Our ref: DOC21/923840
Senders ref: SSI-8609189

Nathan Heath
Planning Officer
Planning and Assessment Group
Department of Planning, Industry and Environment
4 Parramatta Square, 12 Darcy Street
Parramatta NSW 2150

Dear Mr Health

Subject: Exhibition - Upper South Creek Advanced Water Recycling Centre (SSI-8609189)

Thank you for your email received 15 October 2021 requesting comments from Environment, Energy and Science Group (EES) on the Upper South Creek Advanced Water Recycling Centre (SSI-8609189).

It is understood that the project is seeking approval to construct and operate a wastewater treatment plant located between South Creek and Kemps Creek, and associated infrastructure, including new pipelines between Warragamba and Lansdowne. In summary, the EIS states that the project comprises:

- a new Advanced Water Recycling Centre (AWRC) to collect wastewater from businesses and homes and treat it, producing high-quality treated water, renewable energy and biosolids for beneficial reuse
- new infrastructure from the AWRC to South Creek, to release excess treated water during significant wet weather events, estimated to occur about 3 – 14 days each year
- a new treated water pipeline from the AWRC to Nepean River at Wallacia Weir, to release high-quality treated water to the river during normal weather conditions
- a new environmental flows pipeline from Wallacia to Warragamba River, to release high quality treated water to the river just below the Warragamba Dam
- a new brine pipeline from the AWRC connecting into Sydney Water's existing wastewater system to transport brine to the Malabar Wastewater Treatment Plant
- a range of ancillary infrastructure.

The EIS also states that the project is planned to be built in stages, with the EIS assessing Stage 1, consisting of:

- building and operating the AWRC to treat a daily wastewater flow, known as the average dry weather flow (ADWF), of up to 50 megalitres per day (ML/day)
- building all pipelines to cater for up to 100 ML/day flow coming through the AWRC (but only operating them to transport and release volumes produced by Stage 1).

The EIS further states that it also seeks a staged approval for the overall concept of the AWRC operating at up to 100 ML/day and that future stages will involve expansion of the AWRC capacity but will not require new pipelines. In regard to future stages, the EIS indicates:

"The timing and size of these stages will be established over time to align with growth in the servicing area. Sydney Water is seeking approval to build and operate Stage 1 and approval for the overall concept of the AWRC operating at up to 100 ML/day as part of the staged approval.

Future stages will align with the overall concept presented in this EIS and will require further assessment and approval once development plans for future stages can be provided".

EES has reviewed the relevant documentation and provides comments in relation to biodiversity, floodplain risk management and waterway health at Attachment 1. In regard to waterway health, EES comments in this submission are limited to impacts on South Creek. It should however be noted that the NSW EPA will also be providing comments on waterway health matters.

As detailed in Attachment 1, EES raises significant concerns in regard floodplain risk management and waterway health which will require substantial amendments to the EIS. EES also seeks additional information in regard to biodiversity matters.

As previously discussed, EES comments in regard to National Parks and Wildlife Service reserves will be provided separately.

Given the significant and complex issues raised, EES recommends that meetings be arranged between DPIE PAG, EES and Sydney Water to further discuss the issues raised in this submission. It is important to note that the AWRC is one the most significant proposals for water infrastructure in Greater Sydney in the last decade, and it is expected that other responsible water and environment agencies are also providing comments on the EIS.

Environment Protection and Biodiversity Conservation Act 1999 Matters of National Environmental Significance
The SSI proposal is an *Environment Protection and Biodiversity Conservation Act 1999* controlled action as there are likely to be significant impacts on the following controlling provisions:

- Listed threatened species and communities (sections 18 and 18A).
- World Heritage properties (s12 and 15A).
- National Heritage places (s15B and 15C).

EES advice on listed threatened species and communities (sections 18 and 18A) is provided in Attachment 2. Please note that EES advice in regard to World Heritage properties and National Heritage places will be provided separately.

If you have any queries please contact Marnie Stewart via marnie.stewart@environment.nsw.gov.au or 02 9995 6868.

Yours sincerely

S. Harrison

01/12/21

Susan Harrison

Senior Team Leader Planning
Greater Sydney Branch
Biodiversity and Conservation

Attachment 1 – EES on the Upper South Creek Advanced Water Recycling Centre (SSI-8609189) EIS and technical reports

Biodiversity

EES has reviewed the Biodiversity Development Assessment Report (BDAR) and provides the following comments:

- The calculator for the Wollemi IBRA subregion has not been finalised in the BAM-C.
- To be compliant with section 6.15 of the *Biodiversity Conservation Act, 2016* a BDAR must be certified within 14 days of the date shown on the finalised credit report. It is noted the date of the BDAR is 23/9/21, and the date on the credit summary report is 19/10/21, which is longer than 14 days. Also, when the credit report is printed from the BAM-C, the date is 27/10/21.
- The BDAR includes a credit summary report for the Cumberland IBRA subregion but no similar report has been included for the Wollemi IBRA subregion.

In regard to the project, EES raises concern that it will lead to major biodiversity impacts. For example, the proposal will lead to the direct removal of 13.77 ha (non-certified) of vegetation and habitats, which includes 4.37 hectares of the critically endangered ecological community Cumberland Plain Woodland of which 0.93 ha is classed as being in 'intact' condition. A number of other threatened ecological communities, threatened flora species and threatened fauna habitats will also be lost. EES recommends that further avoidance of biodiversity values be considered.

Sydney Region Growth Centres Biodiversity Certification

Part of the development site is located in the Growth Centres subject to the *Order to confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (Biodiversity Certification Order) and *State Environmental Planning Policy Sydney Region Growth Centres 2006* (Growth Centres SEPP).

When undertaking development on land to which the Growth Centres biodiversity certification applies, the following relevant biodiversity measures (RMBs) must be met:

- a minimum of 2000 ha of existing native vegetation (ENV) must be retained and protected within the Growth Centres (RBM) 6
- protection of ENV, either within the certified areas and/or the non-certified areas (RBMs 6, 7 and 8)
- red hatched land (RBM12)
- black hatched land (RBM 17)
- essential infrastructure proposals that involve clearing of ENV in the non-certified areas and that do not require development consent under the SEPP must be offset by applying the requirements specified RMB 8 (RMB 11).

ENV and red hatched areas

Section 14.1.1 of the BDAR states that the project will impact 0.33 ha of ENV subject to RBM 8, RBM 11 and RBM 12, where the impact area crosses Kemps Creek. In regard to the Kemps Creek crossing, the BDAR states that impacts to this vegetation will occur as a result of a need to open trench the watercourse. Also, that the option of underboring the watercourse was considered as a crossing option however geotechnical field investigations identified a fault line under Kemps Creek. To reduce impacts to ENV in this location, the BDAR outlines that the impact area has been narrowed to 15m from 25m over most of the alignment.

The maps in the BDAR however do not depict the location of the validated ENV within the non-certified land to be impacted. Furthermore, there is also a second red-hatched area containing

ENV located on Elizabeth Drive at Cross Street that also appears to be impacted by the proposed development that has not been identified on the maps in the BDAR.

In regard to the red hatched areas, it is important to note that the two red hatched areas of land are zoned Public Recreation – Regional under Part 3 of the Growth Centres SEPP. The acquisition of red hatched land is a commitment under the Biodiversity Certification Order and the Commonwealth Growth Centres Strategic Assessment Approval.

RMB 12 specifies "*in the lands marked by a red hatching on the biodiversity certification maps existing native vegetation must not be cleared unless it is in accordance with a plan of management or unless such clearance has been agreed to by the DECC".*

To determine the impacts on non-certified ENV and red hatched areas, EES seeks finer scale maps and shape files depicting the location of the ENV and red hatched areas and the proposed direct and indirect impacts from the development. The revised information should also include details about the proposed construction methods and mitigation measures to minimise impacts. This information is required to inform EES's consideration of the proposal and decision in regard to RMB 12.

