submissions received.

4.1 Description of change

Following approval of the REF, Sydney Water has completed further analysis of growth forecasts and Environment Protection Licence (EPL) compliance.

A staged delivery of the AWTP is proposed to meet the compliance obligations for the Sackville 2 subzone of the Hawkesbury Nepean Nutrient Management Framework EPL requirements, and better align infrastructure delivery with growth forecasts. The proposed stages are:

- Stage 1: Install 20 ML/day capacity AWTP by 2030
- Stage 2: Upgrade AWTP capacity to 48 ML/day by 2036.

Outside of proposal scope, Sydney Water also proposes nutrient load offsets to further manage the Hawkesbury Nepean Nutrient Management Framework limits. For example, this could include river bank remediation.

The proposal change relates to the program for delivery of the AWTP component of the proposal only. All earthworks and civil works are expected to be completed in stage 1. Construction of stage 2 of the AWTP would take about 2.5 years starting in 2031 and would include mainly mechanical and electrical works. The physical footprint and scope of the proposal, and the timeframes for delivering other components of the proposal, remain the same as described in the REF. Table 4-1 presents the expected stage of delivery for each component of the proposal.

Table 4-1 Staging of the proposal's components under the changed delivery approach

Component	Stage 1 (2030)	Stage 2 (2036)
Existing modifications and ancillary infrastructure	Fully completed and operational	Fully operational under stage 1
Secondary wastewater treatment	Full capacity installed and operational	Fully operational under stage 1
Advanced water treatment	Part installed and operational to provide 20 ML/day treatment capacity	Fully installed and operational to provide 48 ML/day treatment capacity
Brine pipeline	Full capacity installed and operational	Fully operational under Stage 1

4.1.1 Future flows

Due to the reduced capacity of the AWTP under stage 1, the volume of treated water released to Breakfast Creek and brine transferred to the NSOOS by 2030 will differ to those considered within the REF. With less water undergoing advanced treatment, the quantity of brine produced decreases, while the proportion of tertiary treated water increases. This increase in tertiary treated water results in greater treated water releases to Breakfast Creek compared to the REF assumptions. The flows considered in the REF would be achieved in 2036 under stage 2.

Table 4-2 shows the change in the volume of treated water released to Breakfast Creek and brine transferred to the NSOOS by 2030. The volume of inflow, sludge and wastewater transfers to St Marys WRRF, and recycled water transfers to Stonecutters Golf Course for all flow scenarios would remain unchanged from the REF.

Table 4-2 Change in Quakers Hill AWTP flow scenarios (ML/d) by 2030

Flow scenario	Releases to Breakfast Creek		Transfer of brine to NSOOS[1]	
	REF	Stage 1	REF	Stage 1
Average dry weather flow (ADWF)	34	40	5 – 7	3
Peak dry weather flow (1.6x ADWF)	61	69	10	4
Moderate wet weather flow (3x ADWF)	140	136[2]	0	0[2]
Peak wet weather flow (6x ADWF)	284	284	0	0

Notes:

1 This does not include existing dry weather St Marys AWTP brine transfers to NSOOS from Quakers Hill WRRF, which are typically around 10 ML/d

2 Brine (around 4ML/d) will be stored in the Quakers Hill WRRF brine storage ponds

Figure 4-1 illustrates the proposed treatment process at Quakers Hill WRRF (pale blue boxes) under the ADWF flow scenario for stage 1.

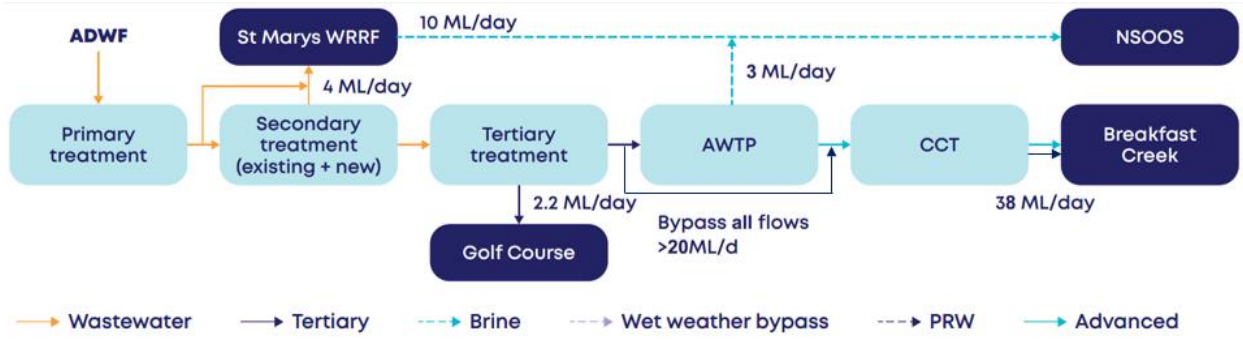

Figure 4-1 ADWF treatment flow diagram under stage 1

4.1.2 Treated water quality

The reduced capacity of the AWTP in stage 1 would also change the treatment quality in 2030, compared to what has been assessed in the REF. In stage 1, volumes above 20 ML/day would receive only tertiary treatment (not advanced treatment) before release to Breakfast Creek as discussed in section 4.1.1.

The change in treatment quality for flows above 20 ML/day would alter the indicative concentrations of the water quality parameters for treated water released to Breakfast Creek. Concentrations presented in the REF will be realised in 2036 following completion of stage 2.

The concentrations of water quality parameters in stage 1 under different flow scenarios are presented in Table 4-3.

Table 4-3 Indicative concentration of water quality released to Breakfast Creek for different treatment levels in stage 1

Parameter	Units	Advanced & tertiary treatment		Tertiary treatment	
		ADWF 50th percentile	ADWF 90th percentile	3x ADWF	6x ADWF
Physical parameters					
Total suspended solids (TSS)	mg/L	1.39	3.88	4.99	10.90
Nutrients and metals					
Total nitrogen (TN)	mg/L as N	1.91	2.74	4.30	4.27
Nitrogen Oxides	mg/L as N	1.08	1.97	3.90	1.92
Nitrogen (Ammonia)	mg/L as N	0.03	0.13	2.28	2.28
Total phosphorus (TP)	mg/L as P	0.04	0.08	0.62	0.67
Soluble Reactive Phosphorus	mg/L as P	0.04	0.08	0.31	0.34
Aluminium (filtered)	mg/L	0.07	0.14	0.23	0.16
Cobalt	µg/L	0.34	0.65	0.24	0.15
Copper	µg/L	1.84	3.34	11.65	8.36
Nickel	µg/L	1.50	2.07	1.06	0.66

Parameter	Units	Advanced & tertiary treatment		Tertiary treatment	
		ADWF 50th percentile	ADWF 90th percentile	3x ADWF	6x ADWF
Zinc	µg/L	15.10	22.20	22.26	15.11

4.2 Justification for change

Following further investigation by Sydney Water, the proposal change is justified for the following reasons:

- Installation of the full capacity by 2030 may risk over-servicing wastewater treatment needed in the short term.
- The staged approach defers capital expenditure and reduces operational expenditure and carbon associated with a larger AWTP. The capital expenditure saving can be used for other priority Sydney Water projects needed in the short-term.
- A deferred approach allows Sydney Water to align the design and treatment capacity to suit the next rollout of EPL and Hawkesbury Nepean Nutrient Management Framework limits (Stage 2 and Phase 2).
- Modelling of the reduced AWTP capacity by 2030, indicates that the Sackville 2 subzone is expected to remain near compliant, with potential for minor exceedances depending on the frequency of future wet years and population growth in the catchment.
- Sydney Water expects the EPA to permit non-infrastructure measures (extreme wet weather licence variations and nutrient offsets), which would resolve these minor exceedances and enable compliance to 2036.

Section 5 assesses additional environmental impacts from the proposal changes.

5 Environmental assessment of the proposal changes

This section assesses potential environmental impacts of the proposal changes detailed in section 4. The focus is on impacts associated with construction and operation at Quakers Hill WRRF and operation of the brine pipeline. Impacts from brine pipeline construction would be the same as assessed in the REF.

Consistent with the REF, the decision report is prepared under Division 5.1 of *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority. The proposal does not require development consent and is not classified as State significant infrastructure.

The Sydney Water Project Manager is accountable to ensure the proposal is carried out as described in this decision report and the REF. If the proposal or methodology described in this decision report or REF change significantly following determination, additional environmental impact assessment may be required.

5.1 Consultation following proposal changes

As the proposal change involves no additional infrastructure or change in impact area from the REF, no new community members would be affected. As a result we have not undertaken any additional community consultation on the proposal change.

At the Sydney Water and EPA Joint Operations Meeting on 12 November 2025, Sydney Water noted that initially, some treated water releases from Quakers Hill WRRF would not receive advanced treatment. Sydney Water has since confirmed this with the EPA by email and offered a meeting to discuss further.

5.2 Legislative requirements

There are no additional legislative requirements to those already assessed in the REF. The legislative requirements noted in the REF are relevant to the proposal change and the proposal remains consistent with the assessment in the REF.

5.3 Environmental impacts

This section assesses the potential environmental impacts of the proposal change.

5.3.1 Surface water and aquatic ecology

Appendix D includes the surface water and aquatic ecology assessment addendum completed for the proposal change. This section summarises key findings of that assessment.

The proposal change is related to how the AWTP will operate. This means construction impacts associated with the proposal remain unchanged from those assessed in the REF. Construction during stage 2 would include electrical and mechanical work, so potential for further impacts to surface water quality or aquatic ecology are unlikely.

Brine concentrations will remain unchanged from those assessed in the REF. However, the volume produced in stage 1 will be lower due to the reduction in water receiving advanced treatment, as discussed in section 4.1.1.

Treated water releases

As discussed in section 4.1.2, the reduced capacity of the AWTP under stage 1 would change the treatment quality in 2030, compared to what has been assessed in the REF. However, the overall quality will be better than the existing treated water releases. The concentrations presented in the REF would be achieved in 2036.

This section compares the treated water quality to be released under stage 1, with the existing releases and modelled treated water releases from the REF. It focuses on the indicators that exceed existing treated water quality and/or guideline values. All other indicators will be higher quality in the proposed releases and/or meet guideline values, and Appendix D tabulates the results for these.

ADWF median water quality

Table 5-1 presents the average dry weather flow (ADWF) median (50th percentile) concentrations that exceed existing treated water quality and / or guideline values.

Table 5-1 ADWF 50th percentile indicators that exceed existing and / or guideline concentrations

Indicator	Existing ADWF 50th Percentile	REF Modelled ADWF 50th Percentile	Stage 1 Modelled ADWF 50th Percentile	EPL 50th Percentile	Guideline
Total nitrogen (mg/L)	**4.71**	0.35	**1.91**	6	1.72[1]
Oxidised nitrogen (mg/L)	**3.38**	0.22	**1.08**	N/A	0.66[1]
Soluble reactive phosphorus (mg/L)	0.03	0.01	**0.04**	N/A	0.04[1]
Filtered aluminium (mg/L)	**0.07**	**0.08**	**0.07**	0.12[4]	0.055[2]
Cadmium (ug/L)	0.15	0.14	**0.16**	0.2[4]	0.2[2]
Copper (ug/L)	3.00	0.04	**1.84**	5[4]	1.4[2]

Indicator	Existing ADWF 50th Percentile	REF Modelled ADWF 50th Percentile	Stage 1 Modelled ADWF 50th Percentile	EPL 50th Percentile	Guideline
Total iron (mg/L)	0.05	**0.07**	**0.05**	N/A	0.3[3]
Zinc (ug/L)	**21.00**	5.23	**15.1**	N/A	8[2]

Notes: Blue numbers exceed existing but not guideline concentrations, orange numbers exceed guideline values. There is no 50th percentile EPL limit for aluminium, value is the average limit

1 DPE (2022 Performance Criteria)

2 ANZG (2018) toxicant guidelines for 95% species protection. Aluminium guideline specified for pH > 6.5

3 ANZECC & ARMCANZ (2000) interim guideline

4 Average concentration limit

The modelled results show that under stage 1:

- all indicators will be lower than the existing releases, except for soluble reactive phosphorus (SRP), filtered aluminium, cadmium and total iron. As noted in the REF, these are slightly higher due to the need for lime dosing of the reverse osmosis permeate, to reduce total phosphorus and meet EPL concentration limits. The modelling has also taken a conservative approach regarding the breakdown of total reactive phosphorus to SRP and assumed that all phosphorus in the treated water release is SRP
- all indicators except for total nitrogen, oxidised nitrogen, filtered aluminium, copper, total iron and zinc will meet the recommended guideline limits for Breakfast Creek
- for indicators that have EPL concentration limits, all of these will be lower than the EPL limit.

Stage 2 concentrations are the same as the concentrations in the REF. Therefore, analysis of median ADWF concentrations for stage 2 are as presented in the REF. When comparing the stage 1 modelled ADWF median concentrations to the REF median concentrations, all indicators except for filtered aluminium and total iron are expected to increase. This is due to the reduction in flows receiving advanced treatment.

ADWF 90th percentile water quality

Table 5-2 presents the ADWF 90th percentile concentrations that exceed existing treated water quality and / or guideline values.

Table 5-2 ADWF 90th percentile indicators that exceed existing and / or guideline concentrations

Indicator	Existing ADWF 90th Percentile	REF Modelled ADWF 90th Percentile	Stage 1 Modelled ADWF 90th Percentile	EPL 90th Percentile	Guideline
Ammonia (mg/L as N)	0.49	**0.10**	**0.13**	1.4	0.08[1] / 0.9[2]
Total nitrogen (mg/L)	**6.31**	0.75	**2.74**	6[4]	1.72[1]
Oxidised nitrogen (mg/L)	**5.13**	0.45	**1.97**	N/A	0.66[1]
Soluble reactive phosphorus (mg/L)	**0.10**	0.004	**0.08**	N/A	0.04[1]
Filtered aluminium (mg/L)	**0.10**	**0.10**	**0.14**	0.19	0.055[2]
Chromium (µg/L)	**1.09**	**1.74**	**1.48**	4	1[2]
Copper (µg/L)	**4.22**	**1.97**	**3.34**	6	1.4[2]
Total iron (mg/L)	0.07	**0.28**	**0.09**	N/A	0.3[3]
Zinc (µg/L)	**30.00**	**14.41**	**22.20**	41	8[2]

Notes: Blue numbers exceed existing but not guideline concentrations, orange numbers exceed guideline value.

