SECTIONS B - D

RESPONSES TO QUESTIONS 2(B) 2(E) and 2(F)

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SECTION B

Response to Question 2(B)

SECTION B – RESPONSE TO QUESTION 2 (B)

Question : What is the design of the infrastructure?

Describe the process to be used to extract and/or treat water or sewage.

Table (B1) details the key steps used to process raw sewage into high quality recycled water. A preliminary PFD has been supplied in **Section J Drawings – Attachment J4 – Process Flow Diagram.** Preliminary P&ID's have been supplied in **Section J Drawings – Attachment J5 – Process and Instrumentation Diagrams.**

Table (B1) – Key process steps

Item	Unit operation	Size / Capacity	Purpose / Comment
1	Pressure sewer system Eco1-60	900L	Raw sewage is collected at each property in a collection tank, macerated and pumped via small (63 – 150mm) rising mains to the flow balance tank.
2	Gravity sewerage network	360kL storage	Raw sewage from the existing Pitt Town village and 80 houses from the new Pitt Town release area is transferred to sewage pumping station T via gravity sewers and carrier mains (Fernadell and Blighton carriers) This network will be owned and operated by council.
3	Sewage pumping station T	7,850kL/day or 91L/s	Raw sewage from Pitt Town is transferred to McGraths Hill Sewage treatment plant via 6.8km 375dia rising main. The pump station is owned and operated by council. Extraction of sewage will occur from the rising main as it leaves the pump station.
4	Flow balance tank	100kL	Raw sewage will be delivered into a new flow balance tank from the existing pump station (pump station T) and the new pressure sewer network. The flow balance tank will be used to buffer diurnal flows.
5	Macerating feed pumps	5L/s	The raw sewage will be macerated prior to entering the inlet screen to eliminate the need for coarse screening and reduce the risk of downstream blockages.
6	Inlet screen	5L/s	Inlet screening will be used to remove to remove solids >2mm which is critical to protect downstream membrane filtration (see Item 6 below).
7, 8 and 9	Membrane Bioreactor	Up to 300kL/day or 4L/s	A membrane bioreactor will form the core of the proposed recycled water factory. The biological reactor will be designed to achieve the required levels of BOD and nutrient reduction. Nitrogen will be removed biologically whereas Phosphorus will be precipitated with alum and subsequently form part of the biomass.

Table (B1) – Key process steps (cont'd)

Item	Unit operation	Size / Capacity	Purpose / Comment
7, 8 and 9	Membrane Bioreactor	Up to 300kL/day or 4L/s	The membranes will separate the biomass from the treated water and provide the first disinfection barrier. The biomass is sent back to the start of the biological reactor and the treated water is sent onto further disinfection. Excess biomass is periodically wasted from the aerobic zone. The bioreactor is configured into distinct zones via baffles to minimise short circuiting.
10	UV Disinfection	8L/s	UV disinfection provides the second disinfection barrier. Importantly the low turbidity water (typically ~0.2NTU) produced from membrane filtration is well suited to UV disinfection.
11	Chlorine Disinfection	>10mg.min/L	Chlorine disinfection provides the third disinfection barrier. Importantly the low turbidity water (typically ~0.2NTU) produced from membrane filtration is well suited to chlorine disinfection. Chlorine will also be dosed to maintain a residual in the recycled water storage tanks.
12	Recycled water storage	2,400kL	Two 1,200kL recycled water storage tanks will provide a buffer between the production capacity of the recycled water factory and the peak recycled water demand.
13	Recycled water distribution	TBA	A delivery pump set will be selected to match the instantaneous and daily demands of the customers to be served.
14	Alum dosing	Storage = 1,200L	An alum dosing system will be used to precipitate phosphorus thus enabling removal by membrane filtration.
15	Caustic dosing	Storage = 500L	A caustic dosing system will be used to maintain the pH of the bioreactor / treated water.
16	Citric acid dosing	Storage = 500L	A citric acid dosing system will be used to clean the membranes.
17	Methanol dosing	Storage = 500L	Methanol will be dosed as required to provide carbon for increased nitrogen removal.
18	General pump station	25kL	A general pump station will be provided to capture overflows and wash down. Generally the contents will be returned to the front of the recycled water factory for re-processing.