Black Hatched lands
The BDAR states that "*The impact area also occurs along the boundary of an area identified by RBM 17 as holding a potential population of Downy Wattle, along Cross St, Kemps Creek, the vegetation was surveyed as per the BAM guidelines Surveying threatened plants and their habitats (DPIE 2020e), therefore addressing the requirements of this RBM".*

RBM 17 requires *Acacia pubescens* to be surveyed to confirm the presence of the species and if present, provide for the protection of the area of suitable habitat for the species to EES's satisfaction. In order to adequately address RMB 17, EES seeks further details about the survey undertaken in this specific location including survey method and maps.

Biodiversity Certification Offset Strategy
Section 15 in the BDAR states *offsets will be secured though either revegetation / restoration at an offsetting ratio of 3:1 (in accordance with the requirements of RBM 8), or through the transfer and retirement of biodiversity credits under the BOS, generated from a Biodiversity Stewardship Site within the Growth Centres.*

EES requires addition information in regard to the Growth Centres Biodiversity Certification offset strategy including:

- the location of the proposed 3:1 restoration including tenure, funding arrangements and proposed measures to ensure long protection, and/or
- the location of the Biodiversity Stewardship Site/s within the Growth Centres.

Growth Centres SEPP – Clause 18A
It is recommended that DPIE PAG consult with the DPIE Infrastructure Planning Team in regard to clause 18A in the Growth Centres SEPP.

EPBC Act – Matters of National Environmental Significance-

The BDAR outlines that the project was declared a controlled action on 3 December 2020 (EPBC Act referral 2020/8816) as there are likely to be significant impacts on the following controlling provisions:

- Listed threatened species and communities (sections 18 and 18A).
- World Heritage properties (s12 and 15A).
- National Heritage places (s15B and 15C).

EPBC Act - Listed threatened species and communities (sections 18 and 18A)

EES's bilateral assessment is detailed in Attachment 2 and has been prepared considering the EPBC notes. As outlined in the advice, EES does not agree with the conclusion that the project will not have a significant impact on two EPBC Act-listed entities, being Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and the Spiked Rice-flower (*Pimelea spicata*). Where significant impacts are likely, offsets are required. EES notes that in accordance with the BAM, like-for-like offsets will be provided for both these entities.

EPBC Act - World Heritage properties (s12 & 15A) and National Heritage places (s15B & 15C)

As previously advised, EES comments will be provided separately.

Floodplain risk management

EES previously communicated and met with the proponent and its consultants in June 2021, to discuss the flood modelling approach required to inform the project's flood impact assessment. In its email dated 7 June 2021, EES advised the proponent about the basic requirements and outcomes of the Flood Impact and Risk Assessment (FIRA) to support this State significant infrastructure. EES advised that the base case modelling of the assessment should be validated to ensure its consistency with the INSW's work (Advisian, 2020) which is based on Penrith City Council's adopted flood studies and plan.

EES has reviewed the USC AWRC Flood Impact Assessment (Aurecon ARUP, September 2021) and considers the assessment, as presented in the report, is not fit for purpose and misleading due to the following key issues that have been identified with the analysis and reporting.

Existing case models are not consistent with Council's adopted models

Section 4.2 model methodology states *5. As the updated South Creek Flood Study (WorleyParsons, 2015) is the local Council's current reference flood study for the study area, the hydrology and hydraulic models were validated against this study using the ARR 1987 data*.

This is clearly different to modelling methodology employed by the Aurecon ARUP Flood Impact Assessment. The validation as outlined in Section 4.3 and Section 4.4.7, which was a form of benchmarking to Penrith Flood Study 2015, was undertaken for hydrologic and hydraulic models that are different than the models used in the Aurecon ARUP Flood Impact Assessment.

The Aurecon ARUP Flood Impact Assessment outlines two different hydrologic models, which are presented below.

(1) The first XP-RAFTS model utilised ARR1987 hydrology and applied input parameters IFD and losses and critical duration like Council's South Creek calibrated adopted parameters. This is the XP-RAFTS model that has been benchmarked against Penrith Flood Study 2015 as outlined in Section 4.3. Table 4-3 shows this XP RAFTS model ARR1987 provides flow of 470m^3/s upstream

of Elizabeth Drive. EES notes the report incorrectly refers to this ARR1987 model as AWRC Model.

(2) The Second XP-RAFTS model is the USC AWRC XP-RAFTS model is used in Aurecon ARUP 2021 Flood Impact Assessment for existing case hydrologic model. This XP_RAFTS utilised ARR2016 hydrologic methodology and applied uncalibrated input parameters for IFD and losses derived from ARR2016 Data Hub.

This XP-RAFTS model's results have not been benchmarked against Penrith Flood Study, 2015. Table 4-8 shows this XP RAFTS model ARR2016 provides flow of 290m^3/s upstream of Elizabeth Drive.

Flood consultants understand that, changes in the model's hydrologic methodology and input parameters will result in different model results. Appropriate calibration and validation to historic events using appropriate techniques and determination of parameters is essential for a reliable model to ensure that the selection of model's principal parameters will achieve reasonable accuracy in model results.

The NSW Government's guideline *'Incorporating ARR2016 in flood studies'* provides a hierarchy of approaches for losses parameters. Utilising parameters of calibrated and validated models is the most preferable approach, while the use of ARR Data Hub is the least preferred approach in NSW. Contrary to the Government's guideline, instead of calibrating and validating the model the consultants selected the most least preferable approach identified by the guideline for adopted parameters. As a result, using this approach the model provides significantly underestimated flow, which is approximately half the flow value in Council's adopted flood study. This is inappropriate and inconsistent with NSW's industry best practice.

Table 4-3 Comparison between 1% AEP XP-RAFTS flows and WorleyParsons (2015) models (ARR1987)

Parameter Value		XP-RAFTS Sub-catchment ID		Peak 1% AEP 36-hr Discharge (m^3/s)		% Difference in flows
		WorleyParsons Model	AWRC Model	WorleyParsons Model	AWRC Model	
South Creek	Upstream of Bringelly Rd	1.08	1.13	312	314	1%
	Upstream of Elizabeth Drive	1.13	1.25	479	470	-2%
	Upstream of M4 Motorway	1.23	1.43	1164	1107	-5%
	Upstream of Great Western Highway	1.25	1.44	1175	1119	-5%
Kemps Creek	Bringelly Road	9	62.02	33	32	-3%
Cosgroves Creek	2.5 km downstream of Elizabeth Drive	12.02	79.05	93	95	2%
Badgerys Creek	Upstream of Badgerys Creek Road	5	47.07	53	57	8%

Table 4-8 Modelled South Creek flood flowrates upstream of Elizabeth Drive

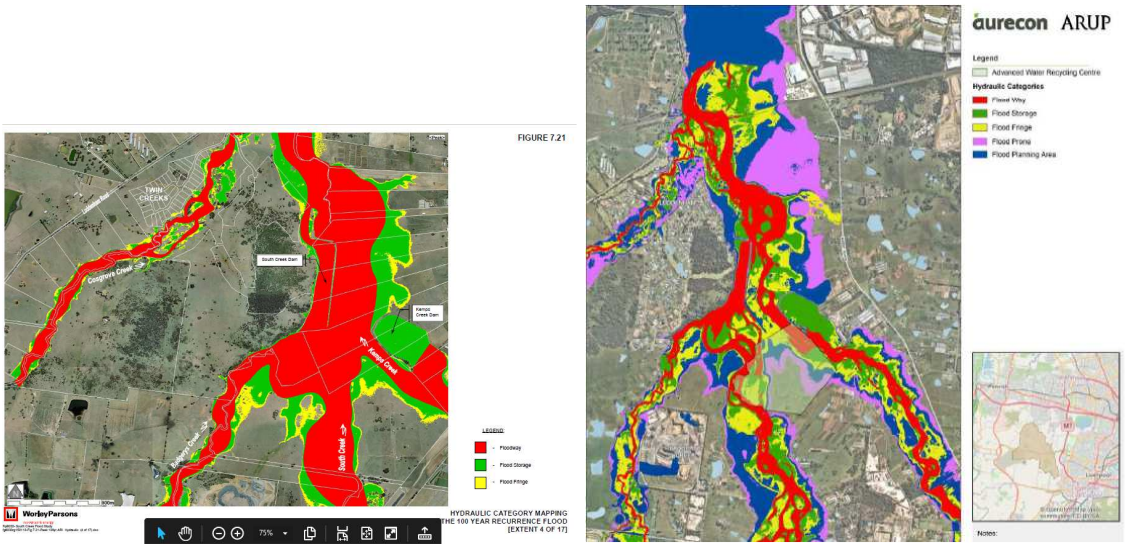
Event modelled	WorleyParsons (ARR 1987)	OEH Study^ (At-site FFA*)	OEH Study^ (ARR 2016)	Advisian Study (ARR 2019)	AWRC Study (ARR 2016)
10% AEP flowrate (m^3/s)	-	170	124		115
1% AEP flowrate (m^3/s)	450	538	295	492	290