1 DPE (2022 Performance Criteria)

2 ANZG (2018) toxicant guidelines for 95% species protection. Aluminium guideline specified for pH > 6.5

3 ANZECC & ARMCANZ (2000) interim guideline

4 50th percentile limit

The modelled results show that under stage 1:

- indicators will be lower than the existing releases, except for filtered aluminium, total iron and chromium
- total iron is higher than existing but will comply with the ANZECC & ARMCANZ (2000) interim guideline
- ammonia will exceed recommended DPE (2022) performance criteria but will comply with the ANZG (2018) toxicant guideline
- total nitrogen, oxidised nitrogen and SRP will exceed DPE (2022) performance criteria, however all are lower than those in the existing releases
- copper and zinc will exceed the ANZG (2018) toxicant guideline, however both are lower than those in the existing releases
- consistent with the REF, filtered aluminium concentrations would exceed the ANZG (2018) guideline and ammonia concentration would exceed the DPE (2022) performance criteria

- chromium is higher than existing and will exceed the ANZG (2018) toxicant guidelines for the ADWF 90th percentile
- all indicators (as applicable) will be lower than EPL concentration limits.

Stage 2 concentrations are the same as the concentrations in the REF. Therefore, analysis of ADWF 90th percentile concentrations for stage 2 are as presented in the REF. When comparing the stage 2 modelled ADWF 90th percentile concentrations to the REF ADWF 90th percentile concentrations, all indicators except for chromium, filtered and total iron are expected to increase.

3x ADWF and 6x ADWF

Consistent with the REF, the modelled results for stage 1 show that all nutrient species will exceed the recommended guidelines and median background concentrations during wet weather. Although Sydney Water does not monitor the quality of treated water releases in these wet weather flow events, the additional treatment to be implemented by the proposal means that the quality of these releases is expected to improve compared with existing releases.

Analysis of results

Consistent with the REF, minor increases in filtered aluminium, total cadmium, and iron, are attributable to the reverse osmosis permeate through lime dosing. These increases are not anticipated to adversely affect aquatic ecosystems within Breakfast Creek, as the modelled cadmium and iron concentrations remain below ANZG (2018) guideline values. While aluminium is slightly above the ANZG (2018) limit, it is still lower than the existing concentrations in Breakfast Creek.

Ammonia concentrations that exceed guideline values at the 90th percentile and during wet weather have the potential to lead to eutrophication and algal blooms. Given the low likelihood of these scenarios, the higher ammonia concentrations are unlikely to cause these events.

As noted in the REF, the guideline value for chromium is specific to hexavalent chromium (chromium VI) while the modelled concentrations are for total chromium. Total chromium includes trivalent (chromium III) and hexavalent chromium. Trivalent chromium is generally less toxic to aquatic life than hexavalent chromium. The use of a coagulant (ferric chloride or aluminium sulphate) as part of the treatment process is expected to reduce hexavalent chromium in the effluent to trivalent chromium. As a result, risk to aquatic life from chromium is anticipated to be much lower than indicated by the concentration.

The results for median and ADWF 90th percentile concentrations for the project change show that while some modelled indicators exceed the corresponding guideline values, these are similar to the existing releases, and modelled concentrations are all below the EPL limits. Consistent with the findings in the REF, the projected releases under the proposal change are unlikely to degrade existing water quality in Breakfast Creek and Eastern Creek, as improved treatment will reduce overall pollutant concentrations compared to current conditions.

Given the result of the additional assessment undertaken, no new mitigation measures beyond those identified within the REF are deemed necessary.

5.3.2 Compliance with the Hawkesbury Nepean Nutrient Framework

As discussed in section 6.3.4.1 of the REF, Quakers Hill WRRF discharges into the Sackville 2 Subzone under the Hawkesbury Nepean Nutrient Framework. Quakers Hill, Riverstone, and St Marys WRRFs, along with the Upper South Creek AWRC, share a common 'bubble' licence load limit in the Sackville 2 subzone.

Changes to the nutrient loads of the Sackville 2 subzone as a result of the proposal change have been considered. The following tables capture the results of the REF with the results of updated modelling for stage 1. Table 5-3 shows the modelled nutrient load limits for total nitrogen and total phosphorus in the Sackville 2 subzone for dry and wet years.

Table 5-3 Dry and wet year performance against future (2036) nutrient load limits Sackville 2 subzone under the stage 1 scenario compared to REF

Performance	Total Nitrogen (kg/yr)		Total Phosphorus (kg/yr)	
	REF	Stage 1	REF	Stage 1
Dry year	76,895	97,252	1,647	2,348
Wet year	109,248	130,583	4,294	4,503
Sackville 2 subzone limit (effective 1 July 2025)	**126,000**	**126,000**	**2,710**	**2,710**

The Sackville 2 subzone load limits are also required to be met over a 5-year rolling average. As loads vary during dry and wet years, representative scenarios demonstrating what this may look like are presented in Table 5-4.

Table 5-4 Example 5-year rolling average performance under the stage 1 scenario compared to the REF

Performance	Total Nitrogen (kg/yr)		Total Phosphorus (kg/yr)	
	REF	Stage 1	REF	Stage 1
2 dry years + 3 wet years	96,307	117,251	3,235	3,641
3 dry years + 2 wet years	89,836	110,584	2,706	3,210
4 dry years + 1 wet year	83,365	103,918	2,176	2,779
Sackville 2 subzone limit (effective 1 July 2025)	**126,000**	**126,000**	**2,710**	**2,710**

Consistent with the REF, the stage 1 results indicate that total nitrogen and total phosphorus compliance will be achieved during dry years once the proposal is operational. Both are predicted

to exceed the load limit during wet years. The increase in total nitrogen during wet years would only exceed the 5-year rolling average if there are 5 consecutive wet years.

As stated in the REF, Sydney Water is investigating further opportunities to reduce nutrients at Riverstone WRRF and to obtain nutrient load offsets through river bank remediation to comply with the load limits. As also noted, nutrient reduction through offsets presents an opportunity that may reduce the flows requiring treatment through the AWTP.

Concentration limits for total nitrogen and total phosphorus are also captured in the Quakers Hill WRRF EPL. Consistent with the REF, all modelled concentrations are predicted to be below the EPL limits.

5.3.3 Hydrology and geomorphology

Appendix E includes a hydrology and geomorphology technical note assessing the proposal change. This section summarises key findings of that assessment. The assessment applied the same relevant legislation, policy, guidelines and assessment methodology as described in the REF.

The flow volumes to Breakfast Creek assessed in the REF were about 10% less than the existing releases. As noted in the REF, although the volume of flows to be treated at Quakers Hill WRRF would increase under the proposal, some of the treated water byproduct will be transferred to the brine pipeline, which means not all flows are transferred to Breakfast Creek.

Flows to Breakfast Creek in stage 1 of the proposal change will increase by about 4 ML/day from an existing 35 ML/day to 40 ML/day as discussed in section 4.1.1. The resulting change in the hydrologic and hydraulic metrics across Breakfast Creek and Eastern Creek is minor, except for the duration of fresh events within Breakfast Creek. The average duration of Breakfast Creek fresh flow events (75^{th} flow percentile) is modelled to almost double from existing despite a small reduction in event frequency. This could lead to increased sediment mobilisation and erosion. It is noted that fresh events and associated sediment mobilisation help create and maintain diverse habitat, with the potential benefits for aquatic ecology.

The changes in the hydrologic and hydraulic metrics across Breakfast Creek and Eastern Creek from stage 1 are considered minor, and the associated risks are low during the operation phase. The potential risk to ecological values of Breakfast Creek is also considered low. The fresh flow frequency and duration metric for Breakfast Creek is considered to have a medium risk. However, as stage 1 represents an interim period expected to operate for about 6 years, this is unlikely to result in long-term channel erosion.

During the operational phase, the most likely geomorphic impact to Breakfast Creek and Eastern Creek is the potential for increased movement of bed sediment within the waterways, resulting from minor increases in the average fresh flow event duration. The likelihood of geomorphic change in Breakfast Creek and Eastern Creek is the same as assessed in the REF.

A mitigation measure in Table 6-13 of the REF requires us to undertake ad-hoc visual monitoring for bed siltation and bank slumping following extended periods of dry weather flow conditions, for up to 2 years after construction. This measure is expected to address any residual risks and assess potential increases in erosion along the creeks.

Construction and operational impacts for the brine pipeline and ancillary infrastructure for stage 1 remain as assessed in the REF.

5.3.4 Other aspects

Potential changes in construction and operational impacts from the proposal change for other environmental aspects are considered in Table 5-5. The changes discussed only apply to Quakers Hill WRRF, as the proposal change is associated with the AWTP and does not apply to the brine pipeline. The potential impacts of stage 2 are the same as those assessed in the REF.

Table 5-5 Identification of potential change in environmental impacts from proposal change

Aspect	Potential impacts	Mitigation measures
Soils and contamination	The proposal change is located within the impact area assessed in the REF. There is no change in construction area, methodology and equipment. Most or all civil work will be completed during construction of stage 1. Construction of stage 2 is unlikely to impact soil and contaminated ground. Operational impacts for the proposal change will be consistent with or less than those assessed in the REF. Potential for further impacts to soil and contaminated ground is unlikely. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Groundwater	The proposal change will not require additional excavation activities that have the potential to encounter groundwater. Operational impacts will be consistent with or less than those assessed in the REF. Potential for further impacts to groundwater is unlikely. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Flooding	The location, construction area and methodology of the proposal change is the same as described in the REF. Most or all civil work will be completed during construction of stage 1. The total impervious area would remain unchanged from that described in the REF, so the impacts to flooding will be consistent with those assessed in the REF. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Aboriginal heritage and Non-Aboriginal heritage	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. Most or all civil work will be completed during construction of stage 1. Construction of stage 2 is unlikely to impact Aboriginal heritage or non-Aboriginal heritage.	The proposal change can be managed under the mitigation measures in the REF.

Aspect	Potential impacts	Mitigation measures
	Operational impacts will be consistent with or less than those assessed in the REF. As such, potential for further impacts to Aboriginal heritage and non-Aboriginal is unlikely. No further assessment of this aspect is necessary.	
Terrestrial ecology	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. No additional biodiversity values have been identified. Most or all civil work will be completed during construction of stage 1. Stage 2 is in the construction footprint of stage 1 and unlikely to further impact terrestrial ecology (flora and fauna). No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Noise and vibration	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. No additional noise receivers have been identified. Most or all noisy civil work will be completed during construction of stage 1. Construction of stage 2 would be shorter, less noisy and screened by buildings installed in stage 1. Stage 2 construction noise is unlikely to impact on the amenity of nearby public spaces or residents. However, associated traffic noise could lead to construction fatigue for nearby residents, but noise impacts would be no greater than that assessed in the REF. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Air quality	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. No additional receivers have been identified. Most or all civil work, including the new odour control unit, will be completed during construction of stage 1. Construction of stage 2 would be shorter, less intrusive and screened by buildings installed in stage 1. As such, the potential air quality and odour impacts are expected to be no greater than those assessed within the REF.	The proposal change can be managed under the mitigation measures in the REF.

Aspect	Potential impacts	Mitigation measures
	No further assessment of this aspect is necessary.	
Traffic and access	The location, construction area, accesses, equipment and methodology of the proposal change is the same as described in the REF. Most or all civil work will be completed during construction of stage 1. Construction of stage 2 would be separate from stage 1, but deliveries and vehicle numbers would be much lower. Traffic and access impacts for construction and operation would be no greater than assessed in the REF. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Waste and hazardous materials	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. There will be no change in total construction waste. Operational waste may decrease from that described in the REF in stage 1, associated with lower treatment capacity. Stage 2 operational waste would be the same as that assessed in the REF. As such, the potential for significant impacts from waste and hazardous materials is unlikely. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Landscape and visual amenity	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. Most or all civil work will be completed during construction of stage 1. Construction of stage 2 would be shorter and less visible due to screening provided by buildings installed in stage 1. As such, the potential landscape and visual amenity impacts would be no greater than assessed in the REF. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Social	The location, construction area, equipment and methodology of the proposal change is the same as described in the REF. Short-term, minor community impacts from traffic and minor amenity impacts from noise may be	The proposal change can be managed under the mitigation measures in the REF.

Aspect	Potential impacts	Mitigation measures
	experienced. However, these would be no greater than assessed in the REF. No further assessment of this aspect is necessary.	
Hazards and risks	The layout and operation of the proposal change is the same as described for the proposal in the REF. A lower volume of the same chemicals identified in the REF would be needed for stage 1 operation. The risk and magnitude of hazards and bush fire is no greater than assessed in the REF. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Sustainability	The proposal change does not change the design of the proposal. The construction and operational sustainability risks identified in Table 6-52 of the REF remain valid and overall greenhouse gas emissions would remain unchanged. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.
Cumulative	Cumulative impacts would remain the same or less than those identified in the REF for stage 1. Due to the delayed construction start of stage 2, future proposals that may interact cumulatively are not known. Proponents of future projects that overlap or interact with impacts in the REF must assess cumulative impacts of their projects with the proposal. No further assessment of this aspect is necessary.	The proposal change can be managed under the mitigation measures in the REF.

5.4 Mitigation measures

All mitigation measures in the REF remain the same and will be incorporated into the contractor's Construction Environmental Management Plan (CEMP). No new construction or operational mitigation measures are required for the proposal change.

