Government of Western Australia
Department of Water and Environmental Regulation

Decision Report

Application for Works Approval

Part V Division 3 of the *Environmental Protection Act 1986*

Works Approval Number	W6910/2024/1
Works Approval Holder	Water Corporation
File number	DER2024/000093~3 and APP-0026102
Premises	Northam Water Resource Recovery Facility 3 - 5 Colebatch Street and Crown Reserve 25729 Burlong WA 6401 Legal description - Lot 29316 on Deposited Plan 221054 Certificate of Title Volume LR3158 Folio 495 Lot 500 and Lot 501 on Deposited Plan 76392 Certificate of Title Volume LR3165 Folio 372 and 373 As defined by the premises map in Schedule 1 of the works approval
Date of report	26 August 2025
Decision	Works approval granted

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1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the construction and operation of the Northam Water Resource Recovery Facility. As a result of this assessment, Works Approval W6910/2024/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) has considered and given due regard to its regulatory framework and relevant policy documents which are available at: https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary

On 22 February 2024, Water Corporation (the applicant) submitted an application for a works approval to the department under section 54 of the *Environmental Protection Act 1986* (EP Act).

The application is to undertake construction works to upgrade sewage treatment facilities at the Northam Water Resource Recovery Facility (WRRF) (the premises). The proposed works will upgrade the premises from a simple pond system with an approved capacity of 1,500 m^3/day to an oxidation ditch system with a design capacity of 2,000 m^3/day. The upgraded system aims to meet current and projected sewage demands for the next 20 years.

The premises relates to the category and assessed design capacity under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in Works Approval W6910/2024/1. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020) are outlined in Works Approval W6910/2024/1.

2.3 Overview of existing premises

The applicant holds Licence L5989/1991/12 in relation to the premises, which is located across Lot 29316 on Deposited Plan 221054, Lot 500 and Lot 501 on Deposited Plan 76392, Burlong (Figure 1). The premises is situated about 1 km northwest of Northam and consists of two sites to the south of the Avon River, separated by Great Eastern Highway and a railway line.

Sewage from the connected network is received at the Primary Treatment Site located on Lots 500 and 501, which currently consists of a grit channel, two primary sedimentation tanks, three sludge digesters, four sludge drying beds and a hardstand with three biosolids storage bays. After processing through the primary plant, partially treated sewage is transferred by pipeline to the Secondary Treatment Site on Lot 29316. This plant currently comprises a four pond system operating in parallel, that includes three secondary ponds (1-3) and a polishing pond (4). Effluent from Ponds 1-3 is dosed with aluminium sulfate (alum) before being input to Pond 4 to flocculate out phosphorus and suspended solids. Treated sewage exiting Pond 4 is disinfected by an ultraviolet (UV) disinfection unit to reduce pathogen levels. The disinfected treated sewage is then stored for reuse or discharged to the environment.

Following UV disinfection, treated sewage is stored in the Shire pond to supply the Shire of Northam reuse scheme and is further chlorinated upon exiting the pond, prior to irrigation of public open spaces. Treated sewage in excess of the reuse scheme demand is discharged via a flume outflow to land on the western side of the premises where it flows through a series of soil furrows, prior to any excess water that has not evaporated or infiltrated exiting the premises boundary through a culvert and discharging to the banks of the Avon River.

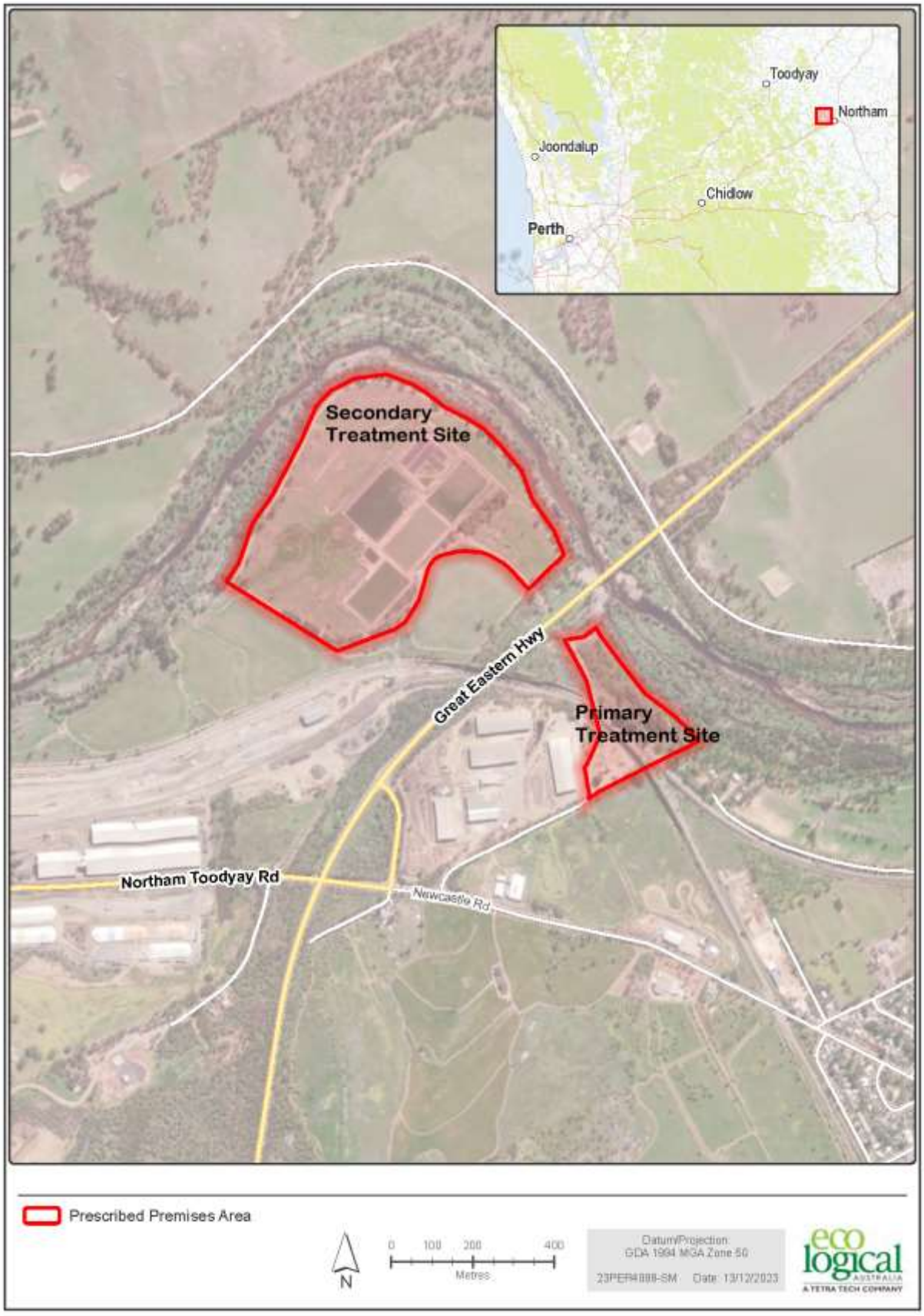

Figure 1: The two treatment sites which comprise the premises

2.4 Findings from December 2024 licence renewal

On 7 September 2023, the applicant applied for a licence renewal under s.57 of the EP Act for the Northam WRRF. The application requested a 5-year licence duration to support the continued operation of the premises while infrastructure upgrades are developed. The existing infrastructure and operational activities at the premises were assessed by the department and Licence L5989/1991/12 was granted on 4 December 2024. The key outcomes of the assessment of the renewal application are outlined below (DWER 2024):

- A number of sampling events and investigations in relation to classification of the premises under the *Contaminated Sites Act 2003* were carried out between 2017 to 2022. These found that the WRRF was contributing nutrients to the Avon River through either surface or groundwater discharge.
- The 2021/22 Annual Environmental Report (AER) indicated that the WWRF effluent had average total nitrogen (TN) concentrations of 36 mg/L (25 - 42 mg/L) and total phosphorus (TP) concentrations of 0.63 mg/L (0.34 - 1.1 mg/L).
- Ingress of stormwater into the sewer network system and overtopping events were found to have occurred at the premises, indicating the plant is overloaded for its current capacity, which could also be negatively impacting the ability of the WRRF to adequately treat sewage.
- Since 2017, the approved 1,500 m^3/day design capacity of the plant has been exceeded in every year except 2019/2020. This was partially attributed to higher than average rainfall events combined with stormwater ingress into the sewer network system.
- Water balance modelling conducted by the applicant found that sewage was being lost from the system prior to discharge, likely due to seepage from the treatment ponds. However, it was unable to be determined if seepage was occurring from just one pond or all four ponds.
- In accordance with the ANZG Water Quality Guidelines (2018), the Avon River should be managed as a high conservation or ecological value system given the high ecological values associated with the river.
- An ecotoxicity assessment needs to be undertaken to determine site-specific criteria for discharge to the Avon River and whether effluent from the Northam WRRF is suitable for discharge to the river. A condition was added to the licence requiring submission of this assessment to the department by 4 December 2026.
- The associated recycled water scheme is considered a medium risk exposure level end use. However, operations have not consistently complied with water quality objectives associated with this risk level.
- The Nutrient Irrigation Management Plan (NIMP) for the reuse scheme requires review to determine current soil nutrient loading capacity, current input levels of nutrients from treated sewage, ongoing ability for turf to adequately utilise the level of nutrients and consideration of any changes to the number of irrigated areas to facilitate increased reuse of treated sewage. A condition was added to the licence requiring submission of the updated NIMP to the department by 4 June 2026.

The application for Works Approval W6910/2024/1, which is the subject of this decision report, was submitted prior to the licence renewal being determined on 4 December 2024.

2.5 Proposed works

2.5.1 Overview

The application proposes to undertake construction and decommissioning works to increase the capacity of the WRRF from 1,500 m^3/day to 2,000 m^3/day, as well as change the sewage treatment process from a simple pond system to an activated sludge system with an oxidation ditch. The proposed design and layout of the upgrade works are shown in Figure 2, Figure 3 and Figure 4. The upgraded WRRF will produce a higher quality treated sewage, particularly regarding nitrogen concentration, than the current pond plant is capable of and has been designed to treat sewage to the final effluent quality listed in Table 1 below.

Table 1: Comparison of treated sewage quality for the upgraded plant

Parameter	Upgraded treated sewage quality	Typical pond system treated sewage quality	Current system treated sewage quality[1]
Total nitrogen	< 8 mg/L	30 - 60 mg/L	41.67 mg/L
Total phosphorus	< 1 mg/L (with alum dosing)	12 - 15 mg/L (no alum dosing) ≤ 2 mg/L (with alum dosing)	0.56 mg/L (with alum dosing) < 1 mg/L (licence limit)
Biochemical oxygen demand (BOD)	< 20 mg/L	< 20 mg/L	13.13 mg/L
Total suspended solids	< 20 mg/L	10 - 150 mg/L	23.33 mg/L
Escherichia coli (faecal pathogen indicator)	< 1,000 CFU/100mL (discharge to ODA) < 10 CFU/100mL (discharge to reuse scheme)	N/A [2]	200 CFU/100mL (median) < 1,000 CFU/100mL (licence limit)

Note 1: Based on the average final effluent monitoring results for the 2023 and 2024 financial years unless indicated otherwise.

Note 2: Typical concentration of faecal pathogen indicator is dependent on the type of disinfection undertaken after pond treatment.

The proposed upgrade works at the premises will include the following:

- Primary Treatment Site – upgrade the existing plant with a new tanker receival, inlet screens, two catch pits below the grit and screening bins, degritter, potable water booster system and new high-density polyethylene (HDPE) pipework.
- Interconnecting pipeline – construction of a new gravity fed pipeline between the degritter at the Primary Treatment Site to the inlet of the bioselector at the Secondary Treatment Site.
- Secondary Treatment Site:
  - Treatment system – replacement of the existing pond system with an oxidation ditch system. This will require construction of a bioselector, oxidation ditch, secondary clarifier, alum storage/dosing system, compacted earthen bunding and containment for a 72 hour duration 20% annual exceedance probability (AEP) stormwater event, sludge dewatering beds and new HDPE internal pipework.

- Treated sewage storage and discharge – conversion of existing ponds 1, 2 and 4 into infiltration ponds for additional disposal capacity and the expansion of the existing UV disinfection facility and chlorinator to accommodate increased flows.

The proposed decommissioning works at the premises will include the following:

- Primary Treatment Site – decommission the existing detritus channel, two primary sedimentation tanks, three anaerobic sludge digesters, three sludge drying beds (one will remain) and two holding bays (one will remain).
- Secondary Treatment Site – decommission secondary treatment pond 3 and the existing alum storage/dosing system.

The works will need to be undertaken in a manner that allows for the treatment of sewage at the premises to continue, as there is no proposed diversion of the connected sewerage network.

2.5.2 Construction

The proposed works will commence with diverting inflow away from Pond 3 to Ponds 1, 2 and 4, followed by the decommissioning of Pond 3 by undertaking earthworks to remove the northeastern embankment and backfill the pond. No other decommissioning will occur at this stage and the remaining three ponds will continue to operate until the upgraded plant is commissioned.

Once the above earthworks are complete, reinforced concrete slab foundations will be installed for the secondary clarifier, bioselector and oxidation ditch at the former location of Pond 3, as well as at the primary treatment plant. Bitumen sealed access tracks for both sites will be constructed once the foundations have been laid, as well as unsealed gravel pavement areas at the secondary site.

Modular equipment and infrastructure for both sites, in addition to new HDPE pipeline networks, will then be constructed on the premises in a manner that will allow the existing sewage facility to continue operating. Once complete, the modular pieces will be relocated and installed into their operational locations and connected to the newly installed HDPE pipeline network.