Similarly, the Aurecon ARUP Flood Impact Assessment outlines two different hydraulic models. The TUFLOW hydraulic model that was benchmarked against Penrith's 2015 Flood Study, as discussed in Section 4.4.7, is not the USC AWRC TUFLOW existing case hydraulic model used in Aurecon ARUP 2021 Flood Impact Assessment.

The consultants benchmarked a TUFLOW hydraulic model that applied inflow inputs from the XP-RAFTS 1987 hydrologic model and presented the results in Table 4-7, Figure 4-10, Figure 4-11 and Figure 4-12. However, the actual USC AWRC TUFLOW hydraulic model that was utilised for the existing case of Aurecon ARUP 2021 Flood Impact Assessment applied inflow inputs the AWRC XP RAFTS model ARR2019.

Flood consultants understand that, changing the inflow inputs into a hydraulic model will result in different model results. Therefore, the consultant's discussion on validation of both hydrologic and hydraulic models as presented in Section 4.3 and Section 4.4.7 is misleading and incorrect. The modelling approach is neither sound nor appropriate to inform the modelling results of the flood assessment.

An example of inconsistency between the Aurecon ARUP Flood Impact Assessment results and Penrith's WorleyParsons (2015) results is presented in the figures below:



Accordingly, all results presented in Figures 6-4 to Figure 6-30 for the 'Existing Case' presented in Section 6.2 are not consistent with Penrith Council's South Creek adopted Flood Study

(WorleyParsons, 2015). All reference in the titles of the figures presented in Section 6.2 that they are based on WorleyParsons (2015) are misleading and incorrect.

Without appropriate modelling, analysis and consistency in reporting, the Flood Impact Assessment as presented by Aurecon ARUP cannot be relied upon to provide its intended purpose. Neither can it be confidently utilised as an existing base case scenario fit for the analysis of this State Significant Infrastructure flood impact and risk assessment.

Recommendations
EES recommends the proponent amend the Flood Impact Assessment and adequately address the following requirements.

Existing Base Condition
Identifying existing flood behaviour (pre-development condition) for the full range of floods up to and including the probable maximum flood. The FIRA should outline and map existing flood behaviour based on the *Wianamatta (South) Creek Catchment Flood Study - Existing Conditions* report (final, version H, 25 Nov 2020) which is consistent with Penrith City Council's adopted flood studies and flood risk management study and plan. INSW has previously provided this information to the proponent.

The study also can be accessed on the NSW Flood Data Portal website and is available at this link: https://flooddata.ses.nsw.gov.au/flood-projects/wianamatta-south-creek-catchment-flood-study-existing-conditions

In addition, information from Council's adopted flood studies would be available for the flood assessment.

If the consultant utilises any alternate models with different input parameters, as is the case with Aurecon ARUP Flood Impact Assessment, they must be calibrated and validated to historical data to ensure that the discharge and hydrographs, levels and timing within the hydraulic model for key events and locations in the pre-developed case, match those within the INSW flood model and/or Council's adopted flood models before commencing the design flood events for the existing scenarios.

The Flood Impact Assessment study area should include the vicinity of the AWRC, adequate distance upstream of Elizabeth Drive and downstream to the Great Western Highway.

Developed Condition and Impact Assessment
- Amend existing case model to develop compatible hydrologic and hydraulic flood models to reflect the post-developed case including landform modification and proposed infrastructure, including the AWRC components, the pumped systems pipes (trenched and tunnelling) from the AWRC and the propose green space area including any earthworks and change in vegetation in floodway areas.
- Identify and map the flood behaviour for the developed condition for the full range of flood up to the PMF.
- Identify and report on the impacts of the proposed infrastructure for the full range of flood up to the PMF on flood behaviour and on the community for both construction phase and operational phase.
- Assess the impacts of flooding on the proposed infrastructure and outline management measures to offset these impacts for both construction phase and operational phase.

- The impact of climate change due to increase in rainfall intensities should consider the life cycle of the infrastructure and not limited to 2070.
- In addition, the impacts on flooding due to the alignment of the pumped systems pipes that are crossing waterways outside the South Creek Catchment should also be adequately assessed.

General comments

- Comments on Section 4.2 that states *As part of the Western Sydney Aerotropolis South Creek Flood Study (AAJV, 2019), a XP-RAFTS hydrology model and a 1D/2D TUFLOW model (refer to Section 4.3 and Section 4.4) were prepared for the South Creek catchment and validated against previous studies. These models were used as the basis for development of the models in the AWRC study.*

  The above statement is incorrect. The Western Sydney Planning Partnership (WSPP) has engaged Advisian to undertake the Western Sydney Aerotropolis Flood Impact and Risk Assessment to inform WSPP's decision on flooding. This Assessment is based on the INSW's South Creek Flood Assessment, which is overseen by an Agency Working Group, including INSW, EES and DPIE PDPS, and aims to inform Government's decisions on the Aerotropolis and South Creek Catchment. INSW's South Creek Flood Assessment is based on Penrith City Council's adopted South Creek Flood Study (WorleyParsons, 2015) and adopted South Creek Floodplain Risk Management Study and Plan (Advisian, 2018).

  INSW's Wianamatta South creek Catchment Flood study Existing Condition, November 2020 can be publicly accessed on the NSW Flood Portal.

- The NSW Flood Prone Land Policy does not exclude the location of stormwater infrastructure from within the extent of the 1% AEP flood if the development demonstrates there are no detrimental impacts on flood behaviour or the community. Infrastructure such as basins should be excluded from the floodway and flood storage areas as these areas are essential for the conveyance and storage of the flow during flood and would result in detrimental impact on flood behaviour and on the community.

Waterway health

The AWRC represents one of the most significant water infrastructure projects in Greater Sydney in the last decade. This is reflected in the EIS, where a review of potential impacts arising from construction and operation of the AWRC is required from across various NSW Government departments. Accordingly, EES in preparing comments on the potential impacts of the AWRC on water quality and health of the receiving waterways, it was assumed that the EIS was also sent to:

- DPIE-Water – for expertise and role in managing environmental flows (e-flows), groundwater ecosystems, aquifers and river health, as required under the *Water Management Act 2000*
- DPI-Fisheries – for expertise and role in managing threatened fish species and key fish habitat under the *Fisheries Management Act 1994*
- WaterNSW – for expertise and role in managing impacts in Sydney's Drinking Water Catchments via NorBE, under the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*. WaterNSW also holds significant water infrastructure assets that could be affected by the proposed AWRC and associated pipelines
- NSW EPA – for expertise and role in managing industrial discharges (via the Hawkesbury-Nepean Nutrient Management Strategy in this specific case) and contaminated sites, *under the Protection of Environmental Operations Act 1997.*

Comments on an EIS of this nature requires good local knowledge of the processes and values of the waterways, and up to date information on State and Local Government discussions and

agreements on a range of management strategies. As such, EES comments are limited to the AWRC impacts in the Wianamatta-South Creek catchment. The main impacts would occur during construction of the AWRC and pipelines, and during wet weather releases which includes release of primary treated sewage. During dry weather, the releases of treated water from the ARWC are transported to the Nepean River and Warragamba River. Brine is transported to the Malabar STP, with some releases to the Georges River.