6 Proposal justification, conclusion and recommendation

Sydney Water has considered the comments raised in the submissions. The proposal and subsequent proposal change is justified on the basis that:

- it is required to service growth and support delivery of the NSW Government's housing strategy
- staging installation of the AWTP better aligns with growth forecasts and defers capital expenditure, which has benefits in making funds available for other Sydney Water priority projects needed in the short-term
- it will protect waterway health through continued EPL compliance within Breakfast Creek and the Sackville 2 subzone of the Hawkesbury Nepean River catchment.

The proposal change described in section 4 introduces a staged delivery of the AWTP. During construction and operation, environmental impacts from the proposal change are expected to be minimal.

Potential impacts can be mitigated through implementation of the measures outlined in the REF. The proposal is not likely to significantly impact the environment.

For the purposes of Division 5.1 of the EP&A Act, it is recommended that the proposal proceed, as described in the REF and as subsequently revised in this decision report. It is recommended that the Quakers Hill WRRF Advanced Treatment Upgrade be implemented in accordance with the mitigation measures listed in the REF and this decision report.

7 Determination

Decision Statement

The main construction impacts include native vegetation removal and amenity impacts (e.g. noise, dust, additional traffic movements and access restrictions in public open spaces). The proposal change to stage delivery of the AWTP is not expected to generate new construction impacts. During operation, the proposal will have an environmental benefit by improving the quality of treated water released to Breakfast Creek. The proposal change will result in minor changes to the water quality of treated water released to Breakfast Creek compared with the impacts assessed in the REF. Water quality will still be better than existing releases. Once stage 2 is completed, the water quality of treated water releases will be the same as that described in the REF.

New infrastructure at Quakers Hill WRRF will be in keeping with existing assets, with potential impacts such as noise and odour similar to current conditions. The brine pipeline will be underground, with the main above ground structure being a barometric loop at Billy Goat Hill Reserve in Blacktown. Issues raised in the 2 submissions received have not triggered any additional environmental impact assessment or mitigation measures.

The proposal will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats. Therefore, a Species Impact Statement (SIS) and/or Biodiversity Development Assessment Report (BDAR) is not required.

Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in the REF and this decision report, the proposal is unlikely to have a significant impact on the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.

Certification

I certify that I have reviewed and endorsed this decision report and, to the best of my knowledge, it is in accordance with the EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). The proposal has been considered against matters listed in section 171 (Appendix B), section 171A (Appendix C) and the guidelines under section 170 of the EP&A Regulation. The information it contains is neither false nor misleading.

Prepared by:	Reviewed by:	Endorsed by:	Approved by:
[redacted]			
Blair Davies Environment Representative Date: 08/12/2025	James Harrington Senior Project Manager Date: 10/12/2025	Murray Johnson Senior Manager Environment and Heritage Services Date: 10/12/2025	Paul Plowman Executive General Manager, Water and Environmental Services Date: 12/12/2025

Appendices

Appendix A - Submissions received

From: [redacted]
Sent: Monday, 27 October 2025 4:58 PM
To: [redacted]
Cc: [redacted]
[redacted]
Subject: Blacktown Council feedback on REF - Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade

Hi [redacted]

Thank you it has been a busy couple of weeks and my apologies getting our comments to you.

Please see attached.

If you have any questions or need clarification please let me know.

Thanks

Blacktown City Council

[redacted]
Acting Manager Asset Design

[redacted]

PO Box 63 Blacktown NSW 2148
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We acknowledge the Dharug as the First People of the Blacktown City region

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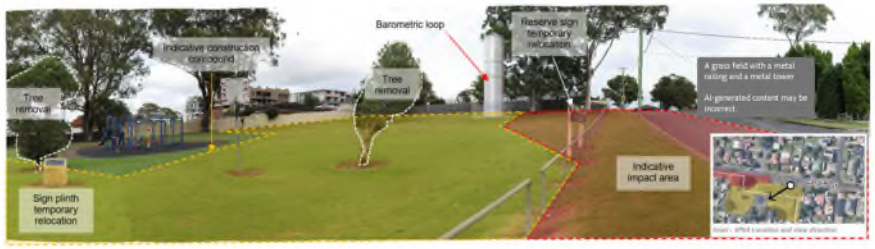
Blacktown Council feedback on Review of Environmental Factors – Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade

Page	Paragraph	Line	Feedback
59	Table 4-2	Table 4-2 Consultation outcomes	Council supports Sydney Water continuing to consult with us on the design details and construction program. Council also advises Sydney Water to provide detailed documentation and Work-as-Executed (WAE) plans of the proposed works for our future reference. Ensure that Sydney Water restores the existing sites to their original condition and provides routine maintenance, including mowing and cleaning of the fenced compound area.

Aspect or location	Questions or notes	Outcomes
Blacktown Aquatic Centre – planned upgrades	Council is proposing mid-2026 construction start, and about 18 months of construction. There may be cumulative impacts between council's project and this proposal. There may also be opportunities to share compounds and construct this section of pipeline while the aquatic centre is closed, to minimise disruption. Access to the netball courts to be maintained and no permanent parking loss.	Sydney Water will schedule a follow up meeting to discuss any updates. Sydney Water to advise on vegetation impacts within the International Peace Park at Seven Hills and impacts to walkway access. Sydney Water to organise a construction agreement with council. Access to the netball courts will be maintained and there will be no permanent parking loss.
Barometric loop	Council proposed alternative locations, but these were unsuitable as they were not at a high point, or too close to private property.	Sydney Water will work with council on future consultation about a mural or artwork treatment for the barometric loop to minimise visual impacts.
Green space (Harvey Park)	This park is one of council's busiest. Access to the sports fields and bicycle tracks needs to be maintained.	Sydney Water to organise pipeline construction and compound use for when the park is less busy (generally mid-December to early February).

60		<table><tr><th>Aspect or location</th><th>Questions or notes</th><th>Outcomes</th></tr><tr><td></td><td></td><td>Sydney Water to organise a construction agreement with council ('access to reserve' application).</td></tr><tr><td>Green space (Lynwood Park)</td><td>The field is used for soccer and cricket. It will be impacted during construction for HDD launch pit and pipe stringing.</td><td>Sydney Water to organise a construction agreement with council ('access to reserve' application) and consult with sporting clubs.</td></tr><tr><td>Vegetation impacts</td><td>Council would like to see vegetation impacts minimised as much as possible.</td><td>Although vegetation impacts can't be avoided, we want to minimise these impacts as much as possible. Sydney Water plans to discuss opportunities for offsets and restoration with council.</td></tr><tr><td>Impacts to council land</td><td>Public spaces including existing amenities, parks and vegetation should not be negatively impacted. Any easements should not exclude the public from public land.</td><td>Impacts to public spaces can't be completely avoided. We will manage and mitigate impacts by following the edges of reserves.</td></tr></table>	Council welcomes Sydney Water's contribution to tree offsets and site restoration where possible. Proposed contributions may also include: • Tree planting along the shared path • Removal of the existing post and rail fencing and replacement with tree planting along the park frontage at Billy Goat Reserve to improve accessibility • Supply and installation of park seating along the new easement area for community use *Please contact Blacktown City Council's Recreation Planning and Design team to confirm the proposed locations.* It is agreed that any easements should not exclude public access to public land. Additionally, new Sydney Water easements should not prevent future embellishment works within the easement areas, such as tree planting, pathway construction, or the installation of park furniture. Sydney Water should consider pipeline depth and materials that enable future park embellishment works to be carried out within the easements. These easements should not restrict minor landscape works such as tree planting, pathway and park furniture in the future.
159	Table 6-27	Tree Removal (Non-locally native or exotic tree) **Table 6-27 Offsetting options for vegetation** <table><tr><th>Residual loss of biodiversity values</th><th>Offset multiplier (Moderate Impact > 0.01 ha)</th></tr><tr><td>Threatened Ecological Communities</td><td>3</td></tr><tr><td>Non-threatened native vegetation (e.g. native remnant, riparian or planted native vegetation)</td><td>2</td></tr><tr><td>Tree Removal (Non-locally native or exotic tree)</td><td>1</td></tr></table>	A minimum offset ratio of 2:1 should apply to any tree removals, meaning two new trees must be planted for every tree removed as a minimum. For offset tree planting, Sydney Water must ensure that all trees are planted in a minimum 100-litre container size and are subject to a 12-month maintenance period to ensure successful establishment. The final planting locations, species selection, and associated details are to be discussed and agreed upon with Council.

			Blacktown City Council also requests confirmation of the total number of trees proposed for removal, as well as the number and location of replacement trees to be planted under this project, for data collection and record-keeping purposes.
212		 **Figure 6-34 Location of, and view west from, viewpoint 4**	The metallic surface of the barometric loop may reflect heat and glare onto surrounding properties. Sydney Water should consider applying a protective coating or using alternative materials that minimise heat absorption and reflection. The structure should be designed to be robust and unclimbable, eliminating the need for additional fencing, which can increase visual clutter and maintenance requirements. New tree planting and screen planting should be incorporated in this area to provide shade, visual screening, and enhance overall amenity. Removal of the existing post and rail fencing and replacement with tree planting along the park frontage at Billy Goat Reserve to improve accessibility.
217		these did not meet hydraulic requirements, would be on private property, or would require a structure taller than 12 m. There was general support from Blacktown City Council and residents for painting the loop once it is built or considering opportunities for incorporating public art to reduce visual amenity impacts.	Sydney Water is to provide evidence of support from both local residents and Blacktown City Council for the proposed works.

DOC25/910607

[redacted]

24 October 2025

Dear [redacted]

Quakers Hill WRRF – EPA comments on advanced treatment upgrade REF

I refer to your email of 26 September 2025 inviting the Environment Protection Authority (EPA) to comment on the Review of Environmental Factors (REF) for the proposed advanced treatment upgrade at Sydney Water's Quakers Hill Water Resource Recovery Facility (WRRF).

Sydney Water's existing wastewater systems were mostly designed and installed in the 20th century. Population growth and climate change are putting increasing pressure on these ageing systems which are becoming less resilient to shocks and stresses over time. Sydney currently has the lowest rainfall independent water sources of any major city in Australia, only around 15% of our water comes from the Kurnell desalination plant, the rest relies on rainfall into our dam catchments in the west of the Sydney Basin. Over 60% of Sydney's wastewater is primary treated before being discharged to the ocean.

Sydney Water's long-term plan is to disrupt the mainly west to east flow of water and wastewater by developing wastewater systems with increased reuse and circularity. This is proposed to be achieved by building new water recycling plants and upgrading existing ones, such as this proposal at Quakers Hill WRRF, to be capable of producing purified recycled water (PRW). PRW is wastewater treated to a very high standard which enables a wide range of reuse opportunities (including potable) and introduces circularity to our water resources. This will not only improve water supply resilience and the ability to adapt to climate change but will also result in better waterway health outcomes from more highly treated effluent and reduce the reliance on coastal discharges.

We would like to take the opportunity to reiterate the EPA's support of Sydney Water's Purified Recycled Water strategic direction, including this proposal, with tangible benefits to water quality and ecosystem health from the advanced treatment of sewage.

The EPA's detailed comments on the REF are provided at Attachment 1.

The Quakers Hill WRRF is licensed by the EPA under the *Protection of the Environment Operations Act 1997* (Environment Protection Licence No. 1724). Changes to the licence in

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relation to the proposed upgrade can be discussed between the EPA and Sydney Water as the project progresses through the approvals process.

If you have any queries about the above please contact [redacted].

Yours sincerely

[redacted]

Manager Operations

Attachment 1 – EPA comments on REF for the proposed advanced treatment upgrade at Sydney Water's Quakers Hill Water Resource Recovery Facility

Operations

While it is stated that the proposal is expected to result in an overall improvement of waterway health and ecology, the EPA notes that the proposal will increase the impervious areas discharging runoff to Breakfast Creek potentially increasing pollutant loads to the creek, and that Sydney Water is considering the following to mitigate this:

- incorporating a first flush system in the AWTP; and/or
- a water quality basin; and/or
- a gross pollutant trap with cartridge filtration.

The options chosen are expected to reduce impacts to existing levels.

The EPA notes that the Sackville 2 Subzone (under the Hawkesbury Nepean Nutrient Management Framework) is modelled to continue to exceed the Phosphorus nutrient load limit for the Hawkesbury Nepean River from Sydney Water's wastewater treatment plants. Quakers Hill WRRF is compliant with its EPL discharge limits and the EPA understands that Sydney Water is currently investigating opportunities to reduce nutrients at Riverstone WRRF as well as to obtain nutrient load offsets through bank remediation projects. The EPA will continue to engage with Sydney Water on this important regulatory framework.

The EPA notes that in the modelled results for median water quality, all indicators are expected to be lower than existing releases, except for total suspended solids, total iron, and filtered aluminium which are elevated due to the need for lime dosing of the reverse osmosis permeate to reduce total phosphorus and meet EPL discharge concentration limits. While some modelled indicators exceeded the guideline values, concentrations are below prescribed EPL limits.

The EPA notes that during operation of the upgrade, solids will be concentrated and transferred to St Marys WRRF for biogas production. Biogas derived from anaerobic digestion of wastewater treatment is considered an Eligible Waste Fuel. Please consider if Sydney Water will need to apply for a resource recovery and exemption in accordance with Part 4 of the *Eligible Waste Fuel Guidelines* (https://www.epa.nsw.gov.au/sites/default/files/22p3822-eligible-waste-fuels.pdf).

Construction

The EPA notes that three sediment basins are proposed be installed during construction to collect sediment-laden runoff from the disturbed areas. The EPA recognises the efforts made by Sydney Water in selecting pipeline alignments to minimise impacts on human health and the environment.

The EPA notes and agrees that noise impacts expected to nearby sensitive receivers can be managed. Sydney Water proposes the following mitigation measures:

- Select equipment with lowest possible noise emissions and use noise reduction features
- Identify and address intrusive noise characteristics
- Install noise barriers around noisy machinery where practicable
- Identify where noisy work can be reduced
- Provide advance notice to affected residents
- Revise noise modelling before starting tunnelling
- Justify all work occurring out of regular hours.