Describe, in bullet point form, the design of the infrastructure, including details of the life-span and system redundancy built into the infrastructure or system

Table (B2) – Life span and system redundancy

Item	Unit operation		Life span	Redundancy
1	Pressure sewer system Eco1-60	Collection vessel	>50 years	Duty only
		G60 Grinder pump	>25 years	Duty only
		Control panel	>25 years	Duty only
		Boundary Kit	>25 years	Duty only
		Telemetry	>25 years	Duty only
		Rising mains	>75 years	Duty only
2	Gravity sewerage network	Carrier mains	Renewals by HCC	Duty only
		Gravity sewers		Duty only
3	Sewage pumping station T	Pump station structure	Renewals by HCC	Duty only
		Transfer pumps		Duty/Duty/ Standby
		Odour control system		Duty only
		Emergency generator		Standby only
		Rising main		Duty only
4 and 5	Flow balance tank Maceration	Concrete structure	>75 years	Duty only
		Macerating feed pumps	>15 years	Duty / Standby
		Flow balance mixer	>15 years	Duty
6	Inlet screen	Inlet screens	>15 years	Duty / Standby
7, 8 and 9	Membrane Bioreactor	Bioreactor Stage 1 – Epoxy coated mild steel	>20 years	Duty only
		Bioreactor Stage 2 - Concrete	>75 years	Duty only
		Anoxic mixers	>15 years	Duty only
		Fine bubble diffusers	>10 years	Duty only
		Recycle pumps	>15 years	Duty / Standby
		Process blowers	>15 years	Duty / Standby
		Membrane blowers	>15 years	Duty / Standby
		Membrane cassette	>10 years	Duty only[1]
		Permeate pump	>15 years	Duty / Standby
		Membrane tank drain pump	>15 years	Duty only
10	UV Disinfection	UV reactors	>15 years	Duty / Standby
11	Recycled water storage	2 x 1.2ML tanks	>25 years	Duty / Duty
12	Recycled water distribution	Delivery pump set	>15 years	Duty / Standby
		Distribution mains	75 years	Duty only

Table (B2) – Life span and system redundancy (cont'd)

Item	Unit operation		Life span	Redundancy
13	Chlorine dosing	1,200L storage tank	>20 years	Duty only
		Dosing pumps	>10 years	Duty / Standby
14	Alum dosing	1,200L storage tank	>20 years	Duty only
		Dosing pumps	>10 years	Duty / Standby
15	Caustic dosing	500L storage tank	>20 years	Duty only
		Dosing pumps	>10 years	Duty / Standby
16	Citric acid dosing	500L storage tank	>20 years	Duty only
		Dosing pumps	>10 years	Duty / Standby
17	Methanol dosing	500L storage tank	>20 years	Duty only
		Dosing pumps	>10 years	Duty / Standby
18	General pump station	Pump station structure	>25 years	Duty only
		Transfer pump	>15 years	Duty only
-	General	Instruments	>10 years	-
		Electrical	>15 years	-
		Valves and pipe work	>15 years	-
		Building	>100 years	-
		Mechanical structures	>50 years	-

NOTES:
1. Membrane cassette will contain ~40 modules. Individual modules can be repaired or replaced.

Is the process common industry practice?

Yes, the unit operations proposed for the recycled water factory at Pitt Town represent common and industry best practice. In particular:

- **Pressure sewer systems** have been installed by many Australian water utilities over the past 10 years. Sydney Water's Priority Sewerage Programme has installed and operates pressure sewer systems in approximately 20 communities within NSW and are currently installing pressure sewer systems in Hawkesbury at Glossodia, Freemans Reach and Wilberforce.

- **MBR technology** is widely used nationally and globally for production of high quality treated water from municipal and industrial wastewater. Installations in Australia range from <1,000L/day to 75,000,000L/day.