2.5.3 Commissioning

The application includes an environmental commissioning period for the new treatment infrastructure of up to 18 weeks. Commissioning will include the following steps:

- Initial 7-day equipment commissioning with potable water;
- 2 - 3 weeks of seeding and stabilising the biological components of the system;
- 7 days of performance testing on processing fluids to prove the equipment functions as designed;
- At least 30 days of reliability testing where the whole system is run in its automatic setting; and
- 60 days of process proving, where the operational processes of the system are optimised to meet the required treated water quality parameters.

2.5.4 Decommissioning and conversion works

Conversion of infiltration ponds

Once the oxidation ditch has been commissioned, existing ponds 1, 2, and 4 will be taken offline simultaneously. Sewage from the ponds will be pumped into the existing Shire re-use pond and sludge will be pumped to the new sludge drying area, which returns leachate to the start of the oxidation ditch for treatment. When the ponds have dried out, any residual sludge and the clay liner will be removed for offsite disposal.

A suitably qualified engineer will then inspect each of the pond floors to ensure that the clay liners have been fully removed and underling soils have been exposed. This will include logging of the soil types across the floor of the ponds in order to ground-truth the water balance model. Once the pond floors are confirmed as suitable, they will be scarified using a tine cultivator or a grader to form a series of windrows.

The infiltration ponds will then be brought online one at a time and filled with treated sewage from the oxidation ditch when the Shire re-use pond is full.

Decommissioning

With the exception of Pond 3, the applicant intends to operate the existing treatment facilities during the construction and commissioning phases of the proposed works. Once these phases have been completed, sewage flows will be diverted into the upgraded facilities and cut-off from existing infrastructure that is planned to be decommissioned or converted.

The following items of infrastructure will be decommissioned once the upgraded plant is connected:

- Primary Treatment Site:
  - Detritus channel.
  - Primary sedimentation tanks (x2).
  - Anerobic sludge digesters (x3).
  - Sludge drying beds (x2).
  - Holding bays (x1).
- Existing interconnecting pipeline.
- Secondary Treatment Site:
  - Alum dosing facility.
  - Chlorination building.

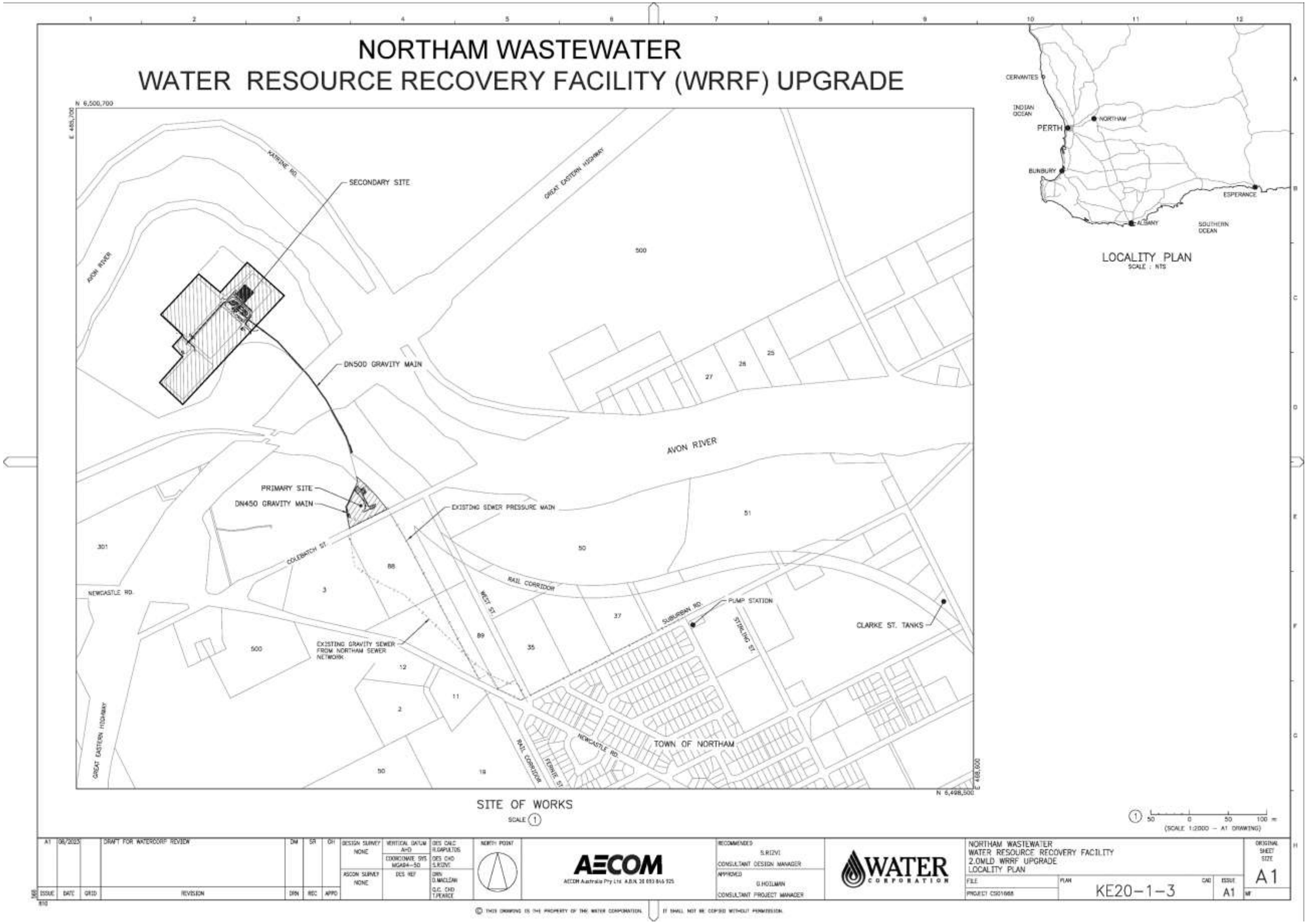

Figure 2: Site plan of the proposed works across the premises
Works Approval: W6910/2024/1

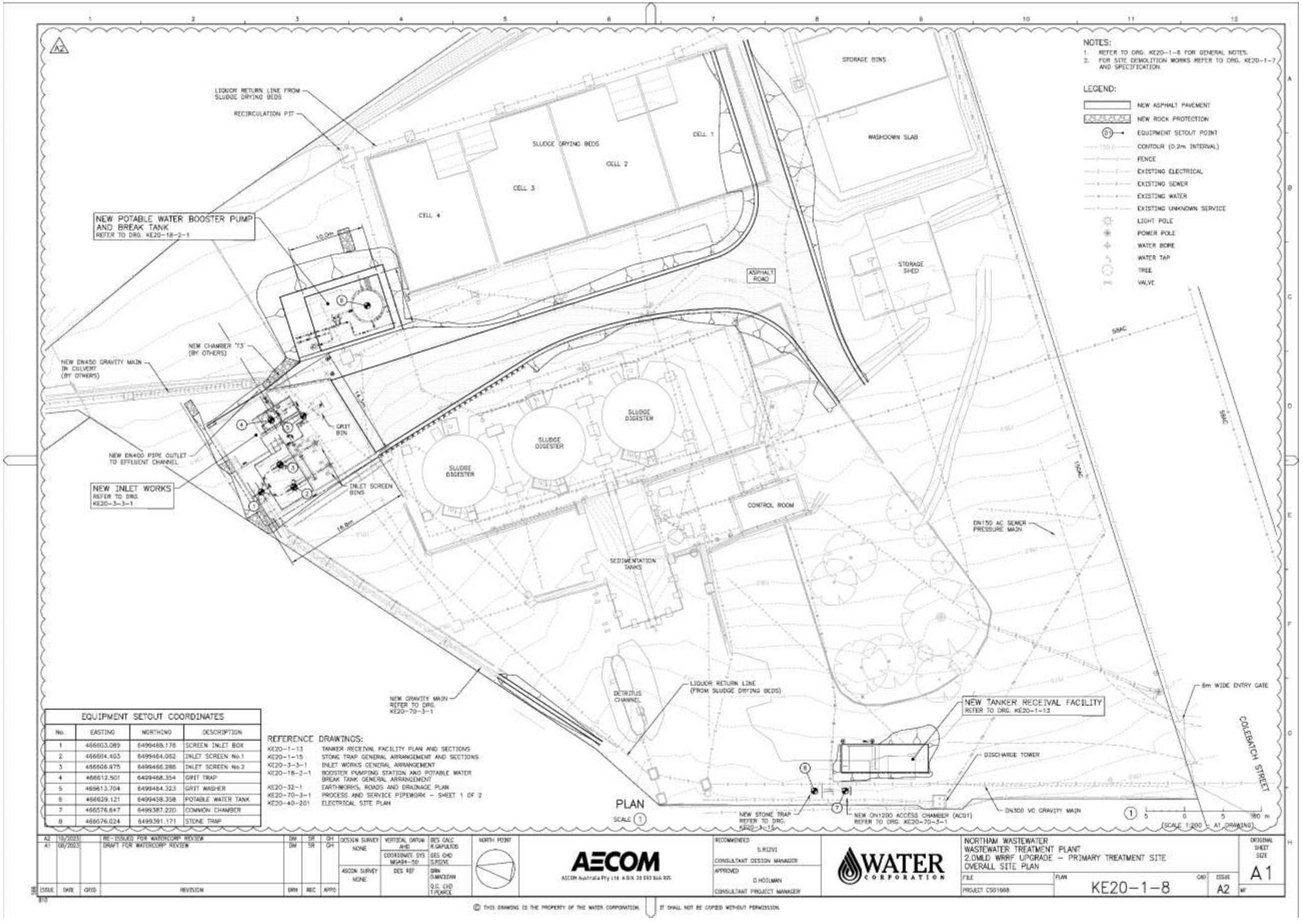

Figure 3: Site plan of the proposed works at the Primary Treatment Site
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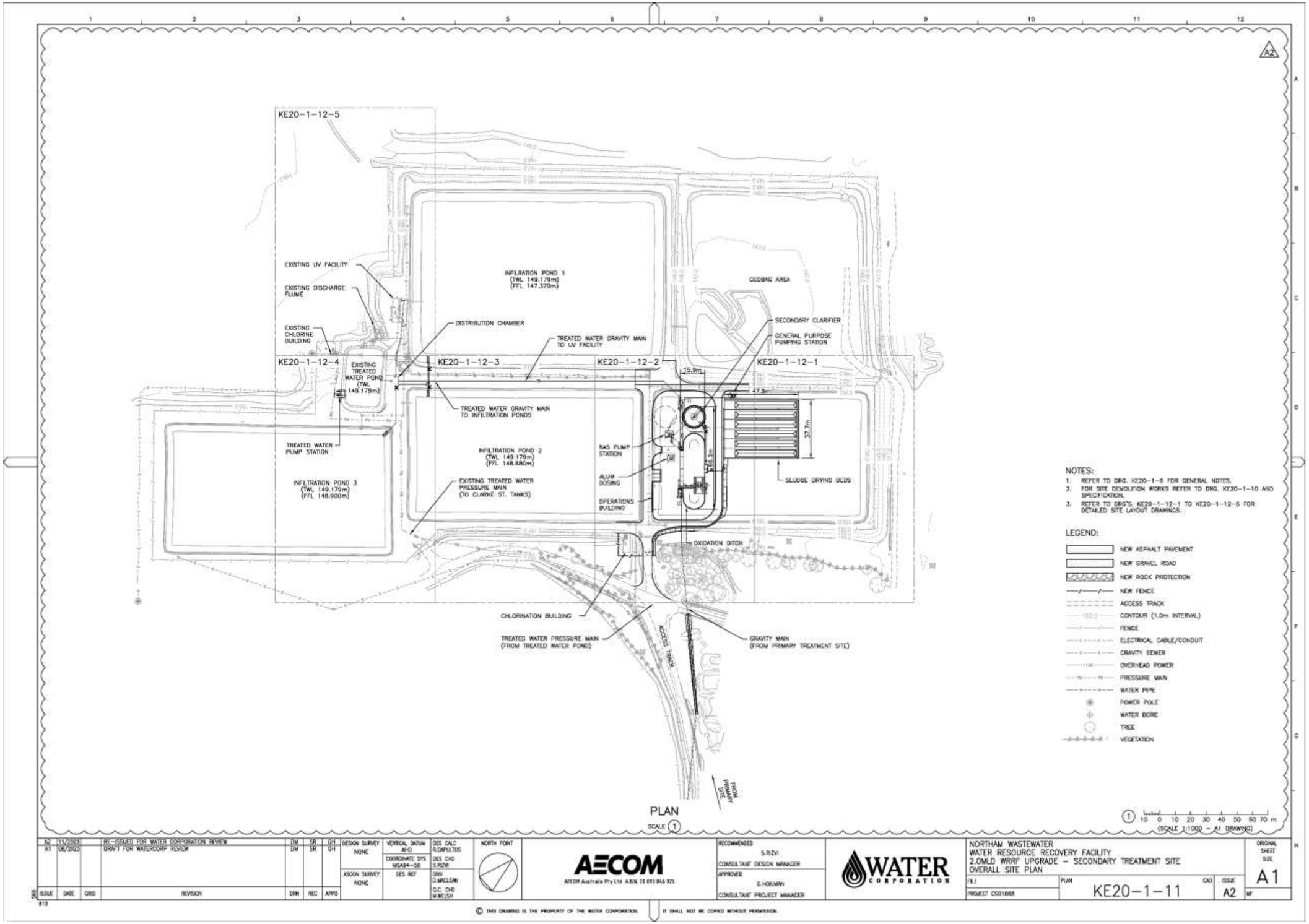

Figure 4: Site plan of the proposed works at the Secondary Treatment Site
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2.6 Proposed operations and time limited operations

2.6.1 Primary Treatment Site

Sewage inputs to the upgraded WRRF will occur at the Preliminary Treatment Site via the connecting pipeline to the local sewerage network or by tankers, which deposit their load into the Tanker Receival Facility. Sewage from these sources is then combined in a common chamber before being piped to the grit and screening process.