The EPA notes and agrees that Sydney Water will prevent nuisance dust impacts to nearby sensitive receivers during construction through the following proposed mitigation measures:

- Covering exposed areas
- Modify or cease work in windy conditions as necessary
- Modifications of site layout as necessary
- Vegetate exposed areas
- Cover transported waste
- Limit speed on unsealed access routes
- Apply odour suppressing agents.

The EPA notes and agrees that to ensure odours from the upgraded plant do not materially differ from existing operations the facility would need to redirect emissions from the existing pump station vents via the new odour control unit. The EPA would appreciate being kept informed of decision making around this opportunity, acknowledging that it is not part of the proposal scope and instead is a separate operational project.

Asbestos

The EPA notes that there is a Waste Management Plan being prepared, additionally, there is planned to be infilling using material stockpiled at the site, some of which is known to contain asbestos. It is anticipated that a long-term environmental management plan for the management of this material will be necessary in these circumstances.

Appendix B - Section 171 checklist

The following table considers the aspects of the section 171 checklist relating to water quality and aquatic ecology, that may have changed as a result of the proposal change described in this decision report. All other aspects of the section 171 checklist remain the same as assessed in the REF.

Section 171 checklist	Report finding
Any environmental impact on the ecosystems of the locality	The proposal change will improve existing wastewater treatment processes to maintain and improve waterway health and associated ecosystems. The water quality of treated water releases in stage 1 will be lower than assessed in the REF. However, the releases will still meet EPL concentration limits and most water quality guidelines and are not expected to have a negative impact on local waterways. The water quality of releases outlined in the REF will be achieved when stage 2 is implemented in 2036.
Any long-term effects on the environment	The proposal change is expected to provide a long-term benefit by providing improved wastewater treatment processes and maintaining the health of local waterways. No additional long-term effects are expected from the proposal change.
Any degradation of the quality of the environment	The proposal change will improve the quality of treated water releases. The reduction in nutrient loads from existing will result in water quality improvements including lower risk of algal blooms, better ecosystem health and long-term sustainability. The lower pollutant loads will support healthy fish and macroinvertebrate populations and improve overall biodiversity. Although the water quality in stage 1 will be lower than assessed in the REF, this is not expected to have a negative impact on local waterways given it is an improvement from existing releases. The volume of treated water releases will increase slightly, allowing sediment in the creek channel to continue to move, with long term siltation of the channel unlikely.
Any reduction in the range of beneficial uses of the environment	The proposal change will improve wastewater treatment processes to enable servicing and compliance with EPL requirements and generally improve waterway system health. No reduction in the range of beneficial uses of the environment (e.g. natural resources, community resources, existing land use) is anticipated compared with the original proposal assessed in the REF.
Any pollution of the environment	The proposal change has been designed to meet the EPA's Hawkesbury Nepean nutrient framework and our EPL requirements, including with the proposal change. Overall, the upgrades will improve the quality of treated water released to the environment.

Section 171 checklist	Report finding
	Environmental mitigation measures will mitigate the potential for the proposal to pollute the environment during construction.
Any cumulative environmental effect with other existing or likely future activities	Cumulative impacts during construction of stage 1 would be no greater than assessed in the REF. Cumulative impacts generated through interactions with future projects could materialise, although the details of relevant future projects are not yet known. It is expected that proponents of future projects will assess cumulative impacts with the proposal.

Appendix C - Section 171A checklist

Section 171A of the EP&A Regulation imposes additional requirements on a determining authority to take into account certain matters under Part 6.2 of State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BCSEPP) for a proposal in a 'regulated catchment'. The regulated catchments are defined under the BCSEPP, and include the:

- Sydney Drinking Water Catchment
- Sydney Harbour Catchment
- Georges River Catchment
- Hawkesbury-Nepean Catchment.

As the proposal is within the Hawkesbury-Nepean catchment, the requirements of section 171(A) are considered in the table below. Only aspects of the section 171A checklist that are relevant to the change in proposal impacts are considered. These relate to water quality, water quantity and aquatic ecology. All other aspects of the section 171A checklist remain the same as assessed in the REF.

Section 171A checklist **(Development in regulated catchments)**	**Report finding**
BCSEPP – Section 6.6(1) - Water quality and quantity In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following:	
(a) whether the development will have a neutral or beneficial effect on the quality of water entering a waterway	Treated water releases during stage 1 operation will generally be better quality than existing releases. Mitigation measures included in the REF will be implemented during construction to ensure the proposal has a neutral impact on water quality in Breakfast Creek and Eastern Creek. Treated water releases during stage 2 operation will be of better quality than stage 1 operational releases, further reducing overall nutrient loading in the Hawkesbury-Nepean Sackville 2 subzone.
(b) whether the development will have an adverse impact on water flow in a natural waterbody	The anticipated changes in flows of Breakfast Creek and Eastern Creek from the proposal change are not expected to modify or adversely affect water flows within the catchment during construction or operation. This remains the same under the proposal change.
(c) whether the development will increase the amount of stormwater run-off from a site	The proposal change will not increase impervious areas assessed in the REF. With the implementation of the mitigation measures in the REF, increases in pollutant loads can be reduced so that they do not exceed those for existing conditions.

Section 171A checklist (Development in regulated catchments)	Report finding
(d) whether the development will incorporate on-site stormwater retention, infiltration or reuse	No change to the construction and operational stormwater management measures identified in the REF is proposed. For Quakers Hill WRRF, these will be refined during detailed design. However, it will likely include sediment basins during construction and considerations such as expanding the existing first flush system during operation.
(e) the impact of the development on the level and quality of the water table	There will be no additional impacts to groundwater under the proposed change. Overall, the proposal is anticipated to require about 0.13ML of short-term dewatering throughout construction, with drawdown limited to within about 6 m of excavations. The implementation of mitigation measures in Table 6-14 of the REF are expected to adequately manage impacts to groundwater and residual impacts are expected to be minor. The fine screen feed pump wet well foundations may be subject to ongoing seepage throughout operation of the proposal. The magnitude and extent of drawdown will be similar to construction and not impact groundwater users or groundwater dependent ecosystems.
(f) the cumulative environmental impact of the development on the regulated catchment	The proposal is required to meet increasing wastewater service demand in the Quakers Hill wastewater catchment. Potential impacts from the proposal and proposal change are expected to be limited and localised. The proposal and proposal change also have a benefit to the Hawkesbury-Nepean catchment by improving the quality of treated water releases into Breakfast Creek. With the implementation of the environmental mitigation measures in the REF, the potential for cumulative impacts between the proposal and other projects within the catchment is low.
(g) whether the development makes adequate provision to protect the quality and quantity of ground water.	As detailed above, impacts to the level and quality of the groundwater are expected to be minor and will not increase under the proposal change.
BCSEPP – Section 6.6(2) - Water quality and quantity Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied the development ensures:	
(a) the effect on the quality of water entering a natural waterbody will be as close as possible to neutral or beneficial	A key driver for the proposal and proposal change is to improve the quality of treated water releases from Quakers Hill WRRF into Breakfast Creek. Appropriate mitigation measures are included in Table 6-12 of the REF to ensure

Section 171A checklist (Development in regulated catchments)	Report finding
	that the proposal will have a neutral or beneficial effect on the water quality of the catchment.
(b) the impact on water flow in a natural waterbody will be minimised	The proposal change described in this decision report will not significantly modify or adversely affect water flows within the catchment during either construction or operation.
BCSEPP – Section 6.7(1) - Aquatic Ecology In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following:	
(a) whether the development will have a direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation	The proposal change does not require further vegetation trimming and removal beyond that identified in the REF. The proposal requires trimming and removal of vegetation within the impact area. No work is required in watercourses or waterbodies, so aquatic vegetation will not be impacted. Direct, indirect or cumulative adverse impacts to terrestrial, aquatic or migratory animals or vegetation of the locality will not be significant. Vegetation removal will be offset.
(b) whether the development involves the clearing of riparian vegetation and, if so, whether the development will require: (i) a controlled activity approval under the *Water Management Act 2000*, or (ii) a permit under the *Fisheries Management Act 1994*	Clearing is required in the riparian zone. These impacts will be offset in accordance with the Sydney Water Biodiversity Offset Guideline. Sydney Water is exempt from the need to obtain a controlled activity approval under the *Water Management Act 2000*. A permit under the FM Act is not required for the proposal. The proposal change does not require further clearing within the riparian zone beyond that identified in the REF.
(c) Whether the development will minimise or avoid: (i) the erosion of land abutting a natural waterbody, or (ii) the sedimentation of a natural waterbody	Mitigation measures to minimise the potential for erosion and sedimentation impacts to adjacent waterways are included in Table 6-3 and Table 6-12 of the REF and no additional measures are needed to address impacts from the proposal change.
(d) whether the development will have an adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area	As identified in the REF, there are no wetlands in proximity to the proposal.

Section 171A checklist (Development in regulated catchments)	Report finding
(e) whether the development includes adequate safeguards and rehabilitation measures to protect aquatic ecology	Mitigation measures to protect aquatic ecology are included in Table 6-12 of the REF. These are considered adequate to protect aquatic ecology.
(f) if the development site adjoins a natural waterbody, whether additional measures are required to ensure a neutral or beneficial effect on the water quality of the waterbody	Appropriate mitigation measures are included in Table 6-3 and Table 6-12 of the REF to ensure that the proposal will have a neutral or beneficial effect on water quality. No additional measures are needed to address impacts of the proposal change.
BCSEPP – Section 6.7(2) - Aquatic Ecology Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied of the following:	
(a) the direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation will be kept to the minimum necessary for the carrying out of the development	Appropriate mitigation measures are included in Table 6-12, Table 6-29 and Table 6-55 of the REF to ensure that the cumulative impacts of the proposal on terrestrial, aquatic or migratory animals or vegetation are limited to the minimum extent necessary. No additional measures are needed to address impacts of the proposal change.
(b) the development will not have a direct, indirect or cumulative adverse impact on aquatic reserves	As identified in the REF, there are no aquatic reserves near the proposal.
(c) if a controlled activity approval under the *Water Management Act 2000* or a permit under the *Fisheries Management Act 1994* is required in relation to the clearing of riparian vegetation—the approval or permit has been obtained	As noted in the REF, Sydney Water is exempt from the need to obtain a controlled activity approval under the *Water Management Act 2000*. A permit under the FM Act is not required for the proposal or proposal change.
(d) the erosion of land abutting a natural waterbody or the sedimentation of a natural waterbody will be minimised	Mitigation measures to minimise the potential for erosion and sedimentation impacts to areas adjacent to waterways are included in Table 6-3 and Table 6-12 of the REF. No additional measures are needed to address impacts of the proposal change.
(e) the adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area will be minimised	As identified in the REF, there are no wetlands in proximity to the proposal.

Appendix D – Surface water and aquatic ecology report

Surface Water Quality and Aquatic Ecology Assessment Addendum

Document no: IA330200-00-T-V-RPT-00-25
Revision: 03

Sydney Water
IN.P0001436

Quakers Hill WRRF Advanced Treatment Upgrade project
11 December 2025

Surface Water Quality and Aquatic Ecology Assessment Addendum

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ⓘ Important note about this report

The sole purpose of this report and the associated services performed by Jacobs is to assess the impact of the Quakers Hill Water Resource Recovery Facility discharge effluent on the water quality at Breakfast Creek. in accordance with the scope of services set out in the contract (and associated variations) between Jacobs and Sydney Water (the Client). That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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Acronyms and abbreviations

ADWF	Average dry weather flow
ANZG	Australian and New Zealand Guidelines
AWTP	Advanced Water Treatment Plant
CEMP	Construction Environmental Management Plan
cm	centimetre
CSWMP	Construction Soil and Water Management Plan
DPE	NSW Department of Planning and Environment
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
HRC	Healthy Rives Commission
KFH	Key Fish Habitat
LGA	Local Government Area
m	metre
mg/L	milligrams per litre
ML/d	megalitres per day
NTU	Nephelometric Turbidity Unit
PRW	Purified Recycled Water
REF	Review of Environmental Factors
SRE	Sensitive Receiving Environment
SSTV	Site Specific Trigger Values
The project	The Quakers Hill WRRF Advanced Treatment Upgrade project
µg/L	Microgram per litre
µS/cm	microsiemens per centimetre
WQOs	Water Quality Objectives
WRRF	Water Resource Recovery Facility
WWF	Wet weather flow

1. Introduction and background

1.1 The project

The Quakers Hill WRRF Advanced Treatment Upgrade project will modify and expand wastewater treatment processes and build a new brine pipeline between the WRRF and Sydney Waters existing wastewater network in Seven Hills. The upgrade will introduce an Advanced Water Treatment Plant (AWTP) and upgrade the secondary treatment process from the current 28 ML/day (ML/d) to 48 ML/day. The project will increase the amount of wastewater that can be treated, to accommodate forecast growth in the Quakers Hill WRRF catchment and support the NSW Government's housing strategy. It will improve the quality of the treated wastewater produced by the WRRF to meet the more stringent water quality requirements in its environment protection licence (EPL). This will be achieved with the AWTP that will include reverse osmosis. A Review of Environmental Factors (REF) has been prepared for these works (final report issued and approved in September 2025).

1.2 Project refinements

Sydney Water has carried out further planning assessment, growth and compliance modelling, and identified that a staged delivery of the AWTP would meet growth and EPL compliance obligations. Two stages are now proposed for delivery of the AWTP:

- Stage 1: Install 20 ML/day capacity AWTP by 2030
- Stage 2: Upgrade AWTP capacity to 48 ML/day by 2036

1.3 Purpose of this document

This surface water quality and aquatic ecology addendum has been prepared to assess the potential impacts from the staged delivery of the AWTP outlined in Section 1.2. The project refinement relates to operation of the project only. There will be no change to the construction of the project. As such, construction impacts identified in the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025) are still relevant and no further assessment of construction impacts is required. Therefore, the project refinements affecting surface water quality and aquatic ecology during operation are presented in Section 3.2 (Operational impacts).