EES has not provided comments on the specific impacts of AWRC releases to the Nepean River and Warragamba River nor on the transfers of brine to the Malabar STP and brine releases to the Georges River. Scientific expertise on these matters within EES sit with the Water, Wetlands and Coastal Science Branch (WWCSB), who has been working closely with the NSW EPA to assess the water quality, ecological health and flow impacts (or benefits) in the main Hawkesbury-Nepean River system as part of a service level agreement to inform a revised Hawkesbury-Nepean Nutrient Management Strategy (which is referred to in the EIS). Note however, that EES contacted the NSW EPA to confirm that it is receiving comments from the WWCSB, and that these comments are being provided separately as part of the NSW EPA submission on the EIS.

In preparing these comments, it should also be noted that EES has not attended any prior briefings on the EIS, but has worked with Sydney Water to develop the water quality and flow-related objectives for Wianamatta-South Creek which are referred to in the EIS. EES comments are not detailed given the size of documentation and time for the review. It is strongly recommended that a follow up meeting with DPIE PAG, Sydney Water and EES be arranged to clarify the issues raised, *in lieu* of misinterpretation/misunderstanding of the complex documentation making up the EIS.

Documents reviewed by EES

The following documentation was specifically reviewed by EES:

- Volume 1 – Executive Summary (59 pages)
- Volume 3 – Impact Assessment Part 1 (188 pages)
- Appendix D – Dry Weather Flow to South Creek (6 pages)
- Appendix F – Hydrodynamics and Water Quality Impact Assessment – Part 1 (280 pages)
- Appendix F – Hydrodynamics and Water Quality Impact Assessment – Part 2 (337 pages)
- Appendix G – Ecohydrology and Geomorphology Assessment Impact Assessment (207 pages)
- Appendix H – Aquatic and Riparian Ecosystem Assessment (324 pages)
- Appendix I – Peer Review of Key Water Quality Impacts (45 pages)
- Appendix K – Surface Water Impact Assessment (206 pages)

Only a cursory overview of the Groundwater Impact Assessment (Appendix M Part 1 and 2) has been completed, with the main comment that this assessment needs to be reviewed by DPIE-Water in context of the NSW Aquifer Interference Policy. It is recognised that the assessment has considered the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 but only in regard to the drawdown impacts and not on the wider impacts on the ecology. As such, EES has made a recommendation for the Aquatic and Riparian Ecosystem Assessment to review the water sharing plan, as well as EES's mapped high ecological value waterways and water dependent ecosystems.

General comments and overall recommendation
At this stage, EES is unable to assess whether the EIS adequately quantifies the extent of impact of the AWRC operations on the receiving waterways and associated riparian corridors for the following reasons:

- Heavily dependent on a coupled series of models, but summary statistics on the performance and uncertainty of the models are not provided. EES accepts the limitations to the models, but without knowledge on the magnitude and source of model error, it is difficult to determine whether these errors mask the variance from the environmental benchmarks or objectives used.
- Assessment is mostly qualitative but can be extended and made more robust *via* simple quantitative statistics.
- It is unclear as to whether cumulative impacts over time were assessed, or whether the model runs were limited to 1-year simulations.

Specific comments on the above dot points are provided below.

Only limited comments on the impacts of construction of the AWRC and associated pipelines are provided, on the expectation that separate construction and water management plans will focus on impacts to the loss of habitats, shallow aquifers (groundwater systems) and interactions with the soil salinity, sodicity and contaminants. However, given the high and real risk of impact of construction, it is strongly recommended that Sydney Water revisit standard requirements (as identified in the EIS) in context of on-ground practice. For example, the EIS identifies that erosion and sediment impacts during construction can be appropriately managed through the standard control measures outlined in the Blue Book. However, the Blue Book is close to 20 years old and there are current efforts to strengthen provisions. One such provision is now reflected in the Mamre Road Precinct Development Control Plan (DCP) and the draft Aerotropolis DCP Phase 2 which requires compliance with construction phase targets, the use of high efficiency basins and certified practitioners with at least 5 years of experience. Impacts of construction of the pipelines across waterways and through shallow aquifers must be revisited, with engineering works and methods of construction agreed by suitably qualified experts in consultation with relevant state and local authorities.

EES notes that the EIS was developed ahead of a regional stormwater strategy for the Western Parkland City being approved by the NSW Government. Given the recent public release of planning requirements for the Aerotropolis, it is expected that the EIS will be significantly revised to accommodate a reticulated harvesting system to ensure the integrated water cycle management strategy is implemented. Sydney Water has publicly discussed such a regional integrated approach (via a 'purple pipe') with various stakeholders, including EES and it therefore expected that such plans/modifications are already underway to enable the EIS to be revised. A key factor that must be incorporated is the scenario analysis/modelling to demonstrate that the AWRC and associated pipelines have the (volume) capacity to accommodate the harvested stormwater and manage the wet weather releases to South Creek. It is assumed that the wet weather releases are occurring during the flood events, and hence it is expected that the revised EIS will be strategically aligned with the flood impact assessment.

Finally, EES notes that Sydney Water has not used the stormwater targets or the MUSIC modelling toolkit provided directly to its consultant team for managing stormwater water quality and flows in South Creek. Hence, the Surface Water Impact Assessment (Appendix K) and all other relevant impact assessments that are dependent on it cannot be supported by EES at this stage. Sydney Water is acutely aware that EES has developed the targets and toolkit to support industry in demonstrating compliance with the water quality and flow related objectives. DPIE PAG are

providing the toolkit to all proponents submitting State significant development (SSD) applications, with the expectation that the toolkit is explicitly used. EES maintains that there should be no exception for Sydney Water.

Specific comments
The specific comments below need to be addressed by the proponent. They relate mostly to providing more robust information to support Sydney Water's proposal that the AWRC releases during operation have a negligible impact on the water quality and health of waterways in South Creek.

Volume 1 – Executive Summary

- Table ES1 needs to include data on the drainage areas to permit comparisons with objectives. For example, maximum releases to South Creek are expected to be up to 59ML/day during wet weather. If divided by the drainage area of the AWRC site (78 ha), this volume is equivalent to 0.8ML/ha/day which greatly exceeds EES's high spell flow objective by more than order of magnitude. This seems at odds with the impact assessments for ecohydrology and geomorphology. The Executive Summary needs to be inclusive of sufficient information to avoid uncertainties and concerns in review of the early part of an EIS.
- Some conclusions in the Executive Summary appear to have watered down the findings of the specific impact assessments – for example, construction impacts on waterway crossings and shallow aquifers are stated as being easily managed through standard controls, yet Appendix H has identified the high and real ecological impacts that can only be minimised through extensive mitigation measures including limitations to timing of construction.

Volume 3 – Impact Assessment Part 1

- This volume would benefit from a clearer narrative for various sections.
- Numerical values and headers in Table 8-5 needs to be replaced with that identified in the table provided under Section 4.7 of this document.

Appendix D – Dry Weather Flow to South Creek

- This appendix outlines that releases from the AWRC to South Creek during dry weather flows will not occur, in order to achieve EES' flow related objectives. This strategy is noted and supported by EES.
- Table 1 on page 2, needs to be replaced with the table provided below under *Appendix I – Peer Review of Key Water Quality Impacts*. The replacement table represents EES's final (not draft) objectives, with main changes related to the frequency and duration statistics. These changes do not affect Sydney Water's proposal to exclude AWRC releases to South Creek during dry weather flows. Note, however that there is a change to the table headings to better inform how the flow-related objectives were derived. The table is accompanied by associated text on how the objectives can be used to manage the 1-2 order streams.