- **UV disinfection** is widely used nationally and globally for disinfection of recycled and potable water.

- **Chlorination** is widely used nationally and globally for disinfection of recycled and potable water.

Please provide a process flow diagram of the scheme (from source to end use), and identify the Critical Control Points in the process, specifications of key units and design, and a copy of any independent validation of process or value engineering assessment of the design and/or its suitability for use in the proposed activity to be licensed (if available) in an Appendix.

Please find following preliminary responses to the issues raised above. Further information is available in the DRAFT Recycled Water Quality Management Plan.

- **Process flow diagram** is provided in Section J Drawings – Attachment J4 – Process Flow Diagram.

- **Critical control points for the pressure sewer system** will be monitored through telemetry at each collection tank and the site SCADA as follows:

  - ✓ ***G60 Grinder Pump*** – Maintenance and servicing is determined by pump hours to reduce the likelihood of pump failure. The telemetry provides continuous monitoring of individual pump run hours. The monthly servicing programme will therefore focus on the pumps that are due for service rather than a time based rotational basis.

  - ✓ ***Sewage Volume –*** The discharge volumes and daily discharge trends are monitored continuously for each collection tank. If abnormal discharge is detected then on site checks of the pressure system are carried out to determine leakage or pumping problems.

- **Critical control points for recycled water quality** will be monitored through the site SCADA and can be summarised as follows:

  - ✓ ***Bioreactor Dissolved Oxygen (DO)*** – To ensure a healthy bioreactor and subsequent reduction of BOD, suspended solids and nitrogen removal it is essential to provide sufficient oxygen to the aerobic zone. The DO will be continuously monitored and maintained between upper and lower set points. If the blowers are unable to maintain the DO above the minimum set point (typically 0.5mg/L) the recycled water production process will be shutdown.

  - ✓ ***Bioreactor pH*** – The pH of bioreactor will be monitored continuously and maintained between upper and lower set points. This will ensure a healthy bioreactor and an acceptable pH of the recycled water. The recycled water production process will shutdown if the treated water pH exceeds or drops below the target range (typically 6.5 to 8).

  - ✓ ***Permeate turbidity*** – Given the high solids content of the bioreactor (~10,000mg/L), permeate turbidity is a direct indicator of membrane integrity. Permeate turbidity (typically ~0.2NTU) will be monitored continuously. The recycled water production process will shutdown if the turbidity exceeds 0.5NTU.

- ✓ ***UV Dose*** – There are well established and published relationships between UV dose and the inactivation of various pathogens. The UV dose (typically 40 W/m^2) will monitored continuously. The recycled water production process will shutdown if the UV dose drops below 30 W/m^2.

- ✓ ***Chlorine residual*** – There are well established and published relationships between chlorine dose / contact time and the inactivation of various pathogens. The free chlorine residual (typically 1 to 1.5 mg/L) will monitored continuously and maintained between upper and lower setpoints. Distribution of the recycled water will stop if the free chlorine residual drops below 0.5mg/L.

- ✓ ***Recycled water turbidity*** – Recycled water turbidity has been identified as a critical process parameter as it indicates membrane integrity and, if outside allowable limits, it will also impact on the effectiveness of disinfection by UV and Chlorination. The turbidity of the contents of the recycled water storage tank will be monitored continuously. Distribution of the recycled water will stop if the recycled water turbidity exceeds 0.5NTU.

- **Critical control points for general plant operation** will be monitored through the site SCADA and can be summarised as follows:

  - ✓ ***Tank levels –*** The majority of tank levels will be monitored continuously with ultrasonic or pressure transmitters to ensure they stay within design limits.

  - ✓ ***Flows –*** The majority of process flow will be monitored continuously with electromagentic flow meters or flow switches to ensure they stay within design limits. Flows will be totalised on an hourly and / or daily and / or monthly and / or annual basis.

- **Validation of process** is accomplished through the following means:

  - ✓ ***Project specific validation process*** – A project specific validation process will be developed for the recycled water factory at Pitt Town in line with the requirements of state and federal recycled water guidelines.