This assessment includes additional operational detail or information that has changed since the submission of the REF and should be read in conjunction with the *Quakers Hill WRRF Advanced Treatment Upgrade Review of Environmental Factors* (Sydney Water 2025) and *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025).

2. Existing environment

2.1 Overview

A detailed description of the existing environment with respect to surface water quality and aquatic ecology is provided in Chapter 4 of the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025). The description included:

- Regional setting of the proposal being the Wianamatta -South Creek catchment that forms part of the Hawkesbury-Nepean catchment, as well as a small section falling within the Blacktown Creek sub-catchment located withing the Upper Parramatta River catchment.
- Identification of watercourses and waterbodies located within 500 m of the proposal including Breakfast Creek, Eastern Creek, and Blacktown Creek.
- Identification of sensitive receiving environments (SREs) which include Breakfast Creek and Eastern Creek due to the creeks being considered Key Fish Habitat (KFH) according to DPI (2025) key fish habitat mapping.

2.2 Water quality assessment criteria

The Healthy Rivers Commission (HRC, 1998) and DPE (2022) have categorised the study area subject to the project refinement as 'Predominantly Urban'. Breakfast Creek and Eastern Creek have several nominated water quality objectives (WQOs) and environmental values: aquatic ecosystems, visual amenity, secondary contact recreation, cultural values and irrigation water supply. Key water quality indicators and related numerical criteria have been nominated for each environmental value using the ANZG (2018) water quality guidelines and the site-specific trigger values (SSTVs) nominated for waterways and water bodies in the Wianamatta-South Creek catchment (DPE 2022). As outlined in the REF, existing water quality has been compared ANZG (2018) and DPE (2022) to determine whether waterways are meeting relevant water quality objectives. The values for protection of aquatic ecosystems are provided in Table 2-1.These criteria have been used to compare projected water quality during operation of the project as meeting these guideline values ensures compliance with all nominated water quality objectives as these guidelines are generally the most conservative.

Table 2-1 Key water quality indicators and related numerical criteria for protection of aquatic ecosystems

Indicator	Guideline value
Total nitrogen (mg/L)	1.72[a]
Dissolved inorganic nitrogen (mg/L)	0.74[a]
Ammonia (mg/L)	0.08[a]
Oxidised nitrogen (mg/L)	0.66[a]
Total phosphorus (mg/L)	0.14[a]
Soluble reactive phosphorus (mg/L)	0.04[a]
Turbidity (NTU)	50[a]
Total suspended solids (mg/L)	37[a]
Conductivity (µS/cm)	1,103[a]
pH	6.20–7.60[a]
Dissolved oxygen (% saturation or mg/L)	43–75% or 8[a]
Chlorophyll-*a* (µg/L)	3[b]

Indicator	Guideline value
Toxicants	As per ANZG (2018) toxicant default guideline values (95% level of protection or slightly to moderately disturbed ecosystems and 99% level of protection or toxicants that bioaccumulate) [b]

[a] DPE (2022) SSTV

[b] ANZG (2018) guideline value

2.3 Existing surface water quality

Section 4.2.1 and 4.2.2 of the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025) provides a summary of existing water quality for Breakfast Creek and Eastern Creek based on monitoring undertaken by Sydney Water and Blacktown City Council between 2018 and 2024 during dry and wet weather. No additional data have been collated since the submission of the REF for the preparation of this addendum.

Breakfast Creek has been monitored upstream and downstream of the Quakers Hill WRRF discharge sampling point. Water quality data provided in the REF show that the water quality of Breakfast Creek is considered poor and not suitable for protection of aquatic ecosystems, particularly downstream of the WRRF discharge point. Overall, exceedance of guideline limits was observed for the same group of parameters, irrespective of location, except for dissolved oxygen and nutrients. Upstream of the WRRF discharge, most indicators met the guidelines for protection of aquatic ecosystems apart from soluble reactive phosphorus, total aluminium, copper, and total and filterable zinc. Monitoring sites downstream of the discharge showed notably higher concentrations of total and oxidised nitrogen as well as soluble reactive phosphorus which often exceeded recommended levels. Concentrations of total metals, except for cobalt and nickel, exceeded the recommended limits and were generally higher at the downstream sites than upstream of the WRRF release. In summary, water quality data indicate that the discharge of treated wastewater influences the water quality of Breakfast Creek downstream of the WRRF.

Eastern Creek has been monitored upstream and downstream of the confluence with Breakfast Creek. Key findings from water quality data presented in Section 4.2.2.3 of the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025) were that median electrical conductivity, though compliant was highest downstream of the confluence and that turbidity, total suspended solids, and ammonia concentrations complied with their respective guidelines at both upstream and downstream sites. Medians of total and oxidised nitrogen were low in Eastern Creek upstream of the confluence, but concentrations were higher downstream of the confluence which is likely due to poorer water quality from Breakfast Creek inflows. Total phosphorus concentrations were similar and within guidelines at both sites, but soluble reactive phosphorus exceeded guidelines at both sites and was higher downstream of the stream's confluence.

2.4 Existing hydrology and aquatic ecology

Breakfast Creek and Eastern Creek are third and fourth order streams respectively, according to the Strahler ranking system. Due to their stream order, these waterways are therefore mapped as KFH (DPI, 2025) which is one of the criteria classifying them as SREs. Downstream of the Quakers Hill WRRF, Breakfast Creek flow is consistent and influenced by treated wastewater of between 30 ML/d and 60 ML/d with higher discharge due to rainfall events. Upstream flows are much lower usually between <1 ML/d and 10 ML/d with higher flow following infrequent rain events. Eastern Creek receives Quakers Hill WRRF treated water releases via its confluence with Breakfast Creek which contributes regular flows approximately 80% of the time. Eastern Creek has less regular flows upstream of the confluence with rare low flow events.

Aquatic habitats in Breakfast Creek were found to be severely to moderately disturbed upstream of the Quakers Hill WRRF, with heavily silted stream bottoms, abundant invasive plants, and few instream habitat

features such as boulder complexes and woody debris. At the time of the site visit (see further details in Section4.2.1.1 of the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025)), the creek was dry or nearly dry downstream of two complete flow obstructions. Downstream of the Quakers Hill WRRF, where Breakfast Creek is influenced by effluent discharge, the habitat was of higher quality, although still disturbed. Although pool/riffle sequences, woody debris, and boulders were more common and the creek bottom much less silted, habitat quality is still reduced by frequent breaks in stabilising bank vegetation and invasive species.

Eastern Creek from the confluence of Breakfast Creek for 1 km downstream had moderately disturbed aquatic habitat. The section was predominantly slow flowing and deep with a lack of silting.

Desktop reviews of publicly available databases indicated no records of threatened species in either Breakfast Creek or Eastern Creek.

3. Impact assessment

3.1 Construction impacts

The impacts of project construction on surface water quality and aquatic ecology were discussed in the *Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade: Review of Environmental Factors: Surface water quality and Aquatic ecology assessment* (Jacobs 2025). The implementation of a staged approach is not expected to result in any additional impacts to those described in the REF.

3.2 Operational impacts

This section outlines the potential operational impacts resulting from project refinement, being a proposed staged delivery, as described in Section 1.2, including details of the operation of the project in two stages. Since stage 2 involves operating the project as described in the REF (i.e. the AWTP treating 48 ML/d), no change to operational impacts for Stage 2 is anticipated. Therefore, this section focuses on operational impacts associated with the implementation of Stage 1. Specifically, it compares these impacts with both the existing conditions and those assessed in the REF.

3.2.1 Operation of the advanced water treatment/treated water discharge

Treated water is currently released into Breakfast Creek in compliance with EPL 1724, which applies to the operation of the existing Quakers Hill WRRF (EPA 2024). The EPL specifies concentration limits for various pollutants that must not be exceeded at designated discharge points. For reference, Table 3-1 summarises these concentration limits, as presented in the REF.

Table 3-1 Pollutant concentration limits for the Quakers Hill WRRF discharge to waters at Point 1 prescribed by the Environment Protection Licence 1724

Pollutant (unit)	Average concentration limit	50th percentile concentration limit	90th percentile concentration limit	100th percentile concentration limit
Aluminium (µg/L)	120	-	190	-
Cadmium (µg/L)	0.2	-	0.3	-
Chlorine (total residual) (mg/L)	-	-	0.1	-
Chromium (µg/L)	3	-	4	-
Copper (µg/L)	5	-	6	-
Hydrogen sulphide (un-ionised) (µg/L)	30	-	60	-
Nitrogen (ammonia) (mg/L)	-	0.9	1.4	-
Total nitrogen (mg/L)	-	6	-	-
Total phosphorus (mg/L)	-	0.1	-	-
Zinc (µg/L)	34	-	41	-

Source: EPA (2024).

The staged approach will continue to ensure that wastewater treated by the AWTP meets nutrient limits and achieves high quality suitable for further treatment to produce PRW, as described in the REF. After this treatment, most wastewater will be discharged to Breakfast Creek. The REF assessed the expected quality of 48 ML/d of treated effluent discharged under various scenarios and compared it with the quality of the existing discharge and with existing water quality in Breakfast Creek. Under updated Stage 1 operational

scenario, 20 ML/d would be treated at the Advanced Water Treatment Plant (AWTP), while the remaining 28 ML/d will continue to undergo tertiary treatment. The corresponding scenarios from the new proposed staged operation considered in the present report are:

- Average dry weather flow (ADWF): During Stage 1, 48 ML/d of wastewater (the projected average dry weather flow) would be managed by treating 20 ML/d at the new Advanced Water Treatment Plant (AWTP) and the remaining 28 ML/d continuing to receive tertiary treatment. Of this 48 ML/d, 34 ML/d would be discharged to Breakfast Creek (consistent with the scenario reported in the REF). Water quality modelling results for this discharge were used to determine both the median (50th percentile) and extreme (90th percentile) water quality results to compare them against EPL requirements.
- Wet weather flow (WWF): the operation of the AWTP and associated infrastructure would provide increased hydraulic capacity to accommodate WWFs. Moderate WWFs are the equivalent of 3 x ADWF, leading to an inflow of 144 ML/d and a discharge to Breakfast Creek of 140 ML/d. The peak WWF considered in this scenario is 6 x ADWF or 288 ML/d of which 284 ML/d could be discharged to Breakfast Creek. Both these scenarios were modelled.

Median projected concentrations of physio-chemical indicators for different discharge scenarios during operation of Stage 1 are presented in Table 3-2 together with concentrations under current ADWF conditions.

As stage 2 assumes that 48 ML/d would be treated by the AWTP, the results and conclusions in the *Quakers Hill Water Resource Recovery Facility Advanced Treatment Upgrade: Review of Environmental Factors: Surface water quality and Aquatic ecology assessment* (Jacobs 2025) remain valid for Stage 2.

Table 3-2 Results of water quality modelling in the treated discharge from the Advanced Water Treatment Plant for the existing discharge and predicted discharge under different discharge scenarios (previous modelled scenario and staged approach)

Indicator	Existing ADWF discharge (Mar 2010–Mar 2025)		Modelled projected discharge in REF (48 ML/day) (50th percentile concentrations)			Modelled REF ADWF predicted discharge 90th percentile	Modelled projected discharge for Stage 1 (20 ML/day AWTP + 28ML/day tertiary treated) (50th percentile concentrations)			Modelled Stage 1 ADWF predicted discharge 90th percentile 20 ML/day AWTP + 28ML/day tertiary treated)	Guideline
	50th percentile	90th percentile	ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		
Ammonia (mg/L as N)	0.04	0.49	0.03	1.40	1.40	0.1	0.034	2.275	2.276	0.126	0.08[a] 0.9[b]
Total nitrogen (mg/L as N)	4.71	6.31	0.35	8.40	4.10	0.75	1.913	4.279	4.266	2.735	1.72[a]
Oxidised nitrogen (mg/L as N)	3.38	5.13	0.22	4.00	2.60	0.45	1.083	3.899	1.916	1.973	0.66[a]
Total phosphorus (mg/L as P)	0.065	0.13	0.009	2	0.7	0.015	0.038	0.619	0.674	0.079	0.14[a]
Soluble reactive phosphorus (mg/L as P)	0.031	0.096	0.006	1.2	1	0.004	0.038[f]	0.310	0.337	0.079	0.04[a]
Total suspended solids (mg/L)	2	3	0.5[e]	2	4	1[e]	1.39	4.99	10.90	3.88	37[a]

Indicator	Existing ADWF discharge (Mar 2010–Mar 2025)		Modelled projected discharge in REF (48 ML/day) (50th percentile concentrations)			Modelled REF ADWF predicted discharge 90th percentile	Modelled projected discharge for Stage 1 (20 ML/day AWTP + 28ML/day tertiary treated) (50th percentile concentrations)			Modelled Stage 1 ADWF predicted discharge 90th percentile 20 ML/day AWTP + 28ML/day tertiary treated)	Guideline
	50th percentile	90th percentile	ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		
Filtered aluminium (mg/L)	0.065	0.102	0.08	0.17	0.08	0.1	0.070	0.229	0.159	0.136	0.055[b]
Cadmium (µg/L)	0.15	0.19	0.14	0.07	0.04	0.15	0.163	0.063	0.034	0.163	0.2[b]
Chromium (µg/L)	0.4	1.09	0.08	0.20	0.12	1.74	0.388	0.587	0.396	1.481	1[b]
Cobalt (µg/L)	0.5	1.1	0.13	0.15	0.10	0.14	0.344	0.242	0.151	0.648	1.4[b]
Copper (µg/L)	3	4.22	0.04	0.86	0.58	1.97	1.840	11.647	8.363	3.337	1.4[b]
Filtered iron (mg/L)			0.07	0.04	0.01	0.1	0.049	0.015	0.005	0.065	0.3[c]
Total iron (mg/L)	0.047	0.074	0.07	0.04	0.01	0.28	0.050	7.064	10.180	0.091	0.3[c]
Manganese (µg/L)	28	59.5	19.06	11.74	5.53	22.34	21.934	17.713	10.979	45.883	1,900[b]
Molybdenum (µg/L)	2.1	7.6	0.13	0.57	0.39	0.15	1.259	1.001	0.634	3.679	34[b]
Nickel (µg/L)	2.2	3	0.58	0.70	0.44	0.64	1.497	1.061	0.658	2.067	11[b]

Indicator	Existing ADWF discharge (Mar 2010–Mar 2025)		Modelled projected discharge in REF (48 ML/day) (50th percentile concentrations)			Modelled REF ADWF predicted discharge 90th percentile	Modelled projected discharge for Stage 1 (20 ML/day AWTP + 28ML/day tertiary treated) (50th percentile concentrations)			Modelled Stage 1 ADWF predicted discharge 90th percentile 20 ML/day AWTP + 28ML/day tertiary treated)	Guideline
	50th percentile	90th percentile	ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		ADWF	Moderate wet weather flow (3 x ADWF) [d]	Peak wet weather flow (6 x ADWF) [d]		
Zinc (µg/L)	21	30	5.23	6.89	2.18	14.41	15.100	22.263	15.106	22.199	8[b]
Total residual chlorine (mg/L as Cl_2)	-	-	0	0.1	0.1	0	0.024	0.004	0.008	0.024	-
Hydrogen sulphide (un-ionised) (mg/L)	-	-	0	0.3	0.3	0	0	0	0	0.012	-

Notes:

Orange cells denote exceedance of the recommended guideline for protection of aquatic ecosystems; green cells denote values below the guideline.