The grit and screening process involves passing of sewage through two screens in a duty/standby arrangement and a screening conveyor system. Screened sewage then enters the degritter to remove grit sized particles. The removed grit is transferred to the grit classifier which separates organic from inorganic grit material, with the organic grit being reintroduced into the degritter. The screened and de-gritted sewage is then conveyed via a gravity fed pipeline to the Secondary Treatment Site. Material captured by the screens and inorganic grit removed by the degritter is directed into storge bins for up to two weeks before offsite disposal to an appropriately licensed facility.

2.6.2 Secondary Treatment Site

Screened and de-gritted sewage is input to the Secondary Treatment Site at the bioselector, where it is mixed with activated sludge to promote the growth of floc forming bacteria and assist with the removal of phosphorus. The sewage and activated sludge mixture is referred to as mixed liquor. Alum dosing may also occur at this stage if biological processes are not able to reduce total phosphorus levels to <1.0 mg/L. The mixed liquor is then input to the oxidation ditch.

The oxidation ditch acts as a closed loop flow channel where the mixed liquor is circulated and oxygenated to facilitate additional bacterial growth and increased biological treatment. Once suitably oxygenated, the mixed liquor inputs to the secondary clarifier and waste activated sludge that is excess to requirements is also removed.

The secondary clarifier separates the liquid component of the sewage from the settleable suspended solids (sludge) and floating solids (scum). Sludge removed from the clarifier is returned to the bioselector for reuse and the removed scum is combined with the waste activated sludge previously removed from the oxidation ditch. This combined waste sludge material is then transferred to the sludge drying beds for dewatering. Once suitably dry, the sludge is removed for offsite disposal to an appropriately licensed facility.

Treated sewage outputting from the secondary clarifier is sent to the treated water pond for storage, prior to chlorination and reuse by the Shire or discharge by other means.

Any spilled process fluids throughout the treatment process will be directed through an associated pipeline network towards the bioselector for treatment.

2.6.3 Treated sewage disposal

The upgraded WRRF will dispose of treated sewage by three routes (Figure 5) involving reuse, infiltration/evaporation and direct discharge to land. The methods will vary depending on storage availability and season.

Figure 5: Treated sewage disposal routes

Reuse and discharge to land via irrigation

The preferred method will be through periodic pumping to the Clarke Street Storage Tank, which will occur throughout the year. Treated sewage will be disinfected using chlorine gas prior to pumping to the tank. The Shire of Northam will then use treated sewage from the Clarke Street Storage Tank to irrigate public spaces in accordance with the *Northam Town Recycled Water Scheme - Recycled Water Scheme Approval*.

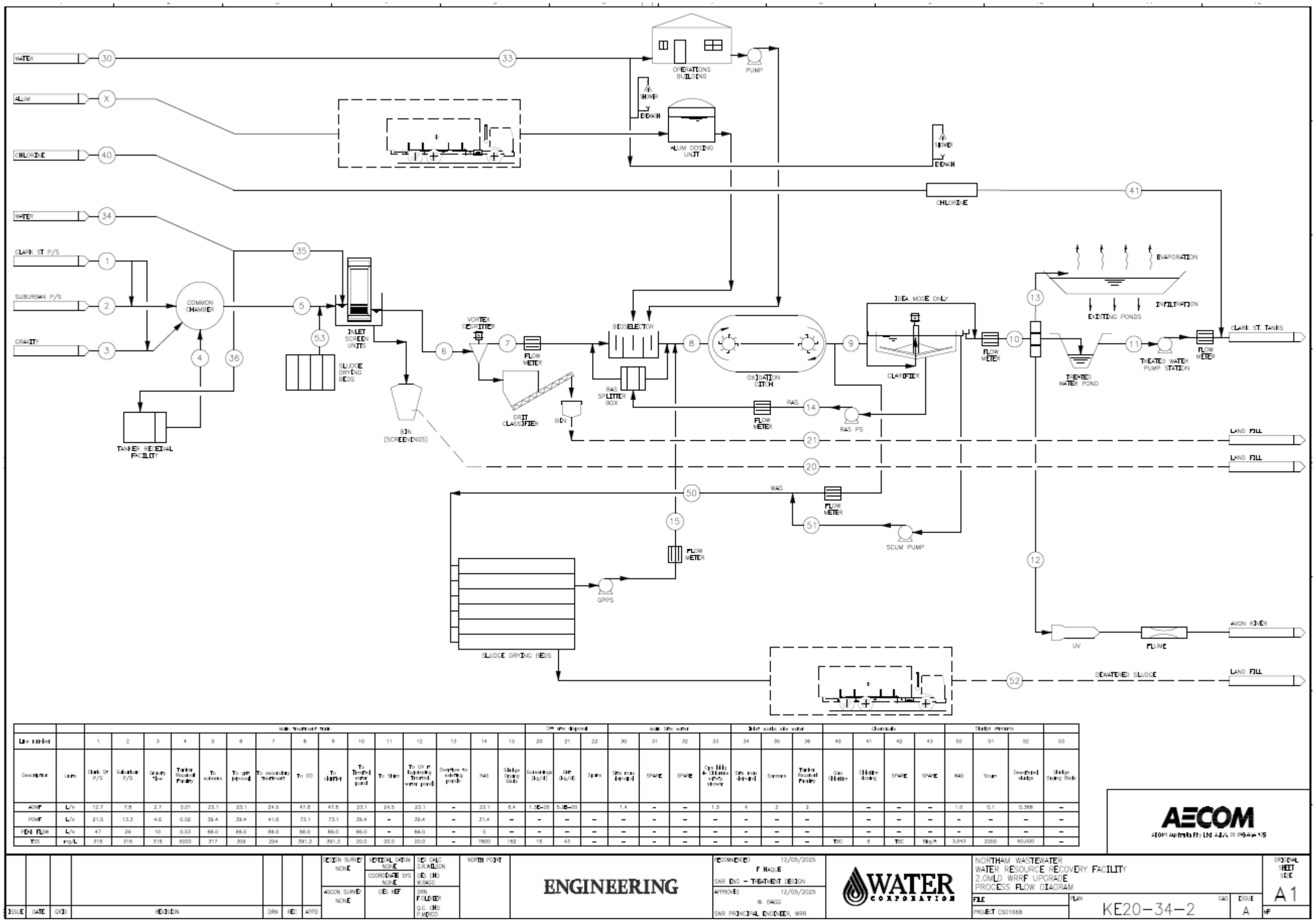
Discharge to land via infiltration ponds

Treated sewage will also be disposed via discharge to existing ponds 1, 2 and 4, which will be converted to infiltration ponds. The treated sewage volume in the ponds will be removed through a combination of evaporation and infiltration, with higher losses to evaporation during the warmer months and a generally consistent rate of infiltration throughout the year.

Discharge to land and water

From March to November, treated sewage will also be discharged to land via a flume outflow to the Overland Discharge Area (ODA). The treated sewage will be disinfected using the upgraded UV system before being discharged to the ODA, which contains a series of soil furrows for the treated sewage to infiltrate and pass through, prior to discharging to the banks of the Avon River.

Discharges to the ODA will not occur from December to February during the low flow period for the Avon River, except where heavy rainfall events have caused capacities issues with the infiltration ponds.



Line number		Main treatment train														Off site disposal			Main Site water				Toilet wash site water			Chemicals				Sludge streams			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	21	22	30	31	32	33	34	35	36	40	41	42	43	50	51	52	53
Description	Units	Clark St P/S	Suburban P/S	Gravity flow	Tanker Received Facility	To screens	To grit removal	To secondary treatment	To OD	To clarifier	To Treated water pond	To Store	To UV if bypassing Treated water pond	Overflow to existing ponds	RAS	Sludge Drying Beds	Screenings (kg/d)	Grit (kg/d)	Spare	Site main demand	SPARE	SPARE	Site Utility + Chlorine safety shower	Site main demand	Screens	Tanker Received Facility	Gas Chlorine	Chlorine dosing	SPARE	SPARE	WAS	Scum	Dewatered sludge	Sludge Drying Beds
ADWF	L/s	12.7	7.8	2.7	0.01	23.1	23.1	24.5	47.6	47.6	23.1	24.5	23.1	–	23.1	5.4	1.3E-05	5.2E-05	–	1.4	–	–	1.3	4	2	2		–	–	–	1.6	0.1	0.368	–
PDWF	L/s	21.5	13.3	4.6	0.02	39.4	39.4	41.8	73.1	73.1	39.4	–	39.4	–	31.4	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–
PEAK FLOW	L/s	47	29	10	0.03	86.0	86.0	86.0	86.0	86.0	86.0	–	86.0	–	0	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–
TDS	mg/L	316	316	316	5000	317	309	294	391.3	391.3	20.0	20.0	20.0	–	7800	182	18	43	–	–	–	–	–	–	–	–	T80	6	T80	80g/l	3,943	2000	60,000	–

AECOM
AECOM Australia Pty Ltd A.B.N. 20 093 846 925

ISSUE	DATE	DRG	REVISION	DRN	RED	APPD

REDSON SURVEY: NONE
ASCON SURVEY: NONE
VERTICAL DATUM: NONE
COORDINATE SYS: NONE
GEN REF
BDS CALC: D.R.WILSON
BDS CHD: W.BAGG
DRN: F.OLIVIER
Q/C CHD: P.MCDOO
NORTH POINT

ENGINEERING

RECOMMENDED 12/05/2025
F HAGUE
SNR ENG – TREATMENT DESIGN
APPROVED 12/05/2025
W. BAGG
SNR PRINCIPAL ENGINEER, WRR

WATER CORPORATION

NORTHAM WASTEWATER
WATER RESOURCE RECOVERY FACILITY
2.0MLD WRRF UPGRADE
PROCESS FLOW DIAGRAM

FILE
PROJECT CS01668
PLAN KE20-34-2
CAD
DSSUE A
ORIGINAL SHEET SIZE A1
sF

Figure 6: Process flow schematic for operation of the upgraded facility

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2.7 Modelling and monitoring data

2.7.1 Avon River flow

The applicant provided flow estimates of the Avon River adjacent to the premises based on an analysis of available flow data from three surface water gauges (615062 Northam Weir, 615013 Frenches, 615020 Odriscolls Farm) located upstream of the ODA discharge point. The monthly median flow estimates are summarised in Table 2 below.

Table 2: Median flow estimates (ML/month) based on data from 1977 to 2022

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	3	111	93	1,097	7,156	24,592	29,164	11,346	2,686	278	16

The applicant considered no flow months to be where the median flow is less than 20 ML/month and low flow months were where the median flow is less than 1,000 ML/month. The no flow months were identified to be the start of December to the end of February, and the low flow months were identified as November and the start of March to the end of April.

2.7.2 Water balance

The application included a Water Balance Technical Report that was completed by the applicant to determine the capacity of the proposed works for disposal of treated sewage. The provided water balance was subsequently revised during assessment of the application to consider newer information, as well as to provide an estimate of volumes being discharged to the ODA. A summary of the key assumptions of the revised water balance are provided in Table 3 below.

Table 3: Key assumptions in revised water balance

Aspect	Model assumptions and inputs
Sewage inputs	Four inflow volume scenarios for the upgraded plant were considered: • the current 2024 annual average daily flow (AADF) of 1,550 kL/day • the forecasted 2035 AADF of 1,750 kL/day • an AADF of 1,900 kL/day, and • the maximum treatment capacity of 2,000 kL/day.
Rainfall inputs	Gain of water through rainfall was estimated using daily rainfall data from the SILO database for the years between 2013 to 2023.
Pond capacity and area	The three infiltration ponds will have capacity to store up to 22,000 m^3 at one time. The upgraded plant will have a total evaporation and infiltration area of 3.93 ha, which includes the repurposed ponds as well as the Shire Pond due to any flow leaving the WRRF also passing through the Shire pond.
Evaporation outputs	Loss of water through evaporation was estimated using Morton's shallow lake evaporation data from the SILO database for the years 2013 to 2023.
Infiltration outputs	A conservative design infiltration rate of 5 mm/day was used that was based on a 6 mm/day pond seepage rate determined from previous investigations into treatment plant losses. The actual infiltration rate of the evaporation and infiltration ponds is likely to be higher than 6 mm/day, as this rate related to seepage loss from ponds with damaged liners that were not designed for infiltration.

Aspect	Model assumptions and inputs
Discharge to recycled water scheme	Recycled water scheme outputs were based on the monthly recommended volumes calculated using the Department of Primary Industries and Regional Development's Irrigation Calculator (DPIRD 2017). As the premises treats more sewage than there is irrigation demand, the volume of treated sewage able to be sent for reuse is already fully utilised and remains the same for all scenarios.
Discharge to ODA	Discharge to the ODA should be avoided during the no flow months (start of Dec to end of Feb) and the ponds have to be emptied prior to November to be available for use during the next no flow period. When discharge to the ODA occurs, this would include flow through the treatment plant as well as any residual treated sewage input to the ponds during the no flow months.
Discharge to Avon River	Currently there is no flow meter at the end of the ODA, so the proportion of treated sewage exiting as surface flow to the Avon River, rather than infiltrating, is unknown. As such, the water balance conservatively assumes that discharges to the ODA reach the Avon River and there is no loss of treated sewage to infiltration through the ODA.

The water balance indicated the upgraded facilities will have capacity to dispose of inflows up to 1,900 kL/day AADF while still ceasing discharges to the ODA from the start of December to the end of February each year. However, if the premises were operated at the 2,000 m^3/day maximum treatment capacity of the oxidation ditch, discharge to the ODA could only be ceased in December and January, as the repurposed ponds in combination with the recycled water scheme would not provide enough disposal capacity. A summary of the discharge volumes to the ODA for the current and modelled post-upgrade scenarios is provided in Table 4 below.