  - ✓ ***NSW validation of flow sheet*** – The flow sheet has been validated to produce recycled water required for "*Exposure Risk Level – High*" under the requirements of the "*Interim NSW Guidelines for Management of Private Recycled Water Schemes – October 2007*" based on the results of the Workplace 6 recycled water facility.

  - ✓ ***Results from similar installations*** – The design principles, technology selection and process configuration of the proposed recycled water factory at Pitt Town is similar to numerous installations, nationally and globally, which continue to produce high quality recycled water from municipal and industrial wastewater.

SECTION C

Response to Question 2(E)

SECTION C – RESPONSE TO QUESTION 2 (E)

Question : How will the infrastructure be maintained and operated?

Describe the arrangements made for the maintenance, monitoring and reporting of standards of service for the infrastructure.

Table (C1) details the arrangements for the operation, monitoring, maintenance and reporting of the infrastructure.

Table (C1) – Operation, monitoring, maintenance and reporting of the infrastructure

Area	Sub area	Comment
Operation	Daily – Basic Operation	Daily operation of the proposed recycled water factory will be undertaken by Water Factory personnel and sub-contractors. Key staff members will be trained in all aspects of plant operation to enable them to identify and troubleshoot basic issues with plant performance. Should it be required plant operators can elevate issues for further investigation by Permeate Partners.
	Daily – Overview	In addition to regular discussion with plant operators, Permeate Partners will check plant performance 2 to 3 times per week via remote monitoring.
Monitoring	Daily	Site staff will complete a basic checklist during their daily site visit. Specifically the checklist will focus on indentifying aspects of plant operation which are considered outside of normal operation.
	SCADA	The site SCADA will continuously monitor pressure sewer and plant performance and enable a simple / user friendly interface to check key parameters and make changes as required. Plant alarms will be structured into three basic categories: 1. Plant critical – Response required immediately. 2. General – Response required inside 24 hours. 3. Information – Response required inside 7 days. Key parameters can be trended over time to assess the impact of process changes. To ensure system security the SCADA will be provided with varying levels of access and operator specific passwords. For reference screen shots from the Pennant Hills Golf Course recycled water factory have been provided in Section I Drawings – Attachment I3 – Example of SCADA.

Table (C1) – Operation, monitoring, maintenance and reporting of the infrastructure (cont'd)

Area	Sub area	Comment
Monitoring (cont'd)	Remote monitoring	Remote monitoring will be installed to enable secure access to the plant by authorised personnel. Via remote monitoring the authorised personnel will be able to check plant performance and make adjustments as required.
	Sampling	Sampling will be undertaken by Water Factory Company personnel under the guidance of Permeate Partners. Analysis will focus on recycled water quality and general process parameters. Adjustments will be made by operators and / or Permeate Partners staff on an as required basis.
	Audits	Permeate Partners will conduct detailed process and mechanical audits twice per year.
Maintenance	Overview	A pressure sewer and plant maintenance schedule will be compiled which identifies: ▪ Tasks undertaken by plant operators (ie inspections, grease, etc) on a daily, monthly and annual basis. ▪ Tasks undertaken by specialist contractors (ie equipment servicing, calibrations, etc) on a monthly and annual basis.
Reporting	Daily	The daily checklists completed by plant operators will be stored on file. Data collected from the SCADA will be backed up regularly and stored off-site.
	Monthly	Monthly reports of plant performance will be prepared by Permeate Partners and circulated to stakeholders. These reports will include **brief** discussion on: ▪ Safety. ▪ Regulatory compliance. ▪ Key performance indicators. ▪ Issues – resolved and pending. ▪ Action items.
	Quarterly	Quarterly reports of plant performance will be prepared by Permeate Partners and circulated to plant management and staff. These reports will include **detailed** discussion on: ▪ Safety. ▪ Regulatory compliance. ▪ Key performance indicators. ▪ Plant optimisation. ▪ Operating costs. ▪ Issues – resolved and pending. ▪ Action items.
	Annual	Annual reports will be compiled for other stakeholders such as Hawkesbury Council, IPART, etc.

