Substance / Parameter	BAT-AEL	Waste Treatment Process to which the BAT-AEL applies	Monitoring Frequency	Monitoring Standard
				2, EN ISO 6878, EN ISO 11885)
Adsorbable organically bound halogens (AOX)	0.2 – 1 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 9562
Benzene, toluene, ethylbenzene, xylene (BTEX)	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 15680
Free cyanide (CN-)	0.02 – 0.1 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 14403-1 and -2)
Hydrocarbon oil index (HOI)	0.5 – 10 mg/l	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 9377-2
PFOA	N/A	All waste treatments	Monthly for 12 months	No EN standard available
PFOS	N/A	All waste treatments	Monthly for 12 months	No EN standard available
Phenol index	N/A	Treatment of water-based liquid waste	Monthly for 12 months	EN ISO 14402
Arsenic (expressed as As)	0.01 – 0.1mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586)
Cadmium (expressed as Cd)	0.01 – 0.1mg/l		Monthly for 12 months	
Chromium (expressed as Cr)	0.01 – 0.3mg/l		Monthly for 12 months	
Copper (expressed as Cu)	0.05 - 0.5mg/l		Monthly for 12 months	
Lead (expressed as Pb)	0.05 -0.3mg/l		Monthly for 12 months	
Nickel (expressed as Ni)	0.05 – 1mg/l		Monthly for 12 months	
Zinc (expressed as Zn)	0.1 – 2mg/l		Monthly for 12 months	
Manganese (Mn)	N/A		Monthly for 12 months	
Hexavalent chromium (Cr(VI))	0.01 – 0.1mg/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 10304-3, EN ISO 23913)
Mercury (expressed as Hg)	1 – 10 ug/l	Treatment of water-based liquid waste	Monthly for 12 months	Various EN standards available (i.e. EN ISO 17852, EN ISO 12846)

Table C2: 6-8 – Proposed analytical suite: Esholt return liquors characterisation programme - freshwater specific pollutants, priority hazardous substances, priority substances and other pollutants