Table 4: Summary of current and modelled discharge volumes to the ODA in megalitres

Period	Discharge to ODA at 1,601 m^3/day (2022/23 reported inflow)	Discharge to ODA at 1,359 m^3/day (2023/24 reported inflow)	Discharge to ODA at 1,750 m^3/day (2035 forcasted inflow)	Discharge to ODA at 1,900 m^3/day	Discharge to ODA at 2,000 m^3/day
Oct	14.17	8.97	35	39.78	42.97
Nov	3.22	1.93	22.94	27.43	30.43
Dec	0.85	0.94	-	-	-
Jan	0.15	0.16	-	-	-
Feb	0.37	1.64	-	-	1.95
Mar	1.78	3.93	-	14.76	24.82
Apr	2.88	-	24.15	30.12	33.05
May	2.55	8.07	53.69	58.44	61.60
Jun	6.92	13.47	57.75	62.40	65.49
Jul	9.61	29.61	50.94	55.41	58.40
Aug	64.49	28.76	48.92	53.59	56.70
Sep	47.14	30.07	41.68	46.21	49.22
Annual	154.12	127.43	335.07	388.14	424.63

To avoid discharge to the ODA during the no flow months and address the shortfall in disposal capacity under the 2,000 m^3/day scenario, the applicant has indicated their intent for the upgraded premises to have a maximum licensed capacity of 1,900 m^3/day.

The application states that the water balance provides a preliminary understanding of the system and will be validated post-upgrade to consider the actual infiltration rate of the evaporation and infiltration ponds. Due to the proposed installation of a flow meter at the end of the ODA, this will also include quantification of the actual volumes of treated sewage that pass through all of the ODA soil furrows to discharge as surface runoff to the banks of the Avon River.

2.7.3 Nutrient loading

Using the water balance modelling provided by the applicant in Section 2.7.2 above and the proposed design specification for final treated sewage quality of the upgraded plant (Table 1), the department has estimated the future annual nutrient loads being discharged to the ODA and possibly the Avon River. The future nutrient loadings have been compared with the current discharge volumes and treated sewage quality reported by the applicant for the 2022/23 and 2023/24 annual periods (Water Corporation 2024) in Table 5 below.

Table 5: Nutrient loading to the ODA under current and future inflow scenarios

Sewage inflow	Discharge to ODA (m^3)	Total nitrogen annual load (kg)	Total phosphorus annual load (kg)	BOD annual load (kg)
1,601 m^3/day (2022/23 inflow)	154,115	6,023	154 [1]	3,082 [1]
1,359 m^3/day (2023/24 inflow)	127,432	5,639	127 [1]	2,549 [1]
1,750 m^3/day inflow (2035 forecast)	335,070	2,681	335	6,701
1,900 m^3/day inflow	388,140	3,105	388	7,763
2,000 m^3/day inflow	424,630	3,397	425	8,493

Note 1: The total phosphorus (TP) and BOD loadings for the existing plant were calculated using the TP concentration limit of 1 mg/L listed in the premises' licence (L5989/1991/12: Condition 7) and 20 mg/L typical BOD concentration for a pond system, to provide a more direct comparison between the design specifications of the existing and upgraded plants.

The annual nutrient loadings estimated in Table 5 above indicate that despite the increase in yearly discharge volumes associated with the proposed upgrade, the reduced total nitrogen concentration in the treated sewage will result in approximately 43% or higher decreases in annual nitrogen loading to the ODA and Avon River. However, this is not the case for annual phosphorus and BOD loading, which due to having the same final effluent specifications as the existing treatment plant, will increase in direct proportion to discharge volume.

2.7.4 Odour impact assessment

The application included a detailed odour impact assessment (OIA) commissioned by the applicant to determine the potential impact of odour emissions from the proposed upgrade works. The OIA included an operational odour analysis, location review and prediction of odour emission rates, resulting in the key findings summarised below (EAQ Consulting 2023):

- The premises is located upwind of the Northam town centre and the prevailing wind direction, low wind speeds, terrain and cooler climate of the area increases the potential for odour nuisance.
- Treatment of sewage using oxidation ditches and clarifiers is considered to have a similar odour quality to treatment using a pond system.
- Highest strength odours are expected to be observed at the Primary Treatment Site associated with the inlet works and at the Secondary Treatment Site associated with the sludge handling and drying beds.
- Higher strength odour emissions from the premises can be expected if there are mechanical failures and upset conditions in the treatment process. However, the proposed upgrade includes further controls to remotely monitor treatment conditions, warn of equipment failures and respond to issues that can lead to higher than normal odour emissions.
- Mass odour emission rates for the current and upgraded premises were estimated using previous assessments of other Water Corporation oxidation ditch and pond treatment plants, due to the similarity in operations and lack of current or historic odour emissions data for the Northam WRRF. The estimated emission rates suggested the upgraded facility will have around half of the odour footprint of the current pond system, mainly due to the reduction in exposed surface area during primary and secondary treatment processes.
- The Water Corporation operates other oxidation ditch treatment plants with higher throughputs and comparable infrastructure to the proposed upgrade works. These plants have a closer proximity to receptors than those surrounding the premises and have not received odour complaints under normal operations.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk Assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this decision report are detailed in Table 6 and Table 7 below. Table 6 and Table 7 also detail the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 6: Proposed applicant controls during construction

Sources	Emission	Potential pathways	Proposed controls
Construction activities, earthworks, machinery and vehicle machinery movements to install new infrastructure and decommission or refurbish existing WWTP infrastructure	Noise	Air / windborne pathway	Compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997*. Construction will be undertaken during weekdays between the hours of 7am and 7pm. If night works are required, relevant approvals from DWER and the Shire of Northam will be obtained. Equipment and machinery will be regularly maintained in accordance with manufacturer's specifications to minimise noise emissions. A complaints register will be maintained and reviewed weekly.
	Dust		Weekly opportunistic visual inspections of dust plumes and dust emissions on the premises during construction. Noticeable changes in dust emissions will be reported to the site manager. Equipment and infrastructure will undergo regular maintenance and housekeeping practices to prevent dust build up. Earthworks will not be conducted if wind conditions are extreme, where practicable. Trucks are to be washed down before leaving the premises to stop the spread or generation of dust offsite during construction activities.

Sources	Emission	Potential pathways	Proposed controls
Construction activities, earthworks, machinery and vehicle machinery movements to install new infrastructure and decommission or refurbish existing WWTP infrastructure	Hydrocarbons and other chemicals	Spills and leaks	Weekly visual inspections of temporary hydrocarbon and chemical storage units for evidence of spills. If spills are reported, then remediation actions will be undertaken as appropriate. Hazardous chemicals and hydrocarbons will be stored in bunded areas in accordance with AS1940 and AS1692 to contain any potential leaks or spills. Hydrocarbon and chemical storage areas will be inspected on a regular basis. Spill kits, recovery equipment and procedures for the management of hydrocarbons and other chemicals will be kept and maintained on the premises. Spill kits will be inspected on a regular basis and replenished as required.
Decommissioning and refurbishment of existing WWTP infrastructure, installation of new infrastructure	Treated and untreated sewage including associated contaminants (nutrients, metals, pathogens, PFAS)	Surface runoff Direct contact Seepage Downgradient groundwater migration	Existing pond 3 will be taken offline and desludged prior to construction of the oxidation ditch. To maintain the ability to contain and treat sewage at the premises, operation of existing treatment ponds 1, 2, and 4 will continue until the oxidation ditch is constructed and operational. After construction of the new infrastructure, sewage flows will be diverted into the upgraded facilities and cut-off from existing infrastructure to be decommissioned or converted. When taking existing ponds 1, 2, and 4 offline, sewage in the ponds will be pumped to the Shire re-use pond and sludge will be pumped to the new sludge drying area. Leachate in the sludge drying area will be returned to the start of the oxidation ditch for treatment. When the ponds have dried out, any residual sludge and the clay liner will be removed for offsite disposal.

Table 7: Proposed applicant controls during operation

Sources	Emission	Potential pathways	Proposed controls
Acceptance and treatment of sewage Sludge drying	Noise	Air / windborne pathway	Noise generating equipment and infrastructure, such as exhausts will be preferentially directed away from noise sensitive receptors. Compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997*. Equipment and machinery will be regularly maintained in accordance with manufacturer's specifications to minimise noise emissions. A complaints register will be maintained and reviewed.
	Odour		Inlet works (screens, conveyors, and grit washer) partially covered with grating to contain odours to the immediate vicinity of the inlet works. Inlet works are sized to minimize purging of the inlet works headspace. Screened material and captured grit bins will be regularly emptied and removed for disposal at a licenced facility. Logic controls, sensors, probes and alarms to allow remote monitoring and operation of the treatment process. Tanker receival facility will include closed connections for pumping waste from tanker to the primary inlet. Regular inspection and maintenance of inlet works for blockages. Dosing of sludge to reduce odour emissions if required. Dried sludge removed from premises for disposal. A complaints register will be maintained and reviewed.

Sources	Emission	Potential pathways	Proposed controls
Spills, leaks and containment loss during acceptance and treatment of sewage Spills, leaks and containment loss during sludge drying and handling	Contaminated stormwater Sewage including associated contaminants (nutrients, metals, pathogens, PFAS) Treatment chemicals (alum sulfate and chlorine)	Surface runoff Direct contact Seepage Downgradient groundwater migration	Weekly visual inspections of facilities within the premises to ensure they are suitably maintained. Visual inspections will also be undertaken when waste material is removed from the premises to ensure no major spills occur. Spill kits, recovery equipment and procedures will be kept and maintained on the premises. Any spills will be controlled, contained, and cleaned up in a timely manner. Spill kits will be inspected on a regular basis and replenished as required. Leachate in the sludge drying area will be returned to the start of the oxidation ditch for treatment. Hazardous chemicals will be stored in bunded areas to contain any potential leaks or spills. Chemical storage areas will be inspected on a regular basis.
Discharge of treated sewage to reuse scheme (Public open space) Discharge of treated sewage via on-site infiltration Discharge of treated sewage to banks and surface waters of Avon River	Treated sewage and associated contaminants (nutrients, metals, pathogens, PFAS)	Surface runoff Direct contact Seepage Downgradient groundwater migration	Upgraded infrastructure and treatment process changes designed to treat sewage to a higher quality than current discharges. Disinfection of treated sewage using chlorine dosing (reuse scheme) or UV lamps (ODA) prior to being discharged. Discharge to the ODA will be stopped or minimised during the drier months of the year where there is low base flow in the Avon River. Discharge volumes to the ODA and exiting the ODA to the Avon River will be monitored daily using a magnetic flow meter. Implementation of the existing *Nutrient Irrigation Management Plan* (AECOM 2014) (required under existing Licence L5989/1991/10) to manage irrigation of treated sewage to public open spaces. Ongoing discharge, surface water and groundwater monitoring undertaken in accordance with the Ambient Environmental Quality Monitoring Plan. Post-upgrade water balance calculations will be completed to more accurately define the proportions of treated sewage discharging from the end of the ODA to the Avon River in comparison to the volumes lost to infiltration and evaporation in the ODA.

3.1.2 Pathways

Information relating to potential pathways and site characteristics at the premises are provided in Table 8 below.

Table 8: Potential pathways and environmental conditions relevant to the premises

Aspect	Details
Topography	Premises topography is relatively flat, with slopes towards the Avon River. The Preliminary Treatment Site lies at approximately 156 mAHD, while the Secondary Treatment Site sits at approximately 158 mAHD. The wider locality has relatively steep topographical characteristics with terrain heights ranging from 150 mAHD to 250 mAHD. These terrain features can cause channelling pathways for odour emissions during seasonal low wind speed periods where there is minimal dispersion in downwind areas (EAQ Consulting 2023).
Soils and surface geology	Regional information suggests the soils at the premises were formed in colluvium or in-situ from mainly Jimperding metamorphic rocks (Sawkins 2010). The soil group of the Preliminary Treatment Site is red deep loamy duplex soils, whilst the dominant soil group of the Secondary Treatment Site is brown loamy earth. Broadscale soil mapping shows two soil subsystems occurring across the premises, with soils at the Preliminary Treatment Site described as the Jelcobine York subsystem and soils at the Secondary Treatment Site described as the Avon Flats subsystem. • Jelcobine York subsystem (256JcYO) - Areas of soils derived from freshly exposed rock. This unit is typified by the red soils of the Avon Valley but also includes areas of similar, but often greyer and lighter textured soils to the east of the valley. • Avon Flats subsystem (256AfAV) - Alluvial terraces and floodplains that occur adjacent to the Avon, lower Mortlock and lower Dale rivers. Site specific investigations at the Secondary Treatment Site recorded soil in the areas as sandy clays interbedded with clayey sand and gravelly clay overlying granite bedrock (AECOM 2023).
Hydrogeology	Bedrock beneath the premises is described as densely fractured and sheared and acting as a fractured rock aquifer. The regolith overlying the bedrock is typically shallow and consisting of alluvial sandy gravels with clay lenses (Cardno 2019). Depth to groundwater at the premises ranges between 2.2 to 5.9 mBGL (141.4 to 149.2 mAHD) at the Secondary Treatment Site and is unknown at the Primary Treatment Site (AECOM 2023). Geotechnical test pits excavated at the Primary Treatment Site to depths of 3 mbgl did not encounter groundwater (AECOM 2022). Groundwater flow direction was inferred to mimic topography and at the Secondary Treatment Site flowed radially to the west, north and east towards the Avon River (Cardno 2021). Groundwater has been previously reported as fresh to saline, with total dissolved solids (TDS) concentrations ranging between 440 mg/L to 7,700 mg/L (Cardno 2019 and 2021).