Describe arrangements for the continued safe and reliable performance of the infrastructure, including the arrangements for the renewal of the infrastructure.

Table (C2) details the arrangements for the continued safe and reliable performance of the infrastructure, including the arrangements for the renewal of the infrastructure.

Table (C2) – Safety, reliability and renewal of the infrastructure

Area	Sub area	Comment
Safety	Training	The safety of all stakeholders in the recycled water factory is paramount. Stakeholders include staff, plant visitors, venue visitors and the general public. Training will be provided to plant operators and management on all aspects of plant operation with a particular emphasis on safety. The general risks of plant operation and the inherent risks of sewage treatment will be outlined and
	Procedures	Standard procedures will be developed and used for various aspects of plant operation and maintenance.
	Hygiene	Industry standard hygiene practices will be adopted including minimising exposure, use of PPE, and hand washing following every visit to the recycled water factory.
	Immunisations	All operators will receive the medically recommended immunisations. Typically these include Hepatitis A, Hepatitis B and Tetanus.
	Specialist support	If stakeholders are concerned regarding the safety of any task or issue at the recycled water factory they can access specialist support via Permeate Partners.
	Visitors	All visitors will complete a short induction to ensure they are aware of the nature of the facility and the general risks. Details of visitors will be recorded in visitors book kept in the control room. All visitors will be accompanied by operators or management.
	Access	Access to the recycled water factory will controlled via two entry points namely, the front and rear entrance to the recycled water factory. Access codes and keys will be strictly controlled to prevent any unauthorised access.
Reliability	Redundancy	The reliability of the infrastructure is paramount, especially during times of high recycled water demand. To ensure maximum plant availability all critical equipment will be installed duty / standby. This level of redundancy enables the plant to continue to operate whilst troubleshooting / repairs are carried out.
	Equipment quality	The proposed recycled water factory includes high quality equipment providing by local suppliers. This approach provides confidence in equipment reliability and reduces the lead time for spare parts.

Table (C2) – Safety, reliability and renewal of the infrastructure (cont'd)

Area	Sub area	Comment
Reliability	Maintenance	All equipment will be maintained in accordance with manufacturer recommendations to reduce or eliminate unplanned downtime.
Renewal	Partial	Parts will be replaced during maintenance and repairs.
	Complete	The asset management plan will allow for the complete replacement of infrastructure components over the life of the plant.

SECTION D

Response to Question 2(F)

SECTION D – RESPONSE TO QUESTION 2 (F)

Question : How will you protect public health, water quality and the environment?

If the water to be supplied is drinking water, how will the 12 elements of the framework for the management of drinking water quality, as detailed in the Australian Drinking Water Guidelines, be addressed, implemented and maintained?

Not applicable. The proposed infrastructure does not include the provision of drinking water.

If the water to be supplied is non-potable water, how will the 12 elements of the framework for the management of recycled water quality and use, as detailed in the Australian Guidelines for Water Recycling, be addressed, implemented and maintained?

A DRAFT Recycled Water Quality Management Plan (RWQMP) has been developed to support this application under WICA. It covers all of the 12 elements of the Australian Guidelines for Water Recycling. The RWQMP will be further developed during detailed design.

If the water to be supplied is non-potable water, what purposes will the water be used for and what purposes will the water not be used for (as determined in accordance with the 12 elements of the framework for the management of recycled water quality and use in the Australian Guidelines for Water Recycling)?

Table (D2) details the intended uses for the recycled water.

Table (D2) – Intended uses of the recycled water

End use	Comments
Residential dual reticulation	Recycled water will be supplied back to residences for use in toilet flushing, garden irrigation and washing machines. At various locations recycled water will also be used for irrigation of public open space as required. Recycled water quality will be in accordance with the requirements for "*Dual reticulation, toilet flushing, washing machines, garden use*" in Table 3.8 of the National recycled water guidelines.
Unrestricted irrigation	Public open space within the Pitt Town area such as parks, schools and community gardens will be irrigated with recycled water. Customers are currently being identified, such as golf courses, turf farms, etc, which may be interested in a recycled water supply from the PTWF.
Water Factory - Plant process water	Recycled water will be used for general plant process water such as inlet screen sprays. Exposure to the plant process water is strictly controlled. Following a review of risks of exposure Water Factory Company is satisfied that the quality requirements for dual reticulation described above address the risks of this end use. Plant process water is not specifically listed as an end-use in Table 3.8 of the National recycled water guidelines.