[a] DPE (2022) performance criteria.

[b] ANZG (2018) toxicant guidelines for 95% species protection. Aluminium guideline specified for pH>6.5.

[c] ANZECC & ARMCANZ (2000) interim guideline.

[d] Modelled wet weather results.

[e] Based on reference data for plants with lime addition post-RO at a 1:1 TSS:NTU ratio.

[f] As there is limited data on the breakdown of total to reactive phosphorus in the existing plant effluent, the water quality modelling has taken a conservative approach and assumed that all phosphorus in the plant effluent is SRP. In practice, some non-SRP will be present in the plant effluent due to the carry-over of solids from the filters, resulting in an SRP which is less than the TP.

- Modelling results indicate that the proposed staged delivery will lead to slightly higher 50th and 90th percentile concentrations of key pollutants, including aluminium, cadmium, chromium, copper, zinc, ammonia total nitrogen, total phosphorus, total residual chlorine and hydrogen sulphide (as listed in EPL1724), when compared to the REF. Nevertheless, compliance with the EPL limits would still be achieved despite these increased modelled concentrations.
- Although most modelled indicator concentrations presented in the REF were of better quality than the median and 90th percentile concentrations under existing ADWF conditions, the proposed staged delivery is predicted to lead to fewer indicators showing reduced percentile concentrations. With the AWTP operating at 20 ML/d, all indicators with the exception of soluble reactive phosphorus, filtered aluminium, total cadmium and iron would demonstrate lower median (P50) concentrations than those at existing conditions. When expressed as 90th percentile, all indicators with the exception of filtered aluminium, total iron and chromium would show benefits at the 90th percentile during refinement operation. Increases in filtered aluminium, total cadmium and iron during stage 1 ADWF (P50) are generally small and the result of being introduced into the reverse osmosis permeate due to lime dosing. Lime dosing results in higher average cadmium concentrations but improves on the peaks in the existing system due to the portion of flow being treated by reverse osmosis such that 90th percentile concentration under Stage 1 are less than existing. Apart from filtered aluminium, indicators comply with the respective guideline values for protection of aquatic ecosystems. As detailed in Table 3-2, increases in soluble reactive phosphorus concentrations are conservative and unlikely to impact on aquatic ecosystems.
- When comparing modelled ADWF median concentrations for AWTP operation at 20 ML/d to the project REF of 48 ML/d, all indicators except for filtered aluminium and total iron are expected to increase. At the 90th percentile, modelled concentrations for all indicators except cadmium, chromium, filtered, and total iron would increase during refinement operation.
- The REF indicated that the median (50th percentile) concentrations of all indicators, apart for filtered aluminium, would meet the recommended guideline limits for Breakfast Creek, but with the proposed staged delivery additional indicators would exceed recommended guidelines. When operating at 20 ML/d, median modelled levels of total nitrogen, oxidised nitrogen, filtered aluminium, copper and zinc would exceed the recommend guidelines for Breakfast Creek, although except for filtered aluminium, will still be less than existing concentrations recorded in Breakfast Creek. These same indicators as well as total phosphorus, soluble reactive phosphorus and total iron would also exceed guidelines at the modelled 90th percentile values. The modelled median ammonia concentrations during Stage 1 would be lower than current ADWF discharge concentrations and will meet both the DPE (2022) performance criteria for Breakfast Creek and the ANZG (2018) toxicant DGV. Whist ammonia concentrations would be slightly higher during Stage 1 than the level modelled in the REF (48 ML/d) and existing concentrations in Breakfast Creek downstream of the discharge, concentrations would be lower than median concentrations at the upstream site. As reported in the REF, ammonia concentrations would exceed the DPE (2022) performance criteria at the 90th percentile and during wet weather, although concentrations during stage 1 would be slightly higher. Given the low likelihood of these scenarios, the higher ammonia concentrations are unlikely to lead to eutrophication and algal blooms.
- As discussed in the REF, wet weather effluent quality data for the 3 x ADWF and 6 x ADWF scenarios do not exist. For operations at 20 ML/d, nutrient concentrations (total nitrogen, oxidised nitrogen, total phosphorus and soluble reactive phosphorus) are predicted to be lower than those for operation at 48 ML/d. However, concentrations of these indicators would still exceed the recommended guideline limits and receiving wet weather quality in Breakfast Creek for peak wet weather (6 x ADWF), and 3 x AWDF (total phosphorus and soluble reactive phosphorus only). Modelled ammonia concentrations would be higher at 20 ML/d than at 48 ML/d for the 3 x and 6 x ADWF scenarios, exceeding both the DPE (2022) performance criteria and ANZG (2018) toxicant guideline value.

- As per the REF, filtered aluminium concentrations would exceed the ANZG (2018) guideline under all scenarios when operating at 20 ML/d. However, the median modelled concentrations are slightly lower at 20 ML/d compared to 48 ML/d.
- Total suspended solids (TSS) in treated wastewater discharges are expected to be slightly lower at the AWDF (50th percentile) during Stage 1, compared to existing ADWF discharge levels and predicted concentrations at 48 ML/d in the REF. However, for the 90th percentile, TSS may be slightly higher than the levels reported in the REF as a result of insoluble impurities included in the lime. Like the REF, TSS concentrations are predicted to increase during wet weather and could exceed modelled levels at 48 ML/d in Breakfast Creek after rainfall and peak wet weather (6 x ADWF) would have higher suspended solids than existing concentrations recorded in Breakfast Creek following rainfall. Across all scenarios, TSS concentrations during stage 1 would remain well below the DPE (2022) performance criteria. Even with increased TSS under some Stage 1 wet weather scenarios, which may lead to greater sedimentation of the streambed, it is expected that the discharge would cause minimal impacts on the water quality and aquatic ecology of Breakfast Creek. This is consistent with the REF findings.
- Modelled concentrations of zinc and copper are expected to increase in Stage 1 under all scenarios compared to the 48 ML/d reported in the REF. These concentrations are also above the ANZG (2018) toxicant DGV for the protection of aquatic species. Although higher values are predicted for Stage 1, aquatic life in Breakfast Creek and Eastern Creek is unlikely to be adversely affected by changes in discharge concentrations. This is because modelled median and 90th percentile concentrations during Stage 1 are lower than those observed in the existing ADWF discharge and lower than the concentrations currently recorded in Breakfast Creek. Consequently, no increased risk to aquatic life is expected, which aligns with the findings from the REF.
- The 90th percentile concentration of chromium is predicted to increase slightly during Stage 1 compared to that in the existing AWDF discharge and would also exceed the guideline value although it would be lower than when the AWTP is operating at 48 ML/d. As discussed in the REF, the guideline of 1 µg/L applies to hexavalent chromium (Cr VI), but modelled concentrations are for total chromium, including both trivalent (Cr III) and hexavalent forms. Trivalent chromium is less toxic to aquatic life with a higher default guideline vale of 3.3 µg/L. The use of a coagulants like ferric oxide or alum in treatment promotes conversion of hexavalent to trivalent chromium, so the actual risk to aquatic like is likely much lower than indicated by total chromium concentrations (Jacobs, 2025).

In summary, modelling shows that the proposed staged delivery will result in higher concentrations of most indicators in ADWF compared to the REF (48 ML/d), but that levels will be lower than existing conditions and meet EPL licence conditions. Similarly to the REF, increases in filtered aluminium, total cadmium and iron whilst small are the result of being introduced into the reverse osmosis permeate due to lime dosing. These increases are not expected to impact on aquatic ecosystems of Breakfast Creek as modelled cadmium and iron concentrations are less than the ANZG (2018) limits and whilst aluminium is slightly higher than ANZG (2018) it is lower than existing concentrations in Breakfast Creek.

3.2.2 Breakfast Creek and Eastern Creek flows

Adopting a staged approach will result in the same volume of water being discharged to Breakfast Creek as previously reported in the REF. Accordingly, the staged implementation is anticipated to have comparable impacts on creek flows as outlined in the REF and is not expected to cause any additional ecological effects directly associated with discharge volumes beyond those already described.

3.2.3 Brine transfer

Adopting a staged approach will reduce the volume of brine released from Quakers Hill from 10ML/day detailed in the REF to between 3 and 5 ML/day when Stage 1 is operating. Existing dry weather brine transfer arrangements from St Marys AWTP to Quakers Hill WRRF would remain unchanged as specified in the REF.

4. Revised environmental management measures

The REF identified a range of environmental outcomes and management measures that would be required to avoid or reduce the environmental impacts. With consideration to the project refinement, the environmental measures for the project in Section 9.1 of the *Quakers Hill WRRF Advanced Treatment Upgrade - Surface Water Quality and Aquatic Ecology Assessment* (Jacobs 2025) remain unchanged and are presented in Table 4-1.

Table 4-1 Summary of revised environmental management measures for surface water quality and aquatic ecology

Reference	Impact	Management measure	Timing
SW01	General water quality	A Construction Soil and Water Management Plan (CSWMP) would be prepared as a sub-plan of the Project's Construction Environmental Management Plan (CEMP). The plan will outline measures to manage soil and water impacts associated with the construction and commissioning works. The SWMP will include but not be limited to: ▪ Measures to minimise/manage erosion and sediment transport within the construction footprint and office. ▪ Measures to manage stockpiles including location, sediment controls and stabilisation and detailed in a Stockpile management plan. ▪ Measures to manage accidental spills in accordance with the Australian Spill Control Industry Standard for Spill Response Kits (ASCIC 2695) (AusSpill 2018) and maintain material such as spill kits. ▪ Details of surface water quality monitoring to be undertaken before, during and after construction. ▪ Measures to manage water (including dewatering of trenches), groundwater ingress into vertical shafts and tunnels, drilling fluids, grout and cement-contaminated water from construction, including water collection protocols, water quality standards to be achieve for various reuse (e.g. dust suppression) purposes, and transportation to disposal facilities. Alternatively, the Construction Contractor would be required to obtain and comply with an EPL and any other approvals to discharge treated water into a downstream receiving environment such as Breakfast Creek or Blacktown Creek. ▪ Measures to manage discharge/collection of water during commissioning, including outlining water collection protocols and transportation to disposal facility or discharge to downstream waterway.	Detailed design Prior to construction Construction

Reference	Impact	Management measure	Timing
SW02	Erosion and sedimentation	A Construction Erosion and Sediment Control Plan would be developed as a sub-plan of the SWMP and would detail the erosion and sediment control measures to be implemented at all works sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction Volume 1* (Landcom 2004) and *Volume 2D* (NSW Department of Environment Climate Change and Water 2008), commonly referred to as the 'Blue Book'. The ESCP would include but not be limited to: ▪ Plans for temporary drainage, scour protection and control measures to reduce erosion and water quality impacts from increased sediment loads from construction and ancillary sites. These water quality controls will likely consist of sediment fencing and sediment basins. The Construction Erosion and Sediment Control Plan would identify locations of proposed construction sediment basins. ▪ The location of construction sediment basins, sediment fences, diversion drains, etc. ▪ Truck loads to be adequately covered when transporting loose material (i.e. spoil). ▪ Dust suppression, spoil rehabilitation/emplacement to ensure no sedimentation or air quality impacts.	Prior to construction During construction
SW03	Spills and leakages	Site-specific controls and procedures would be developed and implemented as part of the CSWMP to reduce the risk of the release of potentially harmful chemicals from spills entering downstream watercourse. The CSWMP would include the following measures: ▪ Storage of chemicals, fuels and oils in bunded areas onsite. ▪ Functioning spill kits will be kept on site for clean-up of accidental chemicals/fuels spills. Spill kits will be stocked and located for easy access and all site personnel will be appropriately trained in the use of spill response equipment. ▪ A spill response procedure will be prepared in accordance with the Australian Spill Control Industry Standard for Spill Response Kits (ASCIS 2695). ▪ Refuelling of vehicles and plant and equipment maintenance will be limited to designated areas with established spill capture and management controls and documented in a refuelling procedure.	Prior to construction During construction
SW04	Impacts of stockpiles	Include a Stockpile Management Plan as part of the SWMP to adequately manage any proposed temporary and permanent stockpiles. This will include detail on: ▪ Exact location of stockpiles including locating stockpiles and equipment storage areas away from drainage pathways and flood prone area and, where possible, in elevated positions or at alternative sites.	Prior to construction During construction