Aspect	Details
Hydrology	The premises is adjacent to the Avon River and approximately 2.7 km downstream to the northwest from where the Mortlock River meets the Avon River. The Avon River immediately downgradient of the confluence with the Mortlock River has a catchment area of over 72,000 km^2 of which 61,000 km^2 is in the upper Avon and 11,000 km^2 in the Mortlock Catchment (Hydrobiology 2018). This stretch of the Avon River typically does not flow during December to March, except in rare events where there are short duration and high-volume flows related to summer storms (Hydrobiology 2018). During periods of no flow, remnant pools of water within the riverbed opposite the premises have been recorded with depths up to 0.5 m (Cardno 2019). Annual river flows recorded at the Northam Weir (located upgradient of the confluence with Mortlock River) since 1977 averaged 108,000 ML/yr and ranged between 13,870 ML/day and 409,500 ML/day at the Toodyay gauging station, located approximately 14 km downstream of the premises. The bed level of the Avon River adjacent to the premises is approximately 139 to 139.5 mAHD and monitoring in all seasons has shown that groundwater at the premises has a higher elevation than the adjacent river level. This indicates there is connectivity between sediments underlying the Secondary Treatment Site and the Avon River is receiving groundwater discharge throughout the year (AECOM 2023).
Meteorology	The nearest representative Bureau of Meteorology weather station is the Northam weather station (No. 010111), located approximately 1.5 km southeast of the premises. The station provides the following climate information, based on records from 1975 to 2023: • Average maximum temperatures range from 17.0˚C in July to 34.3˚C in January, while average minimum temperatures range from 5.4°C in July to 17.2°C in both January and February. • Average annual rainfall is 396.3 mm, with lowest rainfalls occurring in December and highest rainfall in July. The Evaporation Data for Western Australia (Luke *et. al.* 1987) lists the average annual Class A pan evaporation rate for the Northam area as 2,204 mm. The applicant provided an analysis of wind conditions in the area for the period ranging from 2011 to 2021 (EAQ Consulting 2023). This considered the prevailing wind direction to be northwest, with average annual wind speeds of under 12 km/h (< 3.3 m/s).

3.1.3 Receptors

In accordance with the *Guideline: Risk Assessment* (DWER 2020), the Delegated Officer has excluded the applicant's employees, visitors, and contractors from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Table 9 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020)).

Table 9: Sensitive human and environmental receptors and distance from prescribed activity

Receptors	Distance from prescribed activity
Human receptors	
Closest sensitive receptor - Residential premises	490 m south of the premises boundary
Sensitive receptors - Residential premises	680 m southeast and 1,500 m east of the premises boundary
Environmental receptors	
Underlying groundwater – Avon River Catchment Area	Depth to groundwater is generally 3 to 6 m below ground level. Groundwater directional flow is from the northeast, flowing radially to the northwest and west and towards the Avon River. Groundwater salinity is marginal to saline ranging from 657 mg/L to 7,700 mg/L. There are no licensed users for surface water or groundwater abstraction within 5 km of the premises. Groundwater abstraction bores are considered unlikely to be installed in the vicinity of the premises due to the salinity of groundwater and low yield of the superficial aquifer (AECOM 2022).
Surface water – Avon River	Major, non-perennial watercourse located adjacent to the east, north and west of the Secondary Treatment Site boundary. Flow is predominantly seasonal, following rainfall. The river supports saline and eutrophic aquatic communities (flora and fauna). The distance between the riverbank and the Secondary Treatment Site ranges between approximately 40 m (north) and 130 m (north-west), with the northern and southern banks of the river being a floodplain. The river channel is located approximately 120 m from the proposed oxidation ditch at its closest point. The premises is located within the Avon River Waterways Management area, which is proclaimed under the *Waterways Conservation Act 1976*.
Threatened Ecological Community (TEC) – Eucalypt Woodlands of the Western Australian Wheatbelt	Located adjacent to the east, north and northwest of the Secondary Treatment Site and extending along the Avon River riparian zone, with other records within remnant roadside vegetation.
Native vegetation – Multiple records of threatened and priority fauna species occur in riparian vegetation along the Avon River and remnant roadside vegetation in the surrounding area.	Within a 1 km radius of the premises boundary.

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the delegated officer considers the applicant's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the works approval as regulatory controls.

Additional regulatory controls may be imposed where the applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 10 and Table 11.

Works Approval W6910/2024/1 that accompanies this decision report authorises construction and time-limited operations. The conditions in the issued works approval, as outlined in Table 10 and Table 11 have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

An amendment to Licence L5989/1991/12 is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the upgraded premises. A risk assessment for the operational phase has been included in this decision report, however licence conditions will not be finalised until the department assesses the licence application.

Table 10: Risk assessment of potential emissions and discharges from the premises during construction and decommissioning

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Construction								
Construction activities, earthworks, machinery and vehicle machinery movements to install new infrastructure and decommission or refurbish existing WWTP infrastructure	Noise	Air / windborne pathway causing impacts to health and amenity	Residential receptors (490 m south, 680 m southeast and 1,500 m east)	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Yes	N/A	The construction related provisions of the *Environmental Protection (Noise) Regulations 1997* apply.
	Dust			Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Yes	N/A	Due to the scope and short-term nature of construction activities, the Delegated Officer considers dust emissions during construction will probably not impact surrounding receptors in most circumstances. Emissions of dust may be subject to the provisions of section 49 of the EP Act.
	Hydrocarbons	Spills and leaks of hydrocarbons impacting soil, groundwater and surface water quality	Underlying groundwater Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Avon River	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Yes	N/A	Discharges of hydrocarbons and other chemicals are subject to the provisions of the *Environmental Protection (Unauthorised Discharges) Regulations 2004* and do not require further control.
Decommissioning and refurbishment of existing WWTP infrastructure, installation of new infrastructure	Treated and untreated sewage	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Seepage causing impacts to soil and groundwater quality Downgradient groundwater migration causing impacts to beneficial use or terrestrial and aquatic ecosystems	Avon River Underlying groundwater Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Beneficial users of groundwater	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements	The applicant intends to maintain the ability to contain and treat sewage at the premises while the upgrade works are being undertaken. This will be achieved by continuing operation of existing treatment ponds 1, 2 and 4 until the oxidation ditch is constructed and operational. Prior to constructing the oxidation ditch, existing pond 3 will be drained, disconnected and desludged. After construction, sewage flows will be diverted into the upgraded facilities and cut-off from the remaining ponds that are to be converted to infiltration ponds. The Delegated Officer considers the applicant's proposed controls to be sufficient to manage the emission of treated and untreated sewage during the upgrade works. These will be included as requirements in the works approval.
		Direct contact causing impact to human health	Recreational users of public open space and the Avon River					

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

Note 2: Proposed applicant controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

Table 11: Risk assessment of potential emissions and discharges from the premises during commissioning and operation

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Commissioning and operation (including time limited operations)								
	Noise	Air / windborne pathway causing impacts to amenity	Residential receptors (490 m south, 680 m southeast and 1,500 m east)	Refer to Section 3.1.1	C = Minor L = Rare **Low Risk**	Yes	N/A	The provisions of the *Environmental Protection (Noise) Regulations 1997* apply.
Acceptance and treatment of sewage Sludge drying and handling	Odour	Air / windborne pathway causing impacts to amenity	Residential receptors (490 m south, 680 m southeast and 1,500 m east)	Refer to Section 3.1.1	C = Minor L = Unlikely **Medium Risk**	Yes	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements 17: Infrastructure operational requirements 18: Waste acceptance requirements 19: Waste processing requirements	The proposed works will change the sewage treatment process being undertaken at the premises and result in a 500 m^3/day increase to the maximum sewage treatment capacity available onsite. However, the applicant has proposed a 1,900 m^3/day limit to sewage input to the premises, due to seasonal limitations on disposal capacity (Section 2.7.2). An estimate of when the Northam sewerage network will reach a 1,900 m^3/day inflow was not provided, however inflows of 1,750 m^3/day and 2,000 m^3/day have been forecasted by the applicant for 2035 and 2048 respectively, suggesting this would occur around 2043. Historical odour assessments undertaken for the premises have considered 5 odour units (OU) to be the level of odour which can be perceived as annoying by the local community. Odour modelling (CEE 2018) undertaken for the current treatment plant considered odour emissions from the premises would result in a 5 OU contour that extends over several residential properties southeast of the premises. Revised odour modelling (CEE 2018) was provided for a previous upgrade to the premises that did not go ahead, which predicted that the 5 OU contour would reduce in extent and away from the residential area on the edge of the Northam township through that upgrade. This previous proposal also increased capacity to 2,000 m^3/day but did so using an improved pond treatment process rather than an oxidation ditch and clarifier. The OIA provided with this application (EAQ Consulting 2023) did not include odour contour modelling for the upgrade works that are now proposed. Instead, the OIA included an operational odour analysis and prediction of odour emission rates for the upgraded premises. The estimated emission rates indicate that odour emissions from the upgraded facility will reduce by around half from the current pond system, mainly due to the reduction in area of sewage that is exposed to the atmosphere during secondary treatment. The Delegated Officer considers that the lower odour emission rate from the upgraded facility will reduce the likelihood of odours impacting surrounding receptors when compared to existing operations. The OIA sets out that sewage treatment using an oxidation ditch and clarifier produces odour with a similar quality to a pond system and as a result the consequence of the risk event is considered to remain the same between both systems. It is noted that odour impacts are more likely to result where there are disruptions to the treatment process and/or specific meteorological conditions that limit dispersion. A system allowing for the remote monitoring and control of the treatment process is proposed by the applicant to prevent or mitigate adverse process conditions. Accordingly, the Delegated Officer considers that odour emissions from operation of the upgraded facility will have low level impacts to amenity at a local scale and impacts will probably not occur in most circumstances. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval. As unreasonable emissions of odour may be subject to the provisions of Section 49 of the EP Act, there are no further conditions proposed in the works approval.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
Spills, leaks and containment loss during acceptance and treatment of sewage	Treatment chemicals (alum and chlorine)	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Seepage causing impacts to soil and groundwater quality Downgradient groundwater migration causing impacts to beneficial use or terrestrial and aquatic ecosystems	Underlying groundwater Beneficial users of groundwater Avon River Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC	Refer to Section 3.1.1	C = Moderate L = Rare **Medium Risk**	Yes	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements 17: Infrastructure operational requirements	The Delegated Officer notes the applicant's proposed infrastructure control of storing treatment chemicals in bunded areas and management controls for recovery of any leaks or spills that occur. These are considered to provide a sufficient level of control for the risk event and will be specified as conditions on the works approval. A condition requiring recovery of leaks and spills is already included in Licence L5989/1991/12 and applies to the premises as a whole, so this has not been duplicated in the works approval. Unauthorised discharges of treatment chemicals may otherwise be subject to the provisions of the Environmental Protection (Unauthorised Discharges) Regulations 2004.
Spills, leaks and containment loss during acceptance and treatment of sewage	Contaminated stormwater	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Direct contact causing impact to human health	Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Avon River Recreational users of the Avon River	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes	1: Infrastructure design, construction and decommissioning requirements 2: Critical containment infrastructure requirements 7, 15: Commissiong and time limited operations commencement 8: Commissioning requirements 17: Infrastructure operational requirements 18: Waste acceptance requirements 19: Waste processing requirements	In determining the risk rating associated with these risk events, the Delegated Officer has had due regard to the recent review of existing operations and licensing of the premises (DWER 2024). The review notes the historical occurrences of seepage and overtopping from the current treatment pond system at the premises poses a high risk to the environment and human health. Key findings or outcomes of the review relevant to this assessment are: • High levels of stormwater ingress into the Northam sewerage network were likely to have contributed to overtopping events and indicates that the connecting network may require maintenance or replacement in some areas. • High levels of seepage from treatment ponds, likely from damage to pond liners occurring over time and during desludging events. • Expanded sampling of treated sewage is required to determine potential impacts from seepage and overtopping. • Monitoring of groundwater from 10 bores already installed at the Secondary Treatment Site is required to determine if overtopping and seepage events are contributing contaminant inputs to groundwater and in turn to the Avon River. • The need for future upgrades to the premises to mitigate high risks of seepage and overtopping to be further mitigated by upgrades to the premises. The applicant is proposing to upgrade the premises by changing the sewage treatment process from a simple pond system with a maximum throughput capacity of 1,500 m^3/day, to a more mechanically advanced system utilising an oxidation ditch and clarifier with a maximum treatment capacity of 2,000 m^3/day. Due to seasonal limitations on disposal capacity (Section 2.7.2), a lower maximum throughput of 1,900 m^3/day has been proposed. The oxidation ditch and clarifier are constructed from concrete and metal components, so will not experience the same liner degradation and seepage issues as the pond system. Desludging of the system will also take place continuously through active pumping, recycling and removal. This removes the need for heavy machinery to traverse over containment infrastructure, eliminating a potential source of damage that can lead to containment loss and seepage. It is also noted from the application documents and most recent Environmental Report submitted under Licence L5989/1991/12 (Water Corporation 2024) that repairs to the Northam sewerage network have been completed. Inflow data reported in the
	Sewage including associated contaminants (nutrients, metals, pathogens, PFAS)	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Direct contact causing impact to human health	Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Avon River Recreational users of the Avon River	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes		
		Seepage causing impacts to soil and groundwater quality Downgradient groundwater migration causing	Underlying groundwater Beneficial users of groundwater Avon River Recreational	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes		