The recycled water will not be used for any other purpose without appropriate regulator consultation and approval.

If the infrastructure involves treatment infrastructure or results in discharge of waste (including due to potential infrastructure failure), what arrangements have been made or will be made for the disposal of waste from the infrastructure?

Table (D3) details the waste from the infrastructure.

Table (D3) – Waste from the infrastructure

Waste	Comments
Screenings and Waste Activated Sludge (WAS)	Screenings will be collected from the inlet screen and discharged into the WAS / Screenings sump. WAS will be discharged to the WAS / Screenings sump on an as required basis to maintain the desired MLSS concentration in the bioreactor. Negotiations are underway to enable the WAS / Screenings to be discharged into the Hawkesbury City Council sewer system. If agreement with Hawkesbury City Council is not reached the screenings will be collected by a general waster contractor. The WAS will be dewatered on site and collected by a general waster contractor.
General	The proposed recycled water factory includes provision for a general sump to capture general wash down water, spills and overflows. Generally the contents of the general sump will be returned to the plant for re-processing. If this is not possible due to the contents of the general sump it will be collected by a waste contractor for off-site disposal.

If the infrastructure conveys, treats or disposes of sewage, in what manner will health and ecological assessments be undertaken and how will any concerns arising from such assessments be addressed?

A preliminary risk assessment has not identified any concerns that can not be adequately addressed through available controls. Detailed risk workshops will be held during detailed design to ensure that any risks to health or ecological risks are eliminated or mitigated to an acceptable level.

Please identify any potential environmental impacts of the activities to be licensed and provide details of how these activities would be conducted in a manner that would not present a significant risk of harm to the environment.

A preliminary risk assessment has not identified any potential environmental impacts that can not be adequately addressed through available controls. Detailed risk workshops will be held during detailed design to ensure that any potential environmental impacts are eliminated or mitigated to an acceptable level.

SECTION E – PART ONE: INTRODUCTION

Including:

Attachment E1 – Long Term Contingency Plan – Sydney Water supply capacity
Attachment E2 – Long Term Contingency Plan – HCC sewerage system Sec 64 plan

SECTION F – PART TWO: TECHNICAL CAPACITY

Including:

Attachment F3 – Mono Pumps Australia pressure sewer system appraisal - WSAA
Attachment F4 – Construction risk assessment
Attachment F7 – Mono Eco 160 Operations and Maintenance manual
Attachment F9 - Water quality management policy
Attachment F15 – Regulatory/legal compliance policy statement
Attachment F17 – Quality assurance certificates – key suppliers

SECTION G – PART THREE: ORGANISATIONAL STRUCTURE AND CAPACITY

Including:

Attachment G1 – Organisational diagram
Attachment G2 – Management Structure

SECTION I – GENERAL INFORMATION

Including:

Attachment I3 – Screen shots of SCADA ex Pennant Hills GC recycled water plant

SECTION J – DRAWINGS

Including:

Attachment J1 – Location plan
Attachment J2 – Map 1 of the activities to be licensed
Attachment J3 – Map 2 interconnections with other infrastructure
Attachment J4 – Process flow diagram
Attachment J7 – Example pressure sewer layout plan draft

SECTION K – REVIEW OF ENVIRONMENTAL FACTORS WATER FACTORY LOT

Including:

Introduction

Approvals and permits

Statutory planning context

Environmental impacts and management

Summary of impacts and conclusion

Appendix 1 – Plan Lot 1062 DP 1131838

Appendix 2 - Ecology assessment

Appendix 3 – Acoustic assessment

Appendix 4 – Odour impact assessment

Architectural drawings

Landscaping plans