Appendix F – Hydrodynamics and Water Quality Impact Assessment – Part 1

- This appendix outlines the impacts of the AWRC releases on the ambient water quality of the receiving waterways, and localised impacts on water quality at the site of release in context of near field mixing (hydrodynamics). Overall, the impact assessment identifies times of exceedance from water quality objectives but proposes that these exceedances are 'slight', 'marginal' or 'minor'. In some cases, the AWRC releases were identified as being beneficial for providing environmental flows and dilution.

- The impact assessment is heavily reliant on the use of a coupled series of models to predict the changes to water quality as a result of releases from the AWRC under two impact scenarios – 50ML/day in 2036, and 100 ML/day 2056. Sydney Water explicitly recognise the limitations with modelling but also indicate that the models are fit for purpose as they have been reviewed by independent subject matter experts. The reviews of the models have not, however, been provided as part of the EIS nor has information/data on uncertainty estimates for the modelling. It is recommended that a summary of the model reviews, numerical performance statistics and uncertainty estimates be included with the EIS. Until this information is available, EES is unable to decide on the extent of impact of the AWRC releases on the water quality in South Creek. For example, the level of uncertainty could outweigh/mask the exceedance above the objectives, and/or the models may not capture the flow processes correctly and hence relative changes among scenarios are incorrect.

- The WQRMs were developed and calibrated using only a 1-year time series, and an additional 2 month warm up period for the model run. The rationale for a limited time series needs to be better explained, given that typical periods for good model development are between 5-10 years.

- Regarding the above dot point, it is unclear as to whether the cumulative impacts of the AWRC releases over time have been assessed. The modelled outcomes are presented for only the 1-year time spans for which the model was tested. It is important to clarify whether the 2036 and 2056 scenario outputs reflect the potential impact of the cumulative releases from 2020 (baseline), or whether the scenario outputs just reflect the change in population growth and development. If the latter, then it is recommended that the models are run to produce the time series to allow the cumulative impacts over time to be assessed.

- The analysis of the extent of impact is qualitative, making it difficult to determine whether the impacts are indeed ‘slight’, ‘marginal’ or ‘minor’ as reported by Sydney Water. The typical approach is to use a worst expected value assessment or exceedance of medians in relation to quartiles, and an analysis of frequency of exceedance.

- The analysis of the extent of impact does not appear to be comparing ‘apples with apples’. The water quality objectives (guideline values) are for long term ambient conditions and ideally not compared to individual release events as shown in the various plots. It is recommended that in addition to the existing plots, the annual median over an extended time series (to represent the ambient condition) be calculated and be compared to the objectives. For example, the box and whisker plots that Sydney Water used to analyse the monitoring data could also be created for the modelled data.

- The analysis of the extent of impact needs to be extended to identify the change in the biogeochemical regime because of the releases. Changes to the ‘water quality regime’ could affect primary productivity and subsequent upper trophic levels.

- It is important to recognise that the various nutrient forms making up the total concentrations for nitrogen and phosphorus in the EES water quality objectives. The ratio of totals to the bioavailable (inorganic) forms (e.g. TN:DIN) in the AWRC releases should be used to inform the overall impact assessment.

- Sydney Water has identified the impacts (on water quality) of primary treated sewage releases from the AWRC to South Creek during severe wet weather events are minor and temporary given that the events are rare and will be diluted. However, without a longer-term time series analysis of these severe wet weather events, it is difficult to assess whether there are any cumulative impacts of this strategy. EES notes that there are impacts related to elevated toxicants and bank effects at the site of release of primary treated sewage during the wet weather events.

- Flow volume releases are presented in this appendix but are not compared to EES's flow related objectives, in manner consistent with the water quality objectives comparisons. It is recommended that this comparison be included in the revised EIS.

- It is also noted for this specific impact assessment, the main strategy to minimise impacts on water quality is via the treatment itself and releases during wet weather events, when there is also greater stormwater and other catchment runoff to the creeks. If left unmitigated, these higher volumes have the potential to impact stream geomorphology and stability.
- No comments are provided for Part 2.

Appendix G – Ecohydrology and Geomorphology Assessment Impact Assessment

- This appendix outlines the impacts of the AWRC releases on the ambient flow regime and geomorphology of the receiving waters, under the two impact scenarios. Overall impacts of the AWRC releases to the waterways in South Creek during wet weather have been described as low, and not needing any mitigation measures.

- EES has now finalised the flow objectives for South Creek meaning that Table 2 (page 22) of the assessment should be replaced with the table provided below under *Appendix I – Peer Review of Key Water Quality Impacts*. The main changes are to the frequency and duration of freshes, but these changes do not affect the overall outcome of the impact assessment (when comparing with the EES flow objectives - see Table 30 on page 36 of impact assessment). This is because the impact assessment has a different definition of freshes from that used by EES and therefore did not include this comparison in the assessment.

- The upland drainage area should be included in Table 30 for transparency of calculations when comparing to the EES flow related objectives. The modelled (scenario) daily flow volumes in Table 30 are significantly lower than the EES flow objectives, and it is hard to determine from the text whether the modelled daily flow volumes are for the AWRC releases only or whether they include the stormwater discharges too or even whether the calculations are correct. This section of the document needs to be better explained.

- It is noted that the impact assessment outcomes are dependent on the accuracy of the outcomes of the coupled series of models identified in Appendix F. As indicated above, it is difficult to assess the extent of change or impact without information on the model performance and uncertainties. In this specific impact assessment, the baseline scenario has been disregarded by Streamology due to the uncertainty in the baseflow predictions compared to gauged data. Only relative differences between the background and impact scenarios were considered, but as indicated above, if the model performances are not

reported it is difficult to determine whether the model errors mask the variances among the scenarios.

- The extent of impacts is based on a risk assessment matrix, where it is identified that '…*the expert opinion informing the risk assessment detailed in this report was based on the technical expertise of the senior staff within Streamology and was not tested with a broader expert group*..'. Given the nature of this assessment, it is recommended that the document be updated with details of how the modelled and field data were translated into the likelihood and consequence criteria in the matrix. Typically for expert opinion-based approaches, a range of stakeholders that are affected by the decision and/or have subject matter expertise should be consulted. Given that there are modelled data, it is strongly recommended that Streamology scope options to make the risk assessment quantitative rather than qualitative. For example, the modelled outcomes could be categorised according to quartiles, and for each quartile to represent one of the unlikely to almost certain scores in the risk matrix.

- Terminology on the percentiles are not intuitive for those that are unfamiliar with flow exceedance curves e.g. 10th percentiles are identified as high flows and the 90th percentiles as low flows.

- Overall, it is difficult to determine whether the assessment of low impact is correct given the qualitative nature of the assessment.

Appendix H – Aquatic and Riparian Ecosystem Assessment

- This appendix outlines the impacts of constructing and operating the AWRC (and associated pipelines) on a range of aquatic ecological values, including riparian vegetation.

- The assessment method is heavily reliant on the outputs of the coupled series of models outlined in Appendices F, G and K, and has independently identified the difficulty in assessing the ecological impacts of the hydraulic changes in the Nepean and Warragamba Rivers due to the limitations of the models.

- The impact assessment method is informed by a significant amount of field data to not only establish the presence or absence of threatened species and other ecosystems of high ecological value, but also establish a good baseline assessment of current condition. The assessment of ecological changes resulting from the two impact scenarios is limited to a qualitative discussion – mostly inferred from the changes to the ecosystem stressors (water quality and flows and habitat changes), which was based on the modelling. This approach is appropriate in this case especially since stressor and ecological response relationships are well established in the literature. However, as indicated above EES is unable to determine whether the overall conclusion that impacts are negligible or minor is correct due to the limited reporting on the model performance.

- One main point raised in the impact assessment is the relative impact of urban developments compared to the AQRC releases. It is unclear whether the modelling has considered EES's stormwater controls for South Creek, which is expected to be achieved for all new developments.