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
		impacts to beneficial use or terrestrial and aquatic ecosystems	users of the Avon River Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC					Environmental Report for the periods after the upgrade indicates that the repairs have reduced inflow volumes to the premises. In consideration of the above, the Delegated Officer has determined that operation of the upgraded facility will have a lower likelihood for these risk events in comparison to the current system. As these risk events relate to sewage that has not completed treatment, surrounding receptors have not changed and influent characteristics remain the same, the consequence of the events is not considered to have changed. Accordingly, the Delegated Officer considers that the risk events will have mid-level onsite impacts, low level offsite impacts and minimal impacts at a wider scale, and impacts will probably not occur in most circumstances. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval. Groundwater monitoring at the premises is already included in Licence L5989/1991/12 and has not been duplicated in the works approval.
Discharge of treated sewage to reuse scheme (Public open space)	Contaminants associated with treated sewage (nutrients, metals, pathogens, PFAS)	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Seepage causing impacts to soil and groundwater quality Downgradient groundwater migration causing impacts to beneficial use or terrestrial and aquatic ecosystems	Avon River Underlying groundwater Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Beneficial users of groundwater	Refer to Section 3.1.1	C = Moderate L = Possible **Medium Risk**	No	1: Infrastructure design, construction and decommissioning requirements 2: Critical containment infrastructure requirements 8: Commissioning requirements 9, 10, 20, 21: Discharge points and limits 11, 22: Discharge monitoring 17: Infrastructure operational requirements 18: Waste acceptance requirements 19: Waste processing requirements 23: Waste input and output monitoring	In determining the risk rating associated with the risk event, the Delegated Officer has had due regard to the recent review of existing operations and licensing of the premises (DWER 2024). The review noted the following key findings relevant to this assessment: • The premises is already approaching the existing system's treatment capacity, with high levels of stormwater ingress into the Northam sewerage network further exacerbating this problem and impacting the ability to adequately treat sewage prior to irrigation. • Elevated concentrations of nitrogen and phosphorus were observed in treated sewage above soil nutrient loading rates in the existing Nutrient Irrigation Management Plan, indicating soils may be overloaded with nutrients in excess of what the turf can utilise for growth. • The need for future upgrades to the premises to mitigate the high risk of discharges to the irrigation scheme. The applicant is proposing to upgrade the premises by changing the sewage treatment process from a simple pond system with a maximum throughput capacity of 1,500 m^3/day, to a more mechanically advanced system utilising an oxidation ditch and clarifier with a maximum treatment capacity of 2,000 m^3/day. Due to seasonal limitations on disposal capacity (Section 2.7.2), a lower maximum throughput of 1,900 m^3/day has been proposed. The upgraded treatment process has been designed to produce treated sewage with a lower nitrogen concentration than the existing pond system is capable of, with a design quality of < 8 mg/L TN in comparison to the average 41.67 mg/L TN produced by the existing system between July 2022 and June 2024. Due to the use of alum dosing in both systems, phosphorus concentrations are however expected to remain the same, as both systems are designed to achieve a < 1mg/L TP concentration. It is also noted from the application documents and most recent Environmental Report submitted under Licence L5989/1991/12 (Water Corporation 2024) that repairs to the Northam sewerage network have been completed. Inflow data reported in the Environmental Report for the period after the upgrade indicates that the repairs have reduced inflow volumes to the premises. As a result, the potential for stormwater ingress to overload the system and result in incomplete treatment of sewage has reduced. In consideration of the above, the Delegated Officer has determined that operation of the upgraded facility will reduce the likelihood of the risk event in comparison to the current system. This likelihood may reduce further post-construction where the upgraded facility is able to demonstrate that the proposed treated sewage design quality is consistently being achieved and further information is available through

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
								completion of the specified actions imposed on Licence L5989/1991/12 through the recent review. Accordingly, the Delegated Officer considers that the risk event will have mid-level onsite impacts, low level offsite impacts and minimal impacts at a wider scale, and impacts could occur at some time. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval. Existing conditions in Licence L5989/1991/12 are considered sufficient to require further investigations relating to the Avon River and revision of the reuse scheme NIMP.
		Direct contact causing impact to human health	Recreational users of public open space and the Avon River	Refer to Section 3.1.1	C = Moderate L = Unlikely **Medium Risk**	Yes		The Delegated Officer considers the applicant's proposed control of disinfecting treated sewage with chlorine prior to supply for reuse, in combination with discharge monitoring, to provide sufficient controls for the risk event. These controls will be specified as conditions in the works approval. Impacts to public health associated with the Shire of Northam reuse scheme are additionally regulated through the Department of Health (DoH) Recycled Water Scheme Approval No. D49/NT000.
Discharge of treated sewage via infiltration ponds	Contaminants associated with treated sewage (nutrients, metals, pathogens, PFAS)	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Seepage causing impacts to soil and groundwater quality Downgradient groundwater migration causing impacts to beneficial use or terrestrial and aquatic ecosystems	Avon River Underlying groundwater Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Beneficial users of groundwater	Refer to Section 3.1.1	C = Major L = Possible **Medium Risk**	No	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements 9, 10, 20, 21: Discharge points and limits 11, 22: Discharge monitoring 17: Infrastructure operational requirements 18: Waste acceptance requirements 19: Waste processing requirements 23: Waste input and output monitoring	In determining the risk rating associated with the risk event, the Delegated Officer has had due regard to the recent review of existing operations and licensing of the premises (DWER 2024). The review noted that treated sewage discharges posed a high risk to the Avon River. Key findings or outcomes of the review relevant to this assessment are: • The Avon River should be managed as a high conservation or ecological value system given the high ecological values associated with the river. • Adequate treatment of sewage may not be occurring prior to discharge due to overloading of the system when there are high levels of stormwater ingress into the Northam sewerage network. • There was no existing information on other potential metal, metalloid or PFAS that may be present in the treated sewage. • An ecotoxicity assessment needed to be undertaken to determine the suitability and site-specific criteria for discharge to the Avon River. A licence condition was added requiring submission of this assessment to the Department by 4 December 2026. • The need for future upgrades to the premises to mitigate the high risk of discharges to the Avon River. The applicant is proposing to upgrade the premises by changing the sewage treatment process from a simple pond system with a maximum throughput capacity of 1,500 m^3/day, to a more mechanically advanced system utilising an oxidation ditch and clarifier with a maximum treatment capacity of 2,000 m^3/day. Due to seasonal limitations on disposal capacity (Section 2.7.2), a lower maximum throughput of 1,900 m^3/day has been proposed. Application documents and the most recent Environmental Report submitted under Licence L5989/1991/12 (Water Corporation 2024) indicate that repairs to the Northam sewerage network have been completed, and this has reduced inflow volumes to the premises. The upgraded treatment process has been designed to produce a treated sewage with a much lower nitrogen concentration than the existing pond system is capable of, with a design quality of < 8 mg/L TN in comparison to the average 41.67 mg/L TN produced by the existing system between July 2022 and June 2024. Phosphorus concentrations will however remain the same and the upgraded system is not designed to reduce the concentration of any metals, metalloids or PFAS. On this basis it is also assumed that concentrations of other potential contaminants that may be present in treated sewage

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
								will not change, resulting in an increase to total annual contaminant loads along with the increased throughput. Historical investigations undertaken at the Secondary Treatment Site suggest that the Avon River is likely to be receiving groundwater discharge from the premises throughout the year, due to connectivity with underlying sediments and groundwater discharging radially towards the river. This indicates the Avon River is still a relevant receptor for the proposed disposal of treated sewage via infiltration ponds, and the outcomes of the ecotoxicity assessment specified in the recent licence review are needed to fully assess the ongoing suitability of discharges to the Avon River. As this application is being progressed ahead of the ecotoxicity assessment, the Delegated Officer notes that there may be a need for further treatment modifications or upgrades not included in this application, depending on the outcomes of that assessment. In consideration of the above, the Delegated Officer has determined that the risk event could result in short-term impacts to an area of high conservation value or special significance, and impacts could occur at some time. This results in a high rating for the risk event. As further information becomes available regarding effluent toxicity and acceptable discharge criteria for the Avon River, the likelihood and consequence of the event can be reviewed and may result in a lowering of the overall risk rating. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval. Existing conditions in Licence L5989/1991/12 are considered sufficient to require the further investigations needed in relation to the Avon River. Additional regulatory controls may be imposed on the licence once the outcome of the ecotoxicity assessment is known. The applicant should ensure that relevant changes to the operation of the premises as a result of these upgrades are considered in the ecotoxicity assessment.
Discharge of treated sewage via infiltration ponds	Contaminants associated with treated sewage (nutrients, metals, pathogens, PFAS)	Direct contact causing impact to human health	Recreational users of the Avon River	Refer to Section 3.1.1	C = Major L = Rare **Medium Risk**	Yes		The Delegated Officer considers the applicant's proposed control of disinfecting treated sewage with chlorine prior to supply for reuse, in combination with existing discharge monitoring requirements on the licence, provides sufficient controls for the risk event. The key infrastructure and equipment controls will be specified as conditions in the works approval.
Discharge of treated sewage to the ODA and Avon River	Contaminants associated with treated sewage (nutrients, metals, pathogens, PFAS)	Surface runoff causing impacts to terrestrial and aquatic ecosystems or beneficial use Direct contact causing impact to human health	Surrounding native vegetation Eucalypt Woodlands of the Western Australian Wheatbelt TEC Avon River Recreational users of the Avon River	Refer to Section 3.1.1	C = Major L = Possible **High Risk**	No	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements 9, 10, 20, 21: Discharge points and limits 11, 22: Discharge monitoring 17: Infrastructure operational requirements 18: Waste	In determining the risk rating associated with the risk event, the Delegated Officer has had due regard to the recent review of existing operations and licensing of the premises (DWER 2024). The review noted that treated sewage discharges to the Avon River posed a high risk to the environment. Key findings or outcomes of the review relevant to this assessment are: • The Avon River should be managed as a high conservation or ecological value system given the high ecological values associated with the river. • Nitrogen and phosphorus concentrations in treated sewage were more than ten times higher than background nutrient levels of the Avon River recorded in 2012-13. • Adequate treatment of sewage may not be occurring prior to discharge due to overloading of the system when there are high levels of stormwater ingress into the Northam sewerage network. • There was no existing information on other potential metal, metaloid or PFAS that may be present in the treated sewage. • The actual volumes of treated sewage that pass through the entirety of the ODA to then discharge as surface runoff to the banks of the Avon River is unknown and not directly measured.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
							acceptance requirements 19: Waste processing requirements 23: Waste input and output monitoring	• An ecotoxicity assessment needed to be undertaken to determine the suitability and site-specific criteria for discharge to the Avon River. A licence condition was added requiring submission of this assessment to the Department by 4 December 2026. • The need for future upgrades to the premises to mitigate the high risk of discharges to the Avon River. The applicant is proposing to upgrade the premises by changing the sewage treatment process from a simple pond system with a maximum throughput capacity of 1,500 m^3/day, to a more mechanically advanced system utilising an oxidation ditch and clarifier with a maximum treatment capacity of 2,000 m^3/day. To ensure that discharges of treated sewage are not able to runoff to the Avon River during the historical no flow season (December to February inclusive), a lower maximum throughput of 1,900 m^3/day has been proposed. Application documents and the most recent Environmental Report submitted under Licence L5989/1991/12 (Water Corporation 2024) indicate that repairs to the Northam sewerage network have been completed, and this has reduced stormwater ingress volumes to the premises. The upgraded treatment process has been designed to produce a treated sewage with a much lower nitrogen concentration than the existing pond system is capable of, with a design quality of < 8 mg/L TN in comparison to the average 41.67 mg/L TN produced by the existing system between July 2022 and June 2024. Phosphorus concentrations will however remain the same and the upgraded system is not designed to reduce the concentration of any metals, metaloids or PFAS. The nutrient loading estimates outlined in Section 2.7.3 show the upgraded facility will reduce the annual nitrogen load to the Avon River below current conditions, even when operated at the maximum increased inflow of 2,000 m^3/day. Discharge to the ODA when the facility is operated at an inflow of 2,000 m^3/day and design total nitrogen concentration of < 8 mg/L would result in approximately 3.4 tonnes of nitrogen outputs annually, in comparison to the 5.6 tonnes of nitrogen that was output by the existing system between July 2023 to June 2024 at an inflow rate of 1,359 m^3/day. The Delegated Officer notes however that annual phosphorus loads, due to having the same treated sewage design specification as the existing system, will increase along with the higher throughput of the upgrade. On this basis it is also assumed that the annual load from other potential contaminants that may be present in the treated sewage, such as those flagged in the licence review as needing further information, will also increase. It is understood that the ecotoxicity assessment required by the recent licence review has not yet been undertaken by the applicant. Accordingly, the information regarding toxicity of the treated sewage as a whole is not available and the application did not propose or outline any site-specific discharge criteria relating to the Avon River. As this application is being progressed ahead of the ecotoxicity assessment, the Delegated Officer notes that there may be a need for further treatment modifications or upgrades not included in this application, depending on the outcomes of that assessment. In consideration of the above, the Delegated Officer has determined that operation of the upgraded facility will reduce the likelihood of the risk event in comparison to the current system. This is primarily due to the lower annual nitrogen loading, and combination of the capacity upgrade and sewerage network repairs removing one of the causes of inadequate treatment. However, there are still a number of required investigation works outstanding for the premises, and a full assessment of the ongoing acceptability of discharges to the Avon River cannot be determined with the information currently available. The Delegated Officer considers that the risk event could result in short-term impacts

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of works approval	Justification for additional regulatory controls
Sources / activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Applicant controls**				
								to an area of high conservation value or special significance, and impacts could occur at some time. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval. Existing conditions in Licence L5989/1991/12 are considered sufficient to require further investigation of the extent of impacts and suitable discharge criteria to the Avon River. Additional regulatory controls may be imposed on the licence once the outcome of the ecotoxicity assessment is known. The applicant should ensure that relevant changes to the operation of the premises as a result of these upgrades are considered in the ecotoxicity assessment.
Discharge of treated sewage to the ODA and Avon River	Contaminants associated with treated sewage (nutrients, metals, pathogens, PFAS)	Direct contact causing impact to human health	Recreational users of the Avon River	Refer to Section 3.1.1	C = Major L = Unlikely **Medium Risk**	Yes	1: Infrastructure design, construction and decommissioning requirements 8: Commissioning requirements 9, 10, 20, 21: Discharge points and limits 11, 22: Discharge monitoring 17: Infrastructure operational requirements 18: Waste acceptance requirements 19: Waste processing requirements	In determining the risk rating associated with the risk event, the Delegated Officer has had due regard to the recent review of existing operations and licensing of the premises (DWER 2024). The review noted the following key findings relevant to this assessment: • DoH has advised approval is necessary for operational discharges to the Avon River, however the applicant does not hold this approval. • An *E. coli* concentration limit of < 1,000 cfu/100 mL was considered satisfactory to mitigate impacts for the immediate management of the premises. • The need for future upgrades to the premises to mitigate the medium public health risk of discharges to the Avon River. During assessment of the application, the applicant provided the outcomes of further consultation with DoH on the need for approval to discharge to the Avon River. DoH outlined that the previous comments were provided on the assumption of treated sewage being discharged directly to the Avon River. However, indirect discharge to the Avon River, such as through environmental buffering or infiltration ponds, would be supported. The proposed works include an upgrade to the capacity of the UV disinfection system, which is used to disinfect treated sewage prior to disposal to the ODA. The upgraded system is proposed to achieve the same disinfection level as the existing system which is < 1,000 CFU/100 mL *E. coli* concentration . In consideration of the above, the Delegated Officer has determined that operation of the upgraded facility will result in the same consequence and likelihood for the risk event as the current system. Accordingly, the Delegated Officer considers that the risk event could result in health effects requiring mid level medical treatment and impacts will probably not occur in most circumstances. The applicant's proposed infrastructure and equipment controls will be included as requirements in the works approval.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

Note 2: Proposed applicant controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

4. Consultation

Table 12 provides a summary of the consultation undertaken by the department.