Substance / Parameter	Monitoring Frequency	Monitoring Standard
1,1,1-trichloroethane	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
1,1,2-trichloroethane	Monthly for 12 months	
1,2-dichloro-ethane	Monthly for 12 months	
2,4-dichlorophenol	Monthly for 12 months	
2,4-dichlorophenoxyacetic acid (2,4-D)	Monthly for 12 months	
2-chlorophenol	Monthly for 12 months	
3,4-dichloroaniline	Monthly for 12 months	
3-chlorophenol 4-chlorophenol (total or individual monochlorophenols)	Monthly for 12 months	
4-chloro-3-methylphenol	Monthly for 12 months	
Abamectin	Monthly for 12 months	
Aclonifen	Monthly for 12 months	
Alachlor	Monthly for 12 months	
Ammonia (un-ionised)	Monthly for 12 months	
Anthracene	Monthly for 12 months	
Arsenic	Monthly for 12 months	
Atrazine	Monthly for 12 months	
Azinphos-methyl dissolved)	Monthly for 12 months	
Bentazone	Monthly for 12 months	
Benzene	Monthly for 12 months	
Benzo(a)-pyrene (BaP)	Monthly for 12 months	
Benzo(b)-fluor-anthene	Monthly for 12 months	
Benzo(g,h,i)-perylene	Monthly for 12 months	
Benzo(k)-fluor-anthene	Monthly for 12 months	
Benzyl butyl phthalate	Monthly for 12 months	
Bifenox (Methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Biphenyl	Monthly for 12 months	
Boron	Monthly for 12 months	
Brominated diphenylether - total PBDE (or congener) numbers 28, 47, 99, 100, 153 and 154	Monthly for 12 months	
Bromine (total residual oxidant)	Monthly for 12 months	
Bromoxynil	Monthly for 12 months	
C10-13 chloroalkanes	Monthly for 12 months	
Cadmium and its compounds (dissolved)	Monthly for 12 months	
Carbendazim	Monthly for 12 months	
Carbon tetrachloride	Monthly for 12 months	
Chlorfenvinphos	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Chloride	Monthly for 12 months	
Chlorine (total residual oxidant)	Monthly for 12 months	
Chloronitro toluenes	Monthly for 12 months	
Chlorothalonil	Monthly for 12 months	
Chlorotoluron	Monthly for 12 months	
Chlorpropham	Monthly for 12 months	
Chlorpyrifos (chlorpyrifos-ethyl)	Monthly for 12 months	
Chromium (III) (dissolved)	Monthly for 12 months	
Chromium (VI) (dissolved)	Monthly for 12 months	
Cobalt (dissolved)	Monthly for 12 months	
Copper (dissolved)	Monthly for 12 months	
Coumaphos	Monthly for 12 months	
Cyanide	Monthly for 12 months	
Cybutryne	Monthly for 12 months	
Cyclodiene pesticides - total aldrin, dieldrin, endrin and isodrin	Monthly for 12 months	
Cyfluthrin	Monthly for 12 months	
Cypermethrin	Monthly for 12 months	
DDT total	Monthly for 12 months	
Demetons	Monthly for 12 months	
Di(2-ethylhexyl)-phthalate (DEHP)	Monthly for 12 months	
Diazinon (sheep dip)	Monthly for 12 months	
Dibutyl phthalate	Monthly for 12 months	
Dichlorobenzene (total dichlorobenzene isomers)	Monthly for 12 months	
Dichloro-methane	Monthly for 12 months	
Dichlorvos	Monthly for 12 months	
Dicofol	Monthly for 12 months	
Diethyl phthalate	Monthly for 12 months	
Diflubenzuron	Monthly for 12 months	
Dimethoate	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Dimethyl phthalate	Monthly for 12 months	
Dioctyl phthalate	Monthly for 12 months	
Dioxins and dioxin-like compounds	Monthly for 12 months	
Diuron	Monthly for 12 months	
Doramectin	Monthly for 12 months	
EDTA	Monthly for 12 months	
Endosulphan	Monthly for 12 months	
Fenchlorphos	Monthly for 12 months	
Fenitrothion	Monthly for 12 months	
Flucofuron	Monthly for 12 months	
Fluoranthene	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Fluoride - (dissolved)	Monthly for 12 months	
Formaldehyde	Monthly for 12 months	
Glyphosate	Monthly for 12 months	
Heptachlor & heptachlor epoxide	Monthly for 12 months	
Hexabromocyclo-dodecane (HBCDD)	Monthly for 12 months	
Hexachloro-benzene	Monthly for 12 months	
Hexachloro-butadiene	Monthly for 12 months	
Hexachloro-cyclohexane	Monthly for 12 months	
Hydrogen sulphide	Monthly for 12 months	
Indeno(1,2,3-cd)-pyrene (see PAHs below for AA and biota EQS)	Monthly for 12 months	
Ioxynil	Monthly for 12 months	
Iron (dissolved)	Monthly for 12 months	
Isoproturon	Monthly for 12 months	
Ivermectin	Monthly for 12 months	
Lead and its compounds - (dissolved)	Monthly for 12 months	
Linuron	Monthly for 12 months	
Malachite green	Monthly for 12 months	
Malathion	Monthly for 12 months	
Mancozeb	Monthly for 12 months	
Maneb	Monthly for 12 months	
Manganese	Monthly for 12 months	
MCPA (pH level higher than 7)	Monthly for 12 months	
MCPA (pH level less than 7)	Monthly for 12 months	
Mecoprop	Monthly for 12 months	
Mercury and its compounds - (dissolved)	Monthly for 12 months	
Methiocarb	Monthly for 12 months	
Mevinphos	Monthly for 12 months	
Naphthalene	Monthly for 12 months	
Nickel and its compounds - (dissolved)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Nitrilotriacetic acid (NTA)	Monthly for 12 months	
Nonylphenol (4-nonylphenol)	Monthly for 12 months	
Octylphenol (4-(1,1',3,3'-tetramethyl-butyl)-phenol)	Monthly for 12 months	
Omethoate	Monthly for 12 months	
Para-para-DDT	Monthly for 12 months	
PCSDs	Monthly for 12 months	
Pendimethalin	Monthly for 12 months	
Pentachloro-benzene	Monthly for 12 months	
Pentachloro-phenol	Monthly for 12 months	
Perfluorooctane sulfonic acid and its salts (PFOS)	Monthly for 12 months	