- The impact assessment identified that high and likely risk of habitat and species loss as a result of construction of the pipelines and stormwater control measures at AWRC site. The assessment identifies mitigation measures that are supported by EES, with the exception of the construction phase recommendations related to sediment and erosion control which state that the standard methods are adequate. The standard methods are based on the Blue Book, which is increasingly recognised by the industry as being outdated and requiring strengthening simply because specifications are not implemented in practice. EES recommends that the EIS should be amended to include the construction phase targets for erosion and sediment control outlined in the Mamre Road Precinct DCP and Aerotropolis DCP Phase 2.

- The assessment has used EES's new water quality objectives for comparing current water quality in the South Creek catchment. The comparisons need to be extended to the dissolved fractions of nutrients (not just total) where the data are available.

- In regard to identifying threatened and other high ecological value ecosystems and species, it is recommended that this assessment be extended to include comment (and if relevant assessments) on schedule 4 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011. EES has also released mapping of high ecological value waterways and water dependent ecosystems in Greater Sydney, and this mapping/GIS layer can be used as a diagnostic tool to help assess whether other values need to be considered in the assessment (see High Ecological Value Waterways and Water Dependent Ecosystems - GREATER SYDNEY REGION).

- The impact assessment needs to include a section on the timing of changes to the ambient flow regime and potential impacts on the breeding, feeding and migration cycles of aquatic species.

Appendix I – Peer Review of Key Water Quality Impacts

- The peer reviewers and the Sydney Water did not arrange a direct briefing/meeting with EES to clarify the concerns with EES's water quality and flow-related objectives. The final objectives are now available, and technical studies that describe their derivation have been reviewed by several independent subject matter experts and will be published in 2021.

- For information, the final flow objectives are provided in the table below. Main changes are to the table headers, which no longer identify flow objectives for 1-2 order streams or ≥ 3 order streams but rather more appropriately identify current and post development objectives. EES maintains that flow volumes for the current or pre-development state should apply to the more sensitive creek types, such as the 1-2 order streams. If these volumes are applied to the 1-2 order stream types, the cumulative flows to the downstream ecosystems will achieve the post-development objectives – as determined by EES's modelling to derive associated stormwater management targets (draft report provided to Sydney Water).

- The flow objectives for the current or pre-development state are derived directly from the gauging station on South Creek at Elizabeth Drive (212320), and those for the post-development state are derived from combination of Sydney Water's Source model (median, mean, high spells and freshes) and the gauging station 212049 (cease to flow, baseflow).

- The water quality objectives are like the objectives already adopted by Local Government in the South Creek catchment and are not provided here.

FLOW RELATED OBJECTIVES		
	Pre-development	**Post-development**
Median Daily Flow Volume (L/ha/day)	71.8 ± 22.0	1095.0 ± 157.3
Mean Daily Flow Volume (L/ha/day)	2351.1 ± 604.6	5542.2 ± 320.9
High Spell (L/ha/day) > 90th Percentile Daily Flow Volume	2048.4 ± 739.2	10091.7 ± 769.7
High Spell - Frequency (number/y)	6.8 ± 0.6	19.1 ± 1.0
High Spell - Average Duration (days/y)	6.3 ± 0.6	2.2 ± 0.2
Freshes (L/ha/day) ≥ 75th and < 90th Percentile Daily Flow Volume	327.1 to 2048.4	2642.9 to 10091.7
Freshes - Frequency (number/y)	2.8 ± 0.5	8.9 ± 0.4
Freshes - Average Duration (days/y)	3.2 ± 0.8	1.3 ± 0.1
Cease to Flow (proportion of time/y)	0.34 ± 0.05	0.03 ± 0.01
Cease to Flow – Duration (days/y)	39.2 ± 8	3.9 ± 1.2
Baseflow Index	0.13 ± 0.02	0.30 ± 0.02

Appendix K – Surface Water Impact Assessment

- This appendix outlines the impacts of constructing and operating the AWRC (and associated pipelines) on the ambient water quality and flows of surface waters. It includes an on-lot strategy for managing stormwater discharges from the 78 ha AWRC site.

- Construction phase targets have been developed by EES to strengthen existing provisions in the 'Blue Book', and these targets have been adopted in the Mamre Road Precinct DCP and the Aerotropolis DCP Phase 2. It is recommended that the impact assessment be extended to demonstrate how these targets are achieved during the construction phase.

- Headers for Table 7-3 need to be updated to be consistent with those shown in *Appendix I - Peer Review of Key Water Quality Impacts*. Also note the changes to the frequency and duration of the various flow metrics, which affect the comparisons with the freshes. It is however recommended that the compliance assessment be revised to demonstrate compliance with EES's stormwater flow targets, which are now publicly available in the Mamre Road Precinct DCP and the draft Aerotropolis DCP Phase 2. Compliance with these targets, especially the 95% percentile will help manage erosive flows more effectively than the specified stream erosion index of 3.5 (shown in Tables 7-5, 7-6).

- Compliance with EES water quality objectives should be based on achieving the EES load reduction targets specified in the Mamre Road Precinct DCP and the draft Aerotropolis DCP Phase 2. It is noted that the Gross Pollutant and TN load reductions achieved at the AWRC site comply with the respective EES targets. The TSS and TP load reduction targets at the site do not comply.

- Replace Table 2-2 in the Low Flow and Water Quality Assessment with the final EES flow objectives provided in *Appendix I – Peer Review of Key Water Quality Impacts*.

- Sydney Water's MUSIC modelling for the stormwater assessment was based on an uncalibrated model, with rainfall-runoff parameters different from those specified in EES's MUSIC modelling toolkit. It should be noted that EES provided this toolkit to Sydney Water in preparation of this EIS. The differences in the model parameters means that it is difficult to determine whether the assessment represents compliance with EES's objectives. It is strongly recommended that the assessment be revised using the rainfall runoff parameters in the toolkit, and the parameters for WSUD treatment nodes specified in EES's draft technical guide for achieving the objectives. Sydney Water was provided access to the draft technical guide during the preparation of this EIS.

- Tables 4-3, 4-4 in the Low Flow and Water Quality Assessment are empty.

End of Attachment 1

Attachment 2 EES advice on EPBC Act Listed threatened species and communities (sections 18 and 18A).

TABLE 1: BCS OFFICER PROJECT ADVICE TO DPIE ON EPBC ACT LISTED THREATENED SPECIES AND COMMUNITIES

Requirement	Information	Reference (BAM / BLA[1])
Background & Description of Action	Does the EIS/BDAR[2]: ☒ clearly show how operational and construction footprints, including clearing boundaries, structures to be built and elements of the action are situated with regard to MNES ☒ depict stages and timing of the action that may impact on MNES ☒ provide a map(s) of the subject land boundary showing the final proposal/disturbance footprint with respect to location of MNES, including GIS shape files Include references to where this detail is provided. The project description is in section 2 of the BDAR. Figures 12.1-11 show MNES in the impact area and impact assessment area. BCS considers the information to be adequate.	BAM Chapters 3, 4, 5 and 8
	Provide advice on the adequacy of the background and action description with respect to MNES and identify any recommended additional information requirements: The BDAR is adequate with respect to assessment of MNES and no further information is required.	
Landscape Context of the MNES	**Provide advice on the adequacy of the landscape context information and identify any additional information requirements:** The BDAR is adequate with respect to assessment of the landscape context information and no further information is required.	BAM Section 3.1 BLA clause 7.4

[1] Bilateral agreement (BLA) made under section 45 of the EPBC Act, including Amending Agreement No. 1 (2020)
[2] Or revisions of the BDAR and associated documentation made as a result of previous reviews or project changes post-exhibition.