Table 12: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 17 May 2024	None received	N/A
Local Government Authority advised of proposal on 20 May 2024	The Shire of Northam replied on 7 June 2024. Refer to Appendix 1.	Refer to Appendix 1.
Department of Health (DoH) advised of proposal on 20 May 2024	DoH replied on 12 June 2024. Refer to Appendix 1.	Refer to Appendix 1.
Applicant was provided with draft documents on 15 April 2025 and 2 July 2025.	The applicant provided comments on the draft package on 9 May 2025. The applicant provided comments on the second draft package on 6 August 2025 and the schematic on 15 August 2025.	Refer to Appendix 2 and Appendix 3.

5. Conclusion

Based on the assessment in this decision report, the Delegated Officer has determined that a works approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

The outcomes of the risk assessment (Section 3.2) found there to be uncertainty on whether the applicant's proposed controls are sufficient to address treated sewage discharges impacting the Avon River. This is due to further information being required on the waste characteristics and ecotoxicity of the treated sewage.

When an applicant's controls are not sufficient, additional regulatory conditions are generally specified on the instrument being applied for. However, in this instance the existing licence for the premises (L5989/1991/12) already includes regulatory conditions requiring the necessary investigations to be undertaken and submitted to the department. As a result, the Delegated Officer has determined that further regulatory controls are in place and do not need to be specified on the granted works approval.

After construction and commissioning of the proposed upgrade works are completed, the applicant is required to submit a licence amendment application to include those works on Licence L5989/1991/12. This will allow the risk rating of treated sewage impacts to the Avon River to be reassessed in consideration of the required waste characteristics and ecotoxicity information. The outcome of that assessment may result in further treatment modifications or controls being needed at the premises, or a lowering of the risk rating.

References

1. AECOM 2022, *Geotechnical Investigation Report: Northam Water Resource Recovery Facility*, unpublished report prepared for the Water Corporation.
2. AECOM 2023, *Current and Post-Upgrade Risk Evaluation: Northam Water Resource Recovery Facility*, unpublished report prepared for the Water Corporation.
3. Cardno 2019, *Detailed Site Investigation Addendum: Northam Sewage Treatment Plant Ponds*, unpublished report prepared for the Water Corporation.
4. Cardno 2021, *Groundwater and Surface Water Monitoring Event November 2020: Northam Sewage Treatment Plant*, unpublished report prepared for the Water Corporation.
5. Consulting Environmental Engineers (CEE) 2018, *Odour Modelling for Northam Sewage Treatment Plant*, unpublished report prepared for the Water Corporation.
6. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
7. Department of Primary Industries and Regional Development (DPIRD) 2017, *Irrigation Calculator*, accessed January 2025 at https://www.agric.wa.gov.au/irrigation-calculator.
8. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Environmental Siting*, Perth, Western Australia.
9. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
10. DWER 2024, *Decision Report: Application for Licence L5989/1991/12 Northam Water Resource Recovery Facility*, issued 03/12/2024, accessed at https://www.der.wa.gov.au/images/documents/our-work/licences-and-works-approvals/Decisions_/L5989/L5989%2020241203%20DR.pdf.
11. EAQ Consulting 2023, *Northam WRRF 2.0 MLD Upgrade Works Approval Odour Impact Assessment*, unpublished report prepared for the Water Corporation.
12. Hydrobiology 2018, *Northam WWTP: Environmental Impact Assessment*, unpublished report prepared for the Water Corporation.
13. Luke G. J., Burke K. L., and O'Brien T. M. 1987, *Evaporation data for Western Australia*, Report 65, reported prepared for the Department of Primary Industries and Regional Development, Perth, Western Australia.
14. Sawkins D.N. 2010, *Landscapes and soils of the Northam district*, Bulletin 4803 published by the Department of Agriculture and Food, Perth, Western Australia.
15. Water Corporation 2024, *Biennial Environmental Report: Northam Water Resource Recovery Facility Part V Licence L5989/1991/11 1 July 2022 to 30 June 2024*, unpublished report prepared by the Water Corporation.

Appendix 1: Summary of stakeholder comments on the application

Stakeholder	Comments received	Department response
Shire of Northam	Whilst the proposed upgrade will provide a higher quality recycled water being available, concern is raised with respect to the manner in which the water will be disposed of, including evaporation, infiltration and disposal to the Avon River. Given the high value of the recycled water for community purposes a higher and better use for it had been identified. Utilising the water for extension to the current reuse scheme on open spaces throughout the town is seen as a better option from an aesthetic and environmental perspective. It is concerning that the option of increasing the volume of recycled water available to reuse scheme was not considered as part of the project. The Shire of Northam believes that the works approval needs to include an assessment of this option to ensure that the excess recycled water is being used for other uses other than disposal to the river or evaporation. Given the challenges involved in providing high quality open spaces within the Wheatbelt and to reduce the reliance on potable water, it is the Shire of Northam's belief that this should be included in the overall works approval. From the community's perspective the disposal of a valuable resource with an identified alternate use to the Avon River is seen as a major missed opportunity from an environmental and aesthetic perspective. For the works approval to not consider this option which would be of major benefit to the community is disappointing. It is also not clear within the referral documents the total volumes or recycled water being discharged to the environment either through evaporation, transpiration or disposal to the river both now and following the upgrading works. If this information was more clear and made publicly available the community would be able to make informed comments.	The operating licence for the Northam WRRF was recently renewed on 4 December 2024 (see Section 2.4), which occurred after these comments were received on the works approval application. The Shire's desire to expand the Northam reuse scheme has been communicated to the applicant through determination of the licence renewal. A condition was placed on the renewed licence which requires the applicant to update their Nutrient Irrigation Management Plan (NIMP) by 4 June 2026. This revision to the NIMP will provide the opportunity to consider provision of additional recycled water volumes to the Northam reuse scheme. The department also found the initial application documents unclear with regards to the total volumes of treated sewage discharged to the environment. Further information was requested from the applicant during the assessment of the application to address this information gap. A summary of the revised information provided is contained in Section 2.7.

Stakeholder	Comments received	Department response
Department of Health	The last amendment to the Shire of Northam's updated Recycled Water Quality Management Plan (RWQMP) appears to be provided by the DoH on the 28/10/2022 (current), please see attached. Since then, an audit and annual report revealed non-compliances and DoH requested works to be undertaken along with another request to amend their RWQMP in 29 December 2023. These works are yet to be implemented; however, the Shire has submitted further documentation highlighting their investigative and upgrading works on 14 February 2024. Once these works have been undertaken, along with the implementation of other criteria including an amended RWQMP, the DoH will then reassess these and provide an updated RWQMP. The sewage treatment plant upgrades need to comply with the Health Treatment of Sewage and Disposal of Effluent and Liquid Wastes Regulations, 1974 and policy objectives that include the Government Sewerage Policy, 2019. Please be advised, the DoH has not reviewed this system in detail and is therefore unable to make comment as to peak and non-peak specifications, including rain or storm events that may influence the volumes and efficiency, water quality criteria, site and soil evaluations, engineering Certification and other regulated criteria as submitted by the applicant. The proponent should submit a formal application for the upgraded Northam Water Resource Recovery Facility to the Local Government for assessment and then submission onto the DoH for assessment and approval. The DoH has concerns about the number of sewage spills occurring in the Avon River and surrounding areas especially in rain fall events. The DoH has been liaising with and encouraging the Water Corporation to upgrade the sewage treatment plant facilities and management of sewage for the Northam community. The current RWQMP approves reuse of treated effluent onto land-based locations for the benefit of the community and has not been approved for disposal into the Avon River. The proposal makes practical use of the established ponds and facility's infrastructure within the current restricted location. However, it is undetermined if the minimum 100 metre setback has been implemented to meet the Government Sewerage Policy requirements.	It is the applicant's responsibility to ensure they comply with the provisions of other legislation external to the EP Act, including holding the necessary approvals under that legislation. The need to seek approvals under other legislation will be communicated to the applicant through the assessment of this application. The Delegated Officer considers the facility upgrade proposed in the application will result in the likelihood of sewage spills decreasing at the premises, primarily due to the increase in available capacity and replacement of the dated treatment pond infrastructure. The most current environmental report submitted by the applicant also shows that inflow volumes to the premises have decreased following the recent improvements to the connected sewerage network. Further information relating to the risk of sewage spills when operating the upgraded premises is contained in Section 3.2. The separation distance between the closest proposed infiltration pond to the boundary of the premises shared with the Avon River is approximately 175 m. The existing ODA that is proposed to be used for discharge when the infiltration ponds and reuse scheme are at capacity discharges on this boundary, however this location is approximately 100 m from the river channel. If the flood bank of the Avon River is considered, the setback would be less than 100 m.

Appendix 2: Summary of applicant's comments on risk assessment and draft conditions

Condition or Section	Summary of applicant's comment	Department's response
Works Approval		
Condition 1 Table 1: Item 1(b)(v)	pH treated water quality was not included in the Northam WRRF Upgrade WA supporting information (refer Section 4.1.3, table 4-2). Water Corporation design did not propose pH criteria. Water Corporation requests it be deleted from Condition 1, Table 1.	This requirement has been removed.
Condition 1 Table 1: Item 3(a)(i)	Stone trap has been deleted from scope. Water Corporation has designed for the flowmeter installation downstream of primary treatment and upstream of the secondary treatment plant, this a standard design. All flows into the primary treatment plant will pass through the flowmeter with this design. Change condition to remove stone trap and replace with alternate wording of *upstream of the secondary treatment process*.	Reference to the stone trap has been removed from the requirement and replaced with the provided alternate wording.
Condition 1 Table 1: Item 5	Stone trap has been deleted from scope, as this is not required.	The stone trap has been removed from the infrastructure table.
Condition 1 Table 1: Items 23(a), 24(a) and 25(a)	States sewage inflows during construction of the oxidation ditch must be diverted to and treated within ponds 1, 2 and 3. Pond numbers should be 1, 2 and 4, as the Oxidation Ditch will be located at Pond 3.	Error corrected and further clarification added that the requirement relates to the existing ponds. Clarification was considered required, as the pre and post upgrade pond numbering doesn't fully align.
Condition 1 Table 1: Item 26	Remove the requirement for the upgraded UV disinfection system to be capable of disinfecting sewage to a pathogen indicator level of less than 150 cfu/100mL Escherichia coli. As per the WA decision report for Discharge of treated sewage to the ODA and Avon River causing impact to human health (Table 11):	The Delegated Officer notes that the application proposes discharges to the ODA as having a pathogen indicator level of less than 150 cfu/100 mL. This was the primary consideration in determining the risk rating for impacts to human health for recreational users of the Avon River. The applicant further clarified that *E. coli* concentrations being <150 cfu/100 mL was an error in the application documents and the

Condition or Section	Summary of applicant's comment	Department's response
	"An E. coli concentration limit of < 1,000 cfu/100 mL was considered satisfactory to mitigate impacts for the immediate management of the premises."	upgrade was not intending to disinfect treated sewage to these levels. The Delegated Officer has changed the requirement to <1,000 cfu/100 mL and revised the risk assessment (Table 11) to align with the outcomes of the 2024 licence review (DWER 2024), which specified discharges as having an *E. coli* concentration of <1,000 cfu/100mL.
Condition 1 Table 1: Item 27	Delete the *E. coli* limit from the requirement. This is set through DoH recycled water scheme approvals, so there is no requirement to set the level on the WRRF licence. This also means if the DoH update the *E. coli* limit on the water recycling scheme the WWTP licence does not have to be updated as well.	In consideration of a regulatory control being provided through the DoH recycled water scheme approval, the Delegated Officer has removed reference to the <10 cfu/100 mL *E. coli* limit.
Condition 2 Table 2: Item 3(a)	Stone trap has been deleted from scope, as this is not required.	The stone trap has been removed from the table.
Condition 2 Table 2: Item 11(b)	The infrastructure set out in this requirement should be reworded to: *must compromise duty/standby RAS pumps and associated transfer pipeline*	Requirement wording has been revised.
Condition 2 Table 2: Item 12(b)	The infrastructure set out in this requirement should be reworded to: *must compromise duty/standby RAS pumps and associated transfer pipeline*	Requirement wording has been revised.
Condition 3	Due to the complex nature of upgrading an existing and operating WWTP, it is requested that one Environmental Compliance Report is prepared and submitted to DWER after all items of infrastructure have been constructed or installed. Requesting an extended timeframe to conduct audit and submit the report to 90 calendar days to ensure enough	Condition wording has been changed to require only one Environmental Compliance Report (ECR) and the timeframe for submitting the ECR has been increased to 90 days. Please note that conditions relating to the commencement of the commissioning and time limited operations periods for non-critical containment infrastructure are still contingent on submission of the ECR.