Reference	Impact	Management measure	Timing
		▪ Keep stockpiles to a minimum and ensure adequate contingency measures are in place to prevent sedimentation of waterways in the event of a large flood event. The height slopes and batters of the stockpiles should be documented together with the propped erosion and sediment controls. ▪ Minimise stockpile size and ensure delineation between different stockpiled material to prevent mixing and cross contamination. ▪ Consideration for future maintenance and restoration of stockpiles. ▪ Inspecting controls at least weekly and immediately after rainfall, rectifying damaged controls and removing controls once surfaces have been stabilised, including removing trapped sediment in drainage lines.	
SW05	Water quality	The location and details of all water quality controls (including but not limited to temporary sediment basins) would be further considered during pre-construction and may be updated by the construction contractor to suit detailed design changes. Diversion drains and erosion and sediment control measures recommended include but not limited to: ▪ Three temporary drainage lines to construction sediment basins at the WRRF. ▪ Sediment fences and diversion drains.	Prior to construction During construction
SW06	Concrete works	To avoid ingress of concrete waste material into downstream waterways, the CEMP would outline procedures to capture, contain, and appropriately dispose of any concrete waste for concrete works associated with the establishment of slabs for pumps, tanks and other structures.	Prior to construction During construction
SW07	Construction discharges	Prior to disposal of construction water collected in sediment basins, water should be treated to the appropriate standard specified in the CSWMP and repurposed on site wherever possible. Water that cannot be repurposed on site will require the Construction Contractor to seek approval and discharge criteria from the relevant Sydney Water Network Area Manager prior to discharge of water to the wastewater system. Otherwise, tanker construction discharges by a licenced waste contractor and disposed off-site to an appropriately licenced facility.	During construction
SW08	Tunnelling under waterways reduce bank stability and causes erosion and sedimentation	Locate the retrieval shaft back from the channel, beyond the top of bank to allow containment of any sediment or other substances above top of bank. Restore entry and exit points to pre-construction conditions.	Detailed design Construction
SW09	Trenching	Store materials excavated from the trench above the top of bank until the materials can be backfilled into the trench.	Construction
SW10	Drilling fluid entering downstream surface waters	Prepare a Drilling Fluid Management Plan, including measures to: ▪ Contain and monitor drilling fluids at enter/exit points ▪ Re-use and/or dispose of drilling fluids.	Prior to construction During construction

Reference	Impact	Management measure	Timing
SW11	Water quality monitoring – construction	A Construction Surface Water Monitoring Program would be developed and included in the CEMP to establish baseline conditions, to observe any changes in surface water quality and condition in watercourses that have the potential to be directly impacted during construction of the proposal and inform appropriate management responses. As a minimum, Breakfast Creek and Eastern Creek would continue to be monitored (NS090, NS087, NS085, NS094, NS0861). An additional site in Blacktown Creek is recommended in closer proximity to construction works associated with the brine pipeline. Should the results of monitoring identify that the water quality management measures are not effective in adequately mitigating water quality impacts, works would stop until suitable additional mitigation measures are identified and implemented, as required.	Prior to construction During construction
AQ01	Aquatic ecology – riparian vegetation removal	Rehabilitation of disturbed areas of riparian vegetation will be undertaken as soon as practical, progressively and in accordance with the rehabilitation strategy. Rehabilitation of removed riparian vegetation will involve replacing topsoil and re-planting native trees and plants.	Construction

5. Conclusions

This addendum assesses potential impacts on surface water quality and aquatic ecology from project refinements following public exhibition of the project REF. The project refinement is related to how the AWTP will operate and therefore construction impacts associated with the project remain unchanged from those reported in the REF.

For Stage 1, treating 20 ML/d through the AWTP and 28 ML/d via tertiary treatment is expected to lead to some indicators being discharged at higher concentrations than if all 48 ML/d was treated via the AWTP (i.e. as reported in the REF).

Implementing the project in 2 stages is expected to result in higher concentrations of key pollutants - based on modelled medians and 90th percentiles - during stage 1. However, the modelled median concentrations would still comply with the limits of EPL 1724.

All indicators except aluminium and iron would be higher in discharges to Breakfast Creek during Stage 1 compared to the scenario reported in the REF. Median concentration of total nitrogen, oxidised nitrogen, filterable aluminium, copper and zinc exceed recommended DPE (2022) performance criteria or ANZG (2018) DGVs during Stage 1 whereas only filterable aluminium was not expected to comply in the REF scenario. Modelled TSS shows an improvement in median concentrations during Stage 1.

Indicators of most risk to water quality of Breakfast Creek during Stage 1 are filtered aluminium, total cadmium and total iron which increased mainly due to lime dosing. However, they are not expected to affect aquatic ecosystems, as cadmium and iron are below ANZG (2018) limits and aluminium whilst slightly higher than ANZG (2018) is lower than existing Breakfast Creek concentrations.

Staged implementation maintains comparable flows to creeks and brine transfer arrangements, although the volume of brine released directly from Quakers Hill WWTP will be reduced, no additional ecological impacts beyond those in the REF are expected.

6. References

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Appendix E – Hydrology and geomorphology report

Technical Note

Project	Sydney Water Quakers Hill WRRF Upgrade	**Project No.**	24083
Title	REF – AWTP Stage 1 impact assessment technical note		
Date	17 November 2025		
Version	2		

1 Introduction

The Quakers Hill WRRF Advanced Treatment Upgrade project will modify and expand wastewater treatment processes and build a new brine pipeline between the WRRF and Sydney Waters existing wastewater network in Seven Hills.

The upgrade will introduce an Advanced Water Treatment Plant (AWTP) and upgrade the secondary treatment process from the current 28 ML/day to 48 ML/day. The project will increase the amount of wastewater that can be treated, to accommodate forecast growth in the Quakers Hill WRRF catchment and support the NSW Government's housing strategy.

It will improve the quality of the treated wastewater produced by the WRRF to meet the more stringent water quality requirements in its environment protection licence (EPL). This will be achieved with the AWTP that will include reverse osmosis. A Review of Environmental Factors (REF) has been prepared for these works and approved in September 2025.

Sydney Water has carried out further planning assessment, growth and compliance modelling, and identified that a staged delivery of the AWTP would meet growth and EPL compliance obligations. Two stages are now proposed for delivery of the AWTP:

- Stage 1: Install 20ML/day capacity AWTP by 2030
- Stage 2: Upgrade AWTP capacity to 48ML/day by 2036

This report assesses any change to the hydrologic and hydraulic metrics in Breakfast Creek and Eastern Creek from the staged delivery of the AWTP.

The relevant legislation, policy and guidelines; assessment methodology; and existing environment are described in the REF. This report assesses the impacts of Stage 1 in comparison to existing conditions. Stage 1 has been modelled and discharges approximately 3 – 5 ML/d more to Breakfast Creek during ADWF days, compared to the existing scenario.

2 Results

The changes in the hydrologic and hydraulic metrics within Breakfast Creek and Eastern Creek are presented in the following section. These show the magnitude of change for each metric. For some hydrologic metrics the percentage change is large, however when these flow changes are

compared to the ecohydraulic metrics (e.g. depth, velocity, shear stress) the magnitude of change is minor. The implications of these changes are further discussed in Section 3.

2.1 Hydrology

Breakfast Creek

Flow percentiles have been calculated for lower Breakfast Creek. Stage 1 increases the flow in Breakfast Creek across all percentiles, as shown in Table 1.

Table 1 Flow Duration Percentiles - Breakfast Creek, upgraded WRRF

Percentile	% Time Exceeded	Flow (ML/d) [Existing]	Flow (ML/d) [Upgraded WRRF – Stage 1]	% Change of Flow (Stage 1)
99th	1 %	290.7	309.8	6.6
90th	10 %	61.6	130.1	9.3
80th	20 %	42.5	68.0	10.3
75th	25 %	39.6	47.6	12.1
60th	40 %	36.2	44.4	12.2
40th	60 %	33.9	40.8	12.6
20th	80 %	31.8	38.2	12.5
10th	90 %	30.7	35.8	12.7

Streamflow metrics were calculated for Breakfast Creek in Table 2, for the period between 2012-2018. These metrics have been compared to the relevant waterway objectives for these waterways.

The most significant change is the 96% increase in average duration of fresh events. Under existing conditions, freshes would be on average 9 days duration. Under the Stage 1 scenario, the average length of freshes would double to 18 days duration. For high spell events, the duration has increased 17%, which on average increases the spell duration from 5 days to 6 days. These fluctuations in flow can play an important role in mobilising sediment, creating disturbance of the creek bed which is required to create a diversity of habitat. The increase in duration is not automatically a negative outcome. The effect of this increased duration needs to be considered in conjunction with the ecohydraulic results, specifically the changes in bed shear stress. This is discussed in Section 2.2.

Table 2 Streamflow metrics of lower Breakfast Creek compared to the South Creek objectives

Flow Component	Flow Metric	Breakfast Creek Objectives	Existing Breakfast Creek Regime	Upgraded WRRF Breakfast Creek Regime [Stage 1]	Change
Flow Dynamics (Non-Zero Flows)	Mean Daily Flow (ML/d)	12.1 ± 0.7	48.6	54.1	+11.3%
	Median Daily Flow (ML/d)	2.4 ± 0.3	35.0	39.3	+12.3%
Zero Flow (Cease to Flow)	Proportion of time (/y)	0.3 ±0.007	0.015	0.015	Nil
	Duration (days per year)	6 ± 1.1	0.33	0.33	Nil
Freshes	Fresh Threshold (ML/d) 75-90th percentile***	≥ 5.8 – 22.0	≥39.6	≥39.6	
	Frequency (#/y)	24.6 ±0.7	13.8	13.5	-2.2%
	Average Duration (days/y)	2.5 ± 0.1	123.7	242.8	+96.3%
High Spell Events	High Spell Threshold (ML/d) ≥ 90th percentile	22.0 ±1.7	≥61.6	≥61.6	
	Frequency (#/y)	19.2 ±1	9	10	+11.1%
	Average Duration (days/y)	2.2 ±0.2	50.8	59.3	+16.7%

***all spells that exceed the 75th percentile have been included in this analysis

Eastern Creek

Flow percentiles have been calculated for lower Eastern Creek. Stage 1 increases the flow in Eastern Creek across all percentiles as shown in Table 3.

Table 3 Flow Duration Percentiles - Eastern Creek, upgraded WRRF

Percentile	% Time Exceeded	Flow (ML/d) [Existing]	Flow (ML/d) [Upgraded WRRF – Stage 1]	% Change of Flow (Stage 1)
99th	1 %	2317	2338.6	0.9
90th	10 %	170	568.7	2.7

Percentile	% Time Exceeded	Flow (ML/d) [Existing]	Flow (ML/d) [Upgraded WRRF – Stage 1]	% Change of Flow (Stage 1)
80th	20 %	68	180.0	5.9
75th	25 %	57	73.1	8
60th	40 %	45	62.2	8.4
40th	60 %	40	49.8	10.6
20th	80 %	35	43.7	10.7
10th	90 %	33	39.1	12

Streamflow metrics were calculated for Eastern Creek, as shown in Table 4 for the period between 2012-2018. These metrics have been compared to the relevant waterway objectives for these waterways.

The most significant change is the 17% increase in average duration of fresh events. Under existing conditions, freshes would be on average 8 days duration. Under the Stage 1 scenario, the average length of freshes would be 10 days duration. For high spell events, the duration has increased 4%, which does not change the average duration of spells. These fluctuations in flow can play an important role in mobilising sediment, creating disturbance of the creek bed which is required to create a diversity of habitat. The increase in duration is not automatically a negative outcome. The effect of this increased duration needs to be considered in conjunction with the ecohydraulic results, specifically the changes in bed shear stress. This is discussed in Section 2.2.

Table 4 Streamflow metrics of lower Eastern Creek compared to the South Creek objectives

Flow Component	Flow Metric	Eastern Creek Objectives	Existing Eastern Creek Regime	Upgraded WRRF Eastern Creek Regime [Stage 1]	Change
Flow Dynamics (Non-Zero Flows)	Mean Daily Flow (ML/d)	66.6 ± 3.9	149.1	154.6	+3.7%
	Median Daily Flow (ML/d)	13.2 ± 1.9	42.0	46.2	+10%
Zero Flow (Cease to Flow)	Proportion of time (/y)	0.3 ±0.007	0	0	Nil
	Duration (days per year)	6 ± 1.1	0	0	Nil
Freshes	Fresh Threshold (ML/d) 75-90th percentile***	≥31.7 – 121.2	≥57.4	≥57.4	
	Frequency (#/y)	24.6 ±0.7	14.8	14.3	-3.5%

Flow Component	Flow Metric	Eastern Creek Objectives	Existing Eastern Creek Regime	Upgraded WRRF Eastern Creek Regime [Stage 1]	Change
	Average Duration (days/y)	2.5 ± 0.1	121.7	141	+17.0%
High Spell Events	High Spell Threshold (ML/d) ≥ 90th percentile	121.2 ± 9.2	≥169.9	≥169.9	
	Frequency (#/y)	19.2 ± 1	11.8	12.3	+4.2%
	Average Duration (days/y)	2.2 ± 0.2	52.7	54.8	+4.0%

***all spells that exceed the 75th percentile have been included in this analysis

2.2 Ecohydraulics

Breakfast Creek

The differences in velocity, depth, wetted perimeter and flow area are summarised in Table 5 and Table 6. The difference in depth is typically limited to an increase of 0.02 m, with the change in velocity typically limited to less than 0.05 m/s.