Requirement	Information	Reference (BAM / BLA[1])
EPBC Act Listed Threatened Species & Communities	Verify that the EIS/BDAR includes relevant information on the identification of all EPBC Act listed threatened species and communities on the site or in the vicinity[3] via: ☒ field based survey effort ☒ published peer reviewed literature ☐ local data (n/a) ☒ supporting databases (such as the NSW BioNet Vegetation Classification, NSW BioNet Threatened Biodiversity Data Collection, NSW BioNet Atlas, Commonwealth Species Profile and Threats Database search results) ☒ Verify that the EIS/BDAR includes appropriate mapping of all EPBC Act listed threatened species and communities in accordance with the relevant Commonwealth Listing Advice. The EIS/BDAR should include important populations and critical habitat as defined in Approved Listing Advice, Approved Conservation Advice and Recovery Action Plans.	BAM Chapters 4 and 5
	Provide advice on the adequacy of the identification methods and mapping information / any additional information requirements:	
	Confirm that all EPBC Act listed threatened species and communities that occur on the subject land, or in the vicinity, have been identified in the BDAR/EIS including those that are ecosystem credit species. If any species and communities identified in the referral documentation (provided by DAWE) have been ruled out because they don't occur on or near the site, verify that there is robust analysis and justification for why these species can be ruled out. Provide advice on whether there are any other MNES species or communities that are missing from the assessment based on BCS knowledge and experience.	

[3] On land to which impacts may extend

Requirement	Information	Reference (BAM / BLA[1])
	Table 39 lists MNES within the impact area and impact assessment area. This list includes all species and communities that BCS considers would occur on the subject land or in the vicinity. Supporting databases were used appropriately. Adequate surveys were completed, including targeted surveys for all flora and most fauna listed in Table 39. Section 9.3 notes that no targeted surveys were undertaken for the Regent Honeyeater and Swift Parrot as they were not recorded during diurnal bird surveys for other species and Bionet records indicate they are uncommon visitors to the study area. However, the BDAR still assesses impacts on these species. The referral documentation lists the following entities as likely to be significantly impacted: • Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (CPW) • Regent Honeyeater (*Anthochaera phrygia*) • Swift Parrot (*Lathamus discolor*) The BDAR includes an assessment of these species and community. There are no EPBC Act-listed species or communities that BCS considers are missing from the assessment.	
	Advise whether there is appropriate justification and supporting evidence for the addition and/or exclusion of any EPBC Act listed threatened species and/or communities from the list (if applicable): The BDAR has assessed all relevant EPBC Act listed species and communities.	
Avoidance, Minimisation, Mitigation & Management	Verify that the EIS/BDAR demonstrates all feasible alternatives and efforts to avoid and minimise impacts on EPBC Act listed threatened species and communities (including direct, indirect and prescribed impacts) including an analysis of alternative: ☒ designs and engineering solutions ☒ modes or technologies ☒ routes and locations of facilities ☒ sites within the subject site	BAM Chapters 6, 7 and 8 BLA clause 7.1

Requirement	Information	Reference (BAM / BLA[1])
	☒ Verify that the EIS/BDAR identifies any other site constraints in determining the location and design of the proposal (such as bushfire protection requirements, flood planning levels, servicing constraints, etc). Verify that the EIS/BDAR provides feasible measures to mitigate and/or manage impacts on EPBC Act listed threatened species and communities (including direct, indirect and prescribed impacts) including: ☒ techniques, timing, frequency and responsibility ☒ identify measures for which there is risk of failure ☒ evaluate the risk and consequence of any residual impacts ☒ any adaptive management strategy proposed to monitor and respond to impacts.	
	Provide advice on whether all feasible impact avoidance, minimisation, mitigation and management measures have been considered and are adequately justified: Measures to avoid and minimise impacts on MNES are outlined briefly in section 9.6 but more detail on the measures is provided in section 10. Figures 14.1-6 show alternative options that were considered. Table 51 of the BDAR discusses the effectiveness of proposed mitigation measures. An adaptive management strategy is to be prepared specifically for the Camden White Gum because impacts of changes to hydrology are uncertain. Mitigation measures will be the responsibility of Sydney Water.	
Impact Assessment	Verify that the EIS/BDAR: ☒ identifies the residual adverse impacts likely to occur to **each** EPBC Act listed threatened species and/or community after the proposed avoidance and mitigation measures are taken into account ☒ provides adequate justification and evidence for the predicted level of impact, with reference to the: • Commonwealth's Significant Impact Guideline*:* *https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf*	BAM Chapters 8 and 9 BLA clauses 6.2(b)(i)-(ii) and 7.1

Requirement	Information	Reference (BAM / BLA[1])
	• DPIE Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact (SAII): (*https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf*)	
	Complete the following information for each EPBC Act listed threatened species and/or community (add/remove rows as necessary): • EPBC Act listed threatened species and/or community • nature and consequences of impacts (i.e. direct and indirect) • duration of impact (e.g. construction, operation, life of project) • quantum of impact • consequences of impacts on the species, the population and / or extent of the community at local, state and national scales Confirm the level of predicted impact (cross appropriate): ☒ high risk of impact (requiring offsets)# or SAII ☒ Low risk of impact (not requiring offsets) # For purposes of EPBC approval, as a minimum, significant adverse residual impacts **must** be offset (significant impact can be evaluated with reference to the significance impact guidelines) **Provide advice on whether adequate justification and evidence is provided for species and communities that have been identified as being at low risk of impact.** This information is provided in Table 1 below. The BDAR concludes that there will be no significant impact on any EPBC Act-listed threatened species or communities. BCS agrees with this conclusion, except for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and the Spiked Rice-flower (*Pimelea spicata*). It is noted that offsets will be provided for both these entities.	

Requirement	Information	Reference (BAM / BLA[1])
Offsets	Verify that the EIS/BDAR: ☒ identifies any MNES that haven't been offset using the BAM ☒ identifies how impacts requiring offsets correlate to MNES impacts ☒ identifies the plant community types (PCTs) requiring offset and the number and type of ecosystem credits required for impacts to MNES ☒ identifies threatened species requiring offset and the number of species credits required for impacts to MNES ☒ correctly uses the BAM (and BAM calculator) to identify the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity ☒ identifies if ecological rehabilitation and/or biodiversity conservation actions are proposed for offsetting ☒ if known, identifies any other offsetting approach proposed, such as land-based offsets, retiring credits by payment into the Biodiversity Conservation Fund and/or through supplementary measures[#]. [#] In accordance the BAM there is no longer a requirement to define the offsetting approach at EIS stage. **Complete the Impacts and Offsets Summary table below (Table 2)**	BAM Chapter 10 BLA clauses 7.1 and 7.2
	Provide advice on the adequacy of the proposed offsets in meeting the requirements of the BAM: The BDAR states that impacts to MNES as a result of the project have been determined to not be significant, in accordance with Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (CoA 2013). As such, offsetting in accordance with the EPBC Act Environmental Offsets Policy (CoA 2012) and the EPBC Act is not required. However, the BDAR also states that impacts to all MNES will nevertheless be offset in accordance with the NSW BOS through either direct establishment of Biodiversity Stewardship Sites to generate biodiversity credits to offset the project's impacts, through securing biodiversity credits from the open market, or from payment to the Biodiversity Conservation Fund.	