Condition or Section	Summary of applicant's comment	Department's response
	time for engineering review and sign off.	
Condition 5	Requesting an extended timeframe to conduct audit and submit the report to 90 calendar days to ensure enough time for engineering review and sign off.	The timeframe for submitting the Critical Containment Infrastructure Report (CCIR) has been increased to 90 days. Please note that conditions relating to the commencement of the commissioning and time limited operations periods for critical containment infrastructure are still contingent on submission of the CCIR.
Condition 7	Requesting an amendment to the timeframe from 30 to 15 business days to be consistent with previous works approvals granted.	The timeframe after which the commissioning period commences for critical containment infrastructure was reduced to 15 business days after the CCIR is submitted.
Condition 8 Table 3: Stone trap	Stone trap has been deleted from scope, as this is not required.	The stone trap has been removed from the table.
Condition 9 Table 4: Item 1	Change the discharge point location for line item 1 to "As shown in Figure 4". Correct typo: Clarke St.	Table revised. Typo corrected.
Condition 10 Table 5: Item 1	*E. coli* limits for recycled water schemes are legislated through DoH recycled water scheme approvals. As such, there is no requirement to set the level on the WRRF licence. This also means if the DoH update the *E. coli* limit the licence does not have to be updated as well.	In consideration of a regulatory control being provided through the DoH recycled water scheme approval, the Delegated Officer has removed reference to the <10 cfu/100 mL *E. coli* limit.
Condition 10 Table 5: Item 5	Change the *E. coli* limit for discharge to ODA to 1,000 CFU/100 mL. As per the WA decision report for Discharge of treated sewage to the ODA and Avon River causing impact to human health (Table 11): "An E. coli concentration limit of < 1,000 cfu/100 mL was considered satisfactory to mitigate impacts for the	The Delegated Officer notes that the application proposes discharges to the ODA as having a pathogen indicator level of less than 150 cfu/100 mL. This was the primary consideration in determining the risk rating for impacts to human health for recreational users of the Avon River. The applicant further clarified that *E. coli* concentrations being <150 cfu/100 mL was an error in the application documents and the

Condition or Section	Summary of applicant's comment	Department's response
	immediate management of the premises."	upgrade was not intending to disinfect treated sewage to these levels. The Delegated Officer has changed the requirement to <1,000 cfu/100 mL and revised the risk assessment to align with the outcomes of the 2024 licence review (DWER 2024), which specified discharges as having an *E. coli* concentration of <1,000 cfu/100mL.
Condition 11 Table 6: Monitoring location	As requested, amend Table 6 monitoring locations to the following summarised below: • SST SP monitoring location: Field Measurements, Water Quality Parameters, Major Ions, Metals and Metalloids • Post-UV Wet Well SP Monitoring Location: Monitoring of Pathogens to ODA • Post-Chlorination SP monitoring location: Monitoring of pathogens to Shire re-use. A figure of Monitoring Locations and GPS coordinates has also been provided.	Monitoring location named inserted as specified. The provided figure of monitoring locations has been included in the works approval as a new Figure 7 and referenced in the condition.
Condition 12	Due to the nature of WWTPs, it is requested that one single Environmental Commissioning Report is prepared and submitted to DWER for all items of infrastructure as specified in conditions 1 and 2. Requesting an extended timeframe of 90 days to conduct audit and submit the report to ensure enough time for engineering review and sign off.	Condition wording has been changed to require only one Environmental Compliance Report (ECR) and the timeframe for submitting the ECR has been increased to 90 days. Please note that conditions relating to the commencement of the commissioning and time limited operations periods for non-critical containment infrastructure are still contingent on submission of the ECR.
Condition 15	Requesting an amendment to the timeframe from 30 to 15 business days to be consistent with previous works approvals granted.	The timeframe after which the time limited operations period commences for critical containment infrastructure was reduced to 15 business days after the CCIR is submitted.
Condition 17 Table 7: Item 3(a)(i)	Stone trap has been deleted from scope, as this is not required. Requesting an amendment to the wording to reflect the designed flowmeter to be installed downstream of the primary treatment site and upstream from the secondary treatment site.	Condition wording referencing the stone trap has been removed from the condition.

Condition or Section	Summary of applicant's comment	Department's response
Condition 17 Table 7: Item 4(a)	Stone trap has been deleted from scope, as this is not required. Requesting an amendment to the wording to reflect inputs will occur prior to the inlet screens.	Condition wording referencing the stone trap has been removed from the condition and replaced with inlet screens.
Condition 17 Table 7: Item 5	Stone trap has been deleted from scope, as this is not required.	The stone trap has been removed from the infrastructure operational requirements table.
Condition 17 Table 7: Item 14	The process has been incorrectly described in the table. Waste activated sludge is collected from the oxidation ditch and pumped together with clarifier scum to the sludge drying beds for dewatering.	Item 14 has been updated with the corrected phrasing. Based on these comments, item 13 has also been modified for clarity.
Condition 17 Table 7: Item 20(a)	*E.coli* limit for discharge to ODA should be <1,000 CFU/100mL. As per the decision report for discharge of treated sewage to the ODA and Avon River causing impact to human health (table 11): "An *E. coli* concentration limit of < 1,000 cfu/100 mL was considered satisfactory to mitigate impacts for the immediate management of the premises."	The Delegated Officer notes that the application proposes discharges to the ODA as having a pathogen indicator level of less than 150 cfu/100 mL. This was the primary consideration in determining the risk rating for impacts to human health for recreational users of the Avon River. The applicant further clarified that *E. coli* concentrations being <150 cfu/100 mL was an error in the application documents and the upgrade was not intending to disinfect treated sewage to these levels. The Delegated Officer has changed the requirement to <1,000 cfu/100 mL and revised the risk assessment to align with the outcomes of the 2024 licence review (DWER 2024), which specified discharges as having an *E. coli* concentration of <1,000 cfu/100mL.
Condition 17 Table 7: Item 21(a)	*E.coli* limits for recycled water schemes are legislated through DoH recycled water scheme approvals. *E.coli* limits are set through DoH recycled water scheme approvals there is no requirement to set the level on the WRRF licence. This also means if the DoH update the *E.coli* limit the licence does not have to be updated as well.	In consideration of a regulatory control being provided through the DoH recycled water scheme approval, the Delegated Officer has removed reference to the <10 cfu/100 mL *E. coli* limit.
Condition 19	pH treated water quality was not included in the Northam	This requirement has been removed.

Condition or Section	Summary of applicant's comment	Department's response
Table 9: Sewage	WRRF Upgrade WA supporting information (refer Section 4.1.3, table 4-2). Water Corporation design did not propose pH criteria. Water Corporation requests it be deleted from Condition 19, Table 9.	
Condition 19 Table 9: Sewage sludge	Water Corporation are dewatering WAS/scum in Sludge Drying Beds. Dried sludge cake will be removed in vehicles for disposal or reuse	Requirement wording has been revised.
Condition 19 Table 9: Treated sewage	Correct typo: Clarke St.	Typo corrected.
Condition 20 Table 10: Item 1	Request to modify the Clarke St discharge point location to be Figure 4. Correct typo: Clarke St.	Requirement wording has been revised. Typo corrected.
Condition 21 Table 11: Item 1	Request to delete line item 1. *E.coli* limits for recycled water schemes are legislated through DoH recycled water scheme approvals. *E.coli* limits are set through DoH recycled water scheme approvals there is no requirement to set the level on the WRRF licence. This also means if the DoH update the *E.coli* limit the licence does not have to be updated as well.	This requirement has been removed.
Condition 21 Table 11: Item 5	Delete *E. coli* parameter. As per the WA decision report for Discharge of treated sewage to the ODA and Avon River causing impact to human health (table 11): "An *E. coli* concentration limit of < 1,000 cfu/100 mL was considered satisfactory to mitigate impacts for the immediate management of the premises."	The Delegated Officer notes that the application proposes discharges to the ODA as having a pathogen indicator level of less than 150 cfu/100 mL. This was the primary consideration in determining the risk rating for impacts to human health for recreational users of the Avon River. The applicant further clarified that *E. coli* concentrations being <150 cfu/100 mL was an error in the application document and the upgrade was not intending to disinfect treated sewage to these levels. The Delegated Officer has changed the requirement to <1,000 cfu/100

Condition or Section	Summary of applicant's comment	Department's response
		mL and revised the risk assessment to align with the outcomes of the 2024 licence review (DWER 2024), which specified discharges as having an *E. coli* concentration of <1,000 cfu/100mL.
Condition 22 Table 12: Monitoring location	As requested, amend Table 6 monitoring locations to the following summarised below: • SST SP monitoring location: Field Measurements, Water Quality Parameters, Major Ions, Metals and Metalloids • Post-UV Wet Well SP Monitoring Location: Monitoring of Pathogens to ODA • Post-Chlorination SP monitoring location: Monitoring of pathogens to Shire re-use. A figure of Monitoring Locations and GPS coordinates has also been provided.	Monitoring location named inserted as specified. The provided figure of monitoring locations has been included in the works approval as a new Figure 7 and referenced in the condition.
Condition 23 Table 13: Sewage (tankered)	As requested, no monitoring point is specified for monitoring point of tankered sewage. The volume of tankered sewage is measured via DWER controlled waste tracking system.	The monitoring point requirement has been removed.
Decision Report		
Throughout	Delete reference to "stone trap" throughout report. Stone trap has been removed from scope.	Wording revised and reference removed.
Section 3.1.1 Table 6	Update emission wording use of PoPs with PFAS throughout report. PoPs are not defined by DWER. As per WC supporting documentation, PFAS should be referred to instead of PoPs.	The use of POPs and persistent organic pollutants has been revised and the reference modified to PFAS.
Section 3.2 Table 11	Update emission wording use of PoPs with PFAS throughout report. PoPs are not defined by DWER. As per WC supporting documentation, PFAS should be referred to instead of PoPs.	The use of POPs and persistent organic pollutants has been revised and the reference modified to PFAS.

Appendix 3: Summary of applicant's comments on 2nd risk assessment and draft conditions

Condition or Section	Summary of applicant's comment	Department's response
Works Approval		
Condition 1 Table 1: Item 1(e)	This condition refers to all containment not just critical containment. Suggest – "All containment, treatment, storage and conveyance infrastructure must be impermeable and free of leaks and defects, unless designed to infiltrate."	Requirement wording has been revised to ensure the infrastructure is impermeable unless designed to infiltrate, and be free of leaks and defects.
Condition 1 Table 1: Item 2(a)	Water Corporation do not propose "Remote process control, monitoring and telemetry system" for infiltration ponds. Amend condition to remove the inclusion of containment infrastructure.	Process control, monitoring and telemetry is required for the treatment ponds to ensure the system is running at optimal treatment capacity. It is not required for the infiltration ponds, which are considered part of the storage and disposal process. The infiltration ponds are designed to initially store and infiltrate, and secondarily overflow into the Shire storage pond and the overflow discharge area which are considered part of the storage and disposal process. There is no need to monitor this in the process control system. Monitoring via flow meters is adequate. Requirement wording has been revised.
Condition 1 Table 1: Item 6	N/A	For consistency with previous request, 'vortex' has been removed from condition.
Condition 1 Table 1: Item 18	Infrastructure column uses an acronym RAS with no clarification.	Acronym 'RAS' added to Infrastructure and Equipment phrase 'return activated sludge' for clarity.
Condition 2 Table 2: Item 2	Stone trap has been deleted from scope, as this is not required.	Oversight of previous request. The stone trap has been removed from the table.
Condition 2 Table 2: Item 3(a)	Remove 'band' from condition.	Requirement wording has been revised.
Condition 2 Table 2: Item 4 & 5	Remove 'vortex' from condition.	Requirement wording has been revised.

Condition or Section	Summary of applicant's comment	Department's response
Condition 2 Table 2: Item 10	N/A	For consistency with previous request, acronym 'RAS' added to Infrastructure and Equipment phrase 'return activated sludge' for clarity.
Condition 8 Table 3	N/A	For consistency with previous request, 'vortex' has been removed from condition.
Condition 17 Table 7: Item 5	N/A	Oversight of previous request. The text 'new stone trap as shown in Figure 3' deleted from Infrastructure Location.
Condition 17 Table 7: Item 6	N/A	For consistency with previous request, 'vortex' has been removed from condition.
Condition 17 Table 7: Item 12	N/A	For consistency with previous request, acronym 'RAS' added to Infrastructure and Equipment phrase 'return activated sludge' for clarity.
Definitions	N/A	Definition for 'fortnightly monitoring' corrected to delete 'each monthly period' and insert 'each fortnightly period'.
Appendix 1 Figure 5	Provision of replacement process flow diagram depicting removal of the stone trap.	Figure 5 updated.
Decision Report		
Section 2.5.1	N/A	For consistency with previous request, 'vortex' has been removed from this section.
Section 2.6.1	N/A	For consistency with previous request, 'vortex' and 'band' have been removed from this section.
Section 2. Figure 6	N/A	For consistency with previous request, the process flow diagram depicting removal of the stone trap has been replaced.