Table 5 Summary of changes in the ecohydraulic metrics for lower Breakfast Creek

Hydraulic Metric	Flow Percentile	% of Breakfast Creek reach where change < 10%
Depth	80th	100%
	50th	100%
	20th	100%
Velocity	80th	99%
	50th	99%
	20th	99%
Wetted Perimeter	80th	100%
	50th	100%
	20th	100%
Flow Area	80th	100%
	50th	100%
	20th	100%

Table 6 Summary of changes in the hydraulic metric criteria for lower Breakfast Creek

Hydraulic Metric Criteria	Flow Percentile	Existing (m)	Upgraded WRRF (m) [Stage 1]
Length of creek where 0.4 m < Depth < 0.8 m	80th	350	365
	50th	340	360
	20th	345	345
Length of creek where Velocity < 0.05 m/s	80th	30	25
	50th	50	35
	20th	65	40
Minimum Wetted Perimeter (m)	80th	2	2
	50th	1.9	1.9
	20th	1.8	1.9
Minimum Flow Area (m^2)	80th	0.3	0.3
	50th	0.3	0.3
	20th	0.2	0.3

The length of lower Breakfast Creek that reaches the threshold shear stresses at the 75th and 90th percentiles is presented in Table 7. Shear stress thresholds are increased over approximately an additional 25 m length of waterway (3.4%). This will not measurably increase the movement of bed sediment in the creek.

Table 7 Changes in the shear stress ecohydraulic metrics for lower Breakfast Creek

Reach	Sediment Size Description	Shear Stress Threshold (N/m2)	75th Percentile Length (m) exceeding and Percentage of waterway		90th Percentile Length (m) exceeding and Percentage of waterway	
			Existing	Upgraded WRRF [Stage 1]	Existing	Upgraded WRRF [Stage 1]
Breakfast Creek	Fine Grained Sand (D75<1.3 mm)	1	285 (38.3%)	310 (41.9%)	365 (49.0%)	385 (52.0%)
	Fine Gravel (D75<7.5 mm)	5.6	80 (10.7%)	80 (10.7%)	95 (12.8%)	115 (15.5%)
	Fine Graded Silts / Clays	6.6	75 (10.1%)	80 (10.7%)	85 (11.4%)	90 (12.2%)

Eastern Creek

The differences in velocity, depth, wetted perimeter and flow area metrics are summarised in Table 8 and Table 9.

Table 8 Summary of changes in the ecohydraulic metrics for lower Eastern Creek

Hydraulic Metric	Flow Percentile	% of Eastern Creek reach where change < 10%
Depth	80th	99%
	50th	99%

Hydraulic Metric	Flow Percentile	% of Eastern Creek reach where change < 10%
	20th	99%
Velocity	80th	99%
	50th	99%
	20th	99%
Wetted Perimeter	80th	99%
	50th	99%
	20th	99%
Flow Area	80th	99%
	50th	99%
	20th	99%

Table 9 Summary of changes in the hydraulic metric criteria for lower Eastern Creek

Hydraulic Metric Criteria	Flow Percentile	Existing (m)	Upgraded WRRF (m)
Length of creek where 0.4 m < Depth < 0.8 m	80th	235	225
	50th	240	245
	20th	235	230
Length of creek where Velocity < 0.05 m/s	80th	25	15
	50th	100	70
	20th	130	110
Minimum Wetted Perimeter (m)	80th	2.7	2.8
	50th	2.5	2.6
	20th	2.4	2.5
Minimum Flow Area (m^2)	80th	0.4	0.4
	50th	0.2	0.3
	20th	0.2	0.2

The length of lower Eastern Creek that reaches the threshold shear stresses at the 75th and 90th percentiles is presented in Table 10. Shear stress thresholds are increased along on approximately 5m more waterway length (<0.1%). This will result in negligible additional movement of sediment compared to the existing case.

Table 10 Changes in the shear stress ecohydraulic metrics for lower Eastern Creek

Reach	Sediment Size Description	Shear Stress Threshold (N/m^2)	75th Percentile Length (m) exceeding		90th Percentile Length (m) exceeding	
			Existing	Upgraded WRRF [Stage 1]	Existing	Upgraded WRRF [Stage 1]
Eastern Creek	Fine Grained Sand (D75<1.3 mm)	1	245 (38.3%)	250 (39.1%)	445 (69.5%)	450 (70.3%)
	Fine Gravel (D75<7.5 mm)	5.6	95 (14.8%)	100 (15.6%)	150 (23.4%)	155 (24.2%)

Reach	Sediment Size Description	Shear Stress Threshold (N/m²)	75th Percentile Length (m) exceeding		90th Percentile Length (m) exceeding	
			Existing	Upgraded WRRF [Stage 1]	Existing	Upgraded WRRF [Stage 1]
	Fine Graded Silts / Clays	6.6	75 (11.7%)	75 (11.7%)	145 (22.7%)	145 (22.7%)

3 Impacts

3.1 Breakfast Creek

As shown in the section above, the change in the hydrologic and ecohydraulic metrics is minor, except for the duration of fresh events. There is minimal change in the flow components or the depth, velocity, shear stress or wetted perimeter along the Breakfast Creek channel.

The average duration of fresh events almost doubles from 9 days to 18 days under Stage 1, which may result in a minor increase in the movement of bed sediment in the creek. These short-term fluctuations in flow can play an important role in mobilising sediment, creating disturbance of the creek bed which is required to create a diversity of habitat. The increase in duration is not automatically a negative outcome, however this may result in more sediment movement during freshes and high spells events.

The likelihood of geomorphic change in this reach in response to changes in hydraulic conditions is considered "possible" given its low to moderate geomorphic sensitivity and moderate resilience/adaptive capacity. The consequences are considered insignificant given the small to negligible change in the hydrologic and hydraulic metrics, except for the fresh frequency and duration metric. Results are summarised in Table 11.

Table 11 Summary of hydrologic and geomorphic impacts on Breakfast Creek between baseline conditions and the upgraded WRRF

	Baseflow	Depth	Wetted Perimeter	Velocity	Shear Stress	Fresh Frequency and Duration
Consequence	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Minor
Likelihood	Possible	Possible	Possible	Possible	Possible	Possible
Risk	Low	Low	Low	Low	Low	Medium

Given the insignificant change to baseflows in Breakfast Creek, and the limited change in flow conditions as described above, the potential risk to the ecological values of Breakfast Creek is overall considered Low. To mitigate the potential for increased risk due to the increase in the duration of freshes and high spells, we recommend monitoring (Section 3.5) is undertaken.

3.2 Eastern Creek

The change in the hydrologic and hydraulic metrics is minor. There are minimal changes in the depth, velocity or wetted perimeter along the Eastern Creek channel below the confluence.

There is minimal change to the duration of fresh events, although the frequency of these flow components remains the same.

The likelihood of geomorphic change in this reach in response to changes in hydraulic conditions is considered "unlikely" given its low to moderate geomorphic sensitivity and moderate resilience/adaptive capacity. The consequences are considered minor to insignificant given the small to negligible change in the hydrologic and hydraulic metrics.

Results are summarised Table 12.

Table 12 Summary of hydrologic and geomorphic impacts on Eastern Creek between baseline conditions and the upgraded WRRF

	Baseflow	Depth	Wetted Perimeter	Velocity	Shear Stress	Fresh Frequency and Duration
Consequence	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Likelihood	Possible	Possible	Possible	Possible	Possible	Possible
Risk	Low	Low	Low	Low	Low	Low

3.3 Pipeline and Ancillary Infrastructure Impacts

Construction and operational impacts to the pipeline and ancillary infrastructure impacts for Stage 1, remain as per the REF for Stage 2. No additional assessment has been undertaken.

3.4 Cumulative Impacts

Cumulative impacts remain as per the REF for Stage 2. No additional assessment has been undertaken.

3.5 Mitigation and Monitoring Measures

Breakfast and Eastern Creeks

Overall, hydrologic and geomorphic impacts to Breakfast and Eastern Creeks as a result of the change to the treated water discharges are likely to be Low and limited to the operational phase, apart from the fresh frequency and duration metric.

During the operational phase the most likely geomorphic impact will be the potential for increased movement of bed sediment within the waterways, because of minor increases to the

average fresh duration. As Stage 1 is an interim period that is expected to be operational for a period of 6 years, this is unlikely to cause long-term erosion of the channel.

The potential risk to the ecological values of Breakfast Creek is overall considered Low. To mitigate the potential for increased risk due to the increase in the duration of freshes and high spells, we recommend monitoring is undertaken. Residual risks associated with the increase in water discharges can be addressed through an ad-hoc monitoring program.

Inspections of the waterway downstream of the WRRF discharge pipe should be conducted following any extended wet period (>3 months of ADWF) to identify any increases in erosion in the channel for up to 2 years following completion of the works.

Pipeline Waterway Crossings and Ancillary Works

Mitigation measures remain as per the REF for Stage 2. No additional assessment has been undertaken.

Monitoring Requirements

Monitoring during construction remains as per the REF for Stage 2.

During operations, ad-hoc on-going monitoring of the physical attributes of Breakfast and Eastern creeks is suggested to ensure no significant erosion occurs. The following are recommended:

- Monitoring:
    - Baseline monitoring of the bed and vegetation condition, to be completed prior to the upgraded WRRF treatment water releases.
    - Ad-hoc (typically every 6 months) visual monitoring for bed erosion and bank slumping, and vegetation condition monitoring following extended (>3 month) periods of wet weather flow conditions, for up to two years following completion of construction.

This monitoring can be completed using fixed photo-points at strategic locations particularly where critical vegetation has been identified, as per locations recommended in the REF.

4 Conclusion

This technical note assessed impacts on the hydrology (instream water conditions that relate to habitat) and geomorphology (physical form and function) of the receiving waterways from the operational phase of Stage 1 AWTP works. The receiving waters are Breakfast Creek and Eastern Creek which are within the broader South Creek catchment, in the Hawkesbury Nepean River system.

A range of hydrologic and hydraulic metrics were used to determine the implications on the hydraulic habitat and geomorphology of the waterways. The changes in the metrics across both waterways as a result of the upgraded WRRF are minor and the associated risks are Low during the operation phase, except for the Fresh Frequency and Duration metric for Breakfast Creek which is considered to have a Medium risk.

To address any residual risks, ad-hoc monitoring of the waterway is recommended following long wet periods (> 3 months) for the first two years following completion of construction. This would be to assess potential increases in erosion along the creeks.

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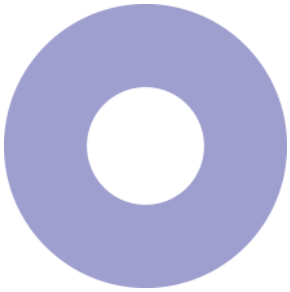
Glossary

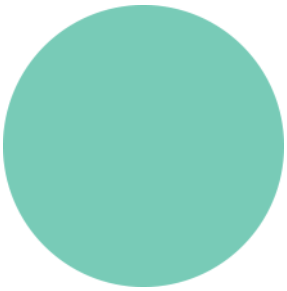
Term	Meaning
Advanced treated water	Water that is treated to an advanced level, including microfiltration, ultrafiltration and reverse osmosis to filter out very fine particles. Also known as very high quality treated water
Aquatic ecology	The study of plants and animals that live in rivers and streams
Bypass	When wastewater bypasses wastewater treatment facilities and is not fully treated. It is caused usually by plant failures or wet weather flows exceeding plant capacity
Catchment	The land area contributing to surface runoff and flow within rivers and creeks
Fauna	Animals
Flood	A high stream flow which overtops the riverbank and inundates land that is usually dry
Flora	Plants
Flow (in waterways)	The flow of water in rivers and creeks. Water flowing in rivers or creeks comes from surface runoff and groundwater
Groundwater	Water that accumulates underground within cracks or pores in rocks. This water forms groundwater resources, which eventually flow into rivers, lakes or the ocean
Groundwater Dependent Ecosystem	Ecosystems that need access to groundwater to meet all or some of their water requirements to maintain their communities of plants and animals
Habitat	The natural resource, physical and biotic factors that are present in an area that support the survival of plants and animals
Impact area	The area that will be impacted by the proposal
Macroinvertebrate	Small animals that live for all or part of their lives in water (eg insect larvae, beetles and snails)
Nutrients	Chemical elements and compounds essential to the growth and survival of living organisms
Pollutant/nutrient load	Describes the quantity of pollutants or nutrients that may enter a waterway in a year
Recycled water	Recycled water is water that has been used before and is then cleaned to remove impurities. Recycled water (sometimes called reclaimed water) comes from wastewater, which includes greywater and stormwater. Sydney Water treats recycled water to Australian Recycled Water Guidelines and NSW Health standards so that it is suitable and safe for its intended use

Term	Meaning
Resource recovery	Recovery of valuable material from wastewater
Sediment basins	A pond like structure designed reduce flow velocities from runoff which then allows sediments to settle and be removed prior to discharge to a waterway
Wastewater	Water used in homes, schools, businesses and industries that goes down drains from sinks, baths, showers, laundries and toilets and other drains inside buildings. Sometimes known as sewage
Wastewater catchment	A wastewater catchment is a geographical area of the wastewater network that drains into a single point within the wastewater network
Water resource recovery facility	A facility where various processes are used to treat wastewater and remove pollutants

Abbreviations

ADWF	Average Dry Weather Flow
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AWTP	Advanced Water Treatment Plant
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CCT	Chlorine contact tank
CEMP	Construction Environmental Management Plan
CLMP	Contaminated Land Management Plan
CSEP	Community and Stakeholder Engagement Plan
DPE	Department of Planning and Environment (former)
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPA	Environment Protection Authority
EPL	Environment Protection Licence
IDALs	Intermittently Decanted Aerated Lagoons
LGA	Local government area
ML	Megalitre / million litres
NSOOS	Northern Suburbs Ocean Outfall Sewer
NSW	New South Wales
PCT	Plant community type
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PRW	Purified Recycled Water
REF	Review of Environmental Factors
SEPP	State Environment Planning Policy
SIS	Species Impact Assessment
SRP	Soluble reactive phosphorus
TISEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
WAE	Work-as-Executed
WRRF	Water Resource Recovery Facility





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