Requirement	Information	Reference (BAM / BLA[1])
Other Considerations	Verify if any relevant Commonwealth guidelines and policy statements are applicable to the action and listed threatened species and/or community, including but not limited to: ☒ International environmental obligations ☒ Recovery Plans ☒ Approved Conservation Advice ☒ Threat Abatement Plans *The relevant Commonwealth guidelines and policy statements for each species and community are available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl*	BLA clauses 6.2(b)(iv), 7.2(c), 7.3 and 7.4
	For each EPBC Act listed threatened species and/or community, provide advice on whether the assessment has been adequately informed by applicable Commonwealth guidelines and/or policy statements. For example, the interaction between the proposed action and important populations or critical habitat identified in policy documents and/or the interaction between the proposed action and threatening processes or recommended conservation actions outlined in Commonwealth policies and plans. The BDAR has taken into account all relevant Commonwealth policies, plans, guidelines, etc.	
Recommended Conditions	**Provide advice on any recommended conditions and reasons for imposing the conditions:** No specific conditions are recommended. The BDAR includes a number of proposed mitigation measures, which are supported and considered to be adequate.	BLA clause 6.2(c)(iii)

TABLE 1: IMPACT ASSESSMENT

Threatened Species / Community listed under EPBC Act	Nature and consequence of impacts	Duration of impact	Quantum of impact	Consequences of impact
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Direct and indirect	Construction, operation, life of project	Direct impacts to 1.88 ha	BDAR concludes the impacts are unlikely to be significant (refer App 6), as there is unlikely to be a significant reduction in the extent of the community. However, BCS considers that there is likely to be a significant impact, as according to the Significant Impact Guidelines, an action is likely to have a significant impact if there is any reduction in the extent of the ecological community.
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Qld ecological community	Direct and indirect	Construction, operation, life of project	Direct impacts to 0.22 ha	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.
Camden White Gum *Eucalyptus benthamii*	Direct and indirect	Construction, operation, life of project	No individual plants impacted but changes to hydrological patterns possible.	BDAR concludes the impacts are unlikely to be significant (refer App 6). BCS agrees with this conclusion, given the impacts are likely to be minor to negligible.
Downy Wattle *Acacia pubescens*	Direct and indirect	Construction, operation, life of project	Direct impacts to max 7 plants and 0.16 ha habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.

Spiked Rice-flower *Pimelea spicata*	Direct and indirect	Construction, operation, life of project	Direct impacts to no plants but 2.99 ha potential habitat impacted	BDAR concludes the impacts are unlikely to be significant. BCS disagrees with this conclusion, as BCS considers the loss of potentially 2.99 ha of this species may be significant.
Sydney Bush-pea *Pultenaea parviflora*	Direct and indirect	Construction, operation, life of project	Direct impacts to nil plants but 4 plants in impact assessment area and impacts to 0.01 ha habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion.
Broad-headed Snake *Hoplocephalus bungaroides*	Direct and indirect	Construction, operation, life of project	Direct impacts to 1.56 ha potential habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.
Brush-tailed Rock Wallaby *Petrogale penicillata*	Direct and indirect	Construction, operation, life of project	Direct impacts to 1.56 ha of potential habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.
Dural Land Snail *Pommerhelix duralensis*	Direct and indirect	Construction, operation, life of project	Direct impacts to 1.45 ha expert mapped habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.
Grey-headed Flying-fox *Pteropus poliocephalus*	Direct and indirect	Construction, operation, life of project	Direct impacts to 13.77 ha foraging habitat; potential indirect impact to non-maternity camp	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact.
Koala *Phascolarctos cinereus*	Direct and indirect	Construction, operation, life of project	Direct impacts to 13.77 ha potential habitat	BDAR concludes the impacts are unlikely to be significant, as a). impacts east of the Nepean River are not critical to the survival of the species, and b). impacts to the west of the Nepean River are approximately 2.05 ha of marginal quality habitat critical to the

				survival of the species (score of 6). BCS agrees with this conclusion
Large-eared Pied Bat *Chalinolobus dwyeri*	Direct and indirect	Construction, operation, life of project	Direct impacts to 3.48 ha of potential foraging habitat. Direct and indirect impacts to potential breeding habitat at the environmental flows treated water outlet near the Warragamba Dam.	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion, given the small degree of impact
Regent Honeyeater *Anthochaera phrygia*	Direct and indirect	Construction, operation, life of project	Direct impacts to 13.77 ha of foraging habitat	BDAR concludes the impacts are unlikely to be significant given the project won't impact on the species' breeding habitats, nor will it impact on an area mapped by EES as an 'Important Area'. BCS agrees with this conclusion.
Swift Parrot *Lathamus discolor*	Direct and indirect	Construction, operation, life of project	Direct impacts to 13.77 ha of foraging habitat.	BDAR concludes the impacts are unlikely to be significant given the project won't impact on the species' breeding habitats, nor will it impact on an area mapped by EES as an 'Important Area'. BCS agrees with this conclusion.
Eastern Ospey *Pandion cristatus*	Direct and indirect	Construction, operation, life of project	Negligible impacts to some foraging habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion
Fork-tailed Swift *Apus pacificus*	Direct and indirect	Construction, operation, life of project	Negligible impacts to some foraging habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion

White-bellied Sea Eagle *Haliaeetus leucogaster*	Direct and indirect	Construction, operation, life of project	Negligible impacts to some foraging habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion
White-throated Needletail *Hirundapus caudacutus*	Direct and indirect	Construction, operation, life of project	Negligible impacts to some foraging habitat	BDAR concludes the impacts are unlikely to be significant. BCS agrees with this conclusion

TABLE 2: MNES IMPACT AND OFFSET SUMMARY

Threatened Species / Community listed under EPBC Act	PCTs associated with the ecosystem credit species / ecological community (if applicable)	Area of Impact (ha)	Credits Required	Offsetting Approach	Reference (EIS, BDAR)
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	PCTs 724 and 849	1.88	157	Offsets to be provided in accordance with the BAM (see offsets section above). Only like-for-like offsets permitted under the BAM for this TEC.	Table 53
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Qld ecological community	PCT 1800	0.22	15	s.a.a	Table 53
Camden White Gum *Eucalyptus benthamii*	PCTs 835, 849, 1005	N/A	N/A		

Downy Wattle *Acacia pubescens*	PCTs 724, 725, 849, 883, 1083	0.16	4	Offsets to be provided in accordance with the BAM (see offsets section above). Only like-for-like offsets permitted under the BAM for threatened species.	Table 54
Spiked Rice-flower *Pimelea spicata*	PCTs 849 & 835	2.99 potential	75	s.a.a	Table 54
Sydney Bush-pea *Pultenaea parviflora*	PCTs 724, 725, 883, 1083	0.01	1	s.a.a	Table 54
Broad-headed Snake *Hoplocephalus bungaroides*	PCTs 1083, 1105, 1181	1.56	N/A (ecosystem credit species)	Offsets for ecosystem credit species to be provided in accordance with the BAM	
Brush-tailed Rock Wallaby *Petrogale penicillata*	PCT 1083	1.56	0	Likelihood of presence of species considered to be very low.	Table 40
Dural Land Snail *Pommerhelix duralensis*	PCTs 724, 725, 1181	1.45	27	Offsets to be provided for this species credit species in accordance with the BAM	Table 57
Grey-headed Flying-fox *Pteropus poliocephalus*	All PCTs	13.77	N/A (ecosystem credit species)	Offsets for this ecosystem credit species to be provided in accordance with the BAM	Table 57
Koala *Phascolarctos cinereus*	PCTs 724, 725, 781, 835, 849, 883, 1083, 1105, 1181, 1800	13.77	N/A (no critical		Table 57

			habitat impacted)		
Large-eared Pied Bat *Chalinolobus dwyeri*	All PCTs	3.48	137	Offsets to be provided for this species credit species in accordance with the BAM	Table 57
Regent Honeyeater *Anthochaera phrygia*	PCTs 724, 725, 781, 835, 849, 883, 1083, 1105, 1181, 1800	13.77	N/A (no important habitat impacted)		Table 57
Swift Parrot *Lathamus discolor*	PCTs 724, 725, 781, 835, 849, 883, 1083, 1105, 1181, 1800	13.77	N/A (no important habitat impacted)		Table 57
Eastern Ospey *Pandion cristatus*	PCTs 724, 781, 835, 883, 1083, 1105, 1800	Negligible	Not required		Table 57
Fork-tailed Swift *Apus pacificus*	N/A (exclusively aerial)	Negligible	Not required		Table 57
White-bellied Sea Eagle *Haliaeetus leucogaster*	PCTs 724, 725, 781, 835, 849, 883, 1083, 1105, 1181, 1800	Negligible	Not required		Table 57
White-throated Needletail *Hirundapus caudacutus*	N/A (exclusively aerial)	Negligible	Not required		Table 57