Substance / Parameter	Monitoring Frequency	Monitoring Standard
Permethrin	Monthly for 12 months	
pH	Monthly for 12 months	
Phenol	Monthly for 12 months	
Pirimicarb	Monthly for 12 months	
Pirimiphos-methyl	Monthly for 12 months	
Polyaromatic hydrocarbons (PAH) - Benzo(a)-pyrene (BaP), Benzo(b)-fluor-anthene, Benzo(k)-fluor-anthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene	Monthly for 12 months	
Prochloraz	Monthly for 12 months	
Propetamphos	Monthly for 12 months	
Propyzamide	Monthly for 12 months	
Quinoxyfen	Monthly for 12 months	
Silver - (dissolved)	Monthly for 12 months	
Simazine	Monthly for 12 months	
Styrene	Monthly for 12 months	
Sulcofuron	Monthly for 12 months	
Sulphate	Monthly for 12 months	
Tecnazene - total	Monthly for 12 months	
Terbutryn	Monthly for 12 months	
Tetrachloroethane	Monthly for 12 months	
Tetrachloro-ethylene	Monthly for 12 months	
Thiabendazole	Monthly for 12 months	
Tin (inorganic) (total)	Monthly for 12 months	
Toluene	Monthly for 12 months	
Total anions	Monthly for 12 months	
Triallate	Monthly for 12 months	
Triazaphos	Monthly for 12 months	
Tributyl phosphate	Monthly for 12 months	
Tributyltin compounds (tributyltin-cation)	Monthly for 12 months	Chemical analysis by UKAS accredited laboratory with an appropriate minimum reporting value (MRV) (usually 10% of the EQS)
Trichloro-benzenes	Monthly for 12 months	
Trichloro-ethylene	Monthly for 12 months	
Tricholoro-methane (chloroform)	Monthly for 12 months	
Triclosan	Monthly for 12 months	
Trifluralin	Monthly for 12 months	
Triphenyltin and derivatives	Monthly for 12 months	
Vanadium	Monthly for 12 months	
Xylene	Monthly for 12 months	
Zinc - (dissolved)	Monthly for 12 months	

Q 6-9 Risk assessment methodology

The risk assessment methodology employed for the noise impact assessment (Q 6-5) and accident management plan (Q 6-7) is summarised in Tables C2 6-9 to 6-12 below.

The overall risk rating for each of the identified risk scenarios is determined on the basis of the probability of the scenario occurring (the probability/likelihood score) and the environmental consequence(s) if the scenario were to occur (the consequence score). The probability and consequence categories used in this methodology are provided in Tables C2: 6-9 and 6-10 below.

Table C2: 6-9: Classification of Consequences

Classification	Definition
Severe	• Acute risks to human health • Short-term risk of pollution of sensitive water resource (e.g. major spillage into controlled waters) • Impact on controlled waters e.g. large-scale pollution or very high levels of contamination • Catastrophic damage to buildings or property (e.g. explosion causing building collapse) • Ecological system effects – irreversible adverse changes to a protected location. Immediate risks
Medium	• Chronic risks to human health • Pollution of sensitive water resources (e.g. leaching of contaminants into controlled waters) • Ecological system effects – substantial adverse changes to a protected location • Significant damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy, such as foundation damage)
Mild	• Non-permanent health effects to human health • Pollution of non-sensitive water resources (e.g. pollution of non-classified groundwater) • Damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy, such as foundation damage) • Substantial damage to non-sensitive environments (unprotected ecosystems e.g. crops)
Minor/Negligible	• Non-permanent health effects to human health (easily prevented by appropriate use of PPE) • Minor pollution to non-sensitive water resources • Minor damage to non-sensitive environments (unprotected ecosystems e.g. crops) • Easily repairable effects of damage to buildings, structures, services or the environment (e.g. discoloration of concrete, loss of plants in a landscaping scene)

Table C2: 6-10: Classification of probability / Likelihood

Classification	Definition
High Likelihood	An event is very likely to occur in the short term, and is almost inevitable over the long term OR there is evidence at the receptor of harm or pollution
Likely	It is probable that an event will occur. It is not inevitable, but possible in the short term and likely over the long term
Unlikely	Circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place, and less likely in the short term
Highly Unlikely	Probability is so low that it is close to zero; It is improbable that an event would occur even in the very long term

Table C2: 6-11 below provides the matrix used to identify the overall risk category using these consequence and probability categories.

Table C2: 6-11: Risk Matrix and Terminology Used for Risk Assessments

		Consequence			
		Severe	**Medium**	**Mild**	**Minor/Negligible**
Probability (Likelihood)	**High Likelihood**	Very high risk	High risk	Moderate risk	Moderate/Low risk
	Likely	High risk	Moderate risk	Moderate/Low risk	Low risk
	Unlikely	Moderate risk	Moderate/Low risk	Low risk	Negligible risk
	Highly Unlikely	Moderate/Low risk	Low risk	Negligible risk	Negligible risk

The overall risk categories are described in Table C2: 6-12 below.

Table C2: 6-12: Description of Risk Categories

Term	Description
Very high risk	Severe harm to a receptor may already be occurring OR a high likelihood that severe harm will arise to a receptor, unless immediate remedial action works / mitigation measures are undertaken.
High risk	Harm is likely to arise to a receptor, and is likely to be severe, unless appropriate remedial actions / mitigation measures are undertaken. Remedial works may be required in the short term, but likely to be required over the long term.
Moderate risk	Possible that harm could arise to a receptor but low likelihood that such harm would be severe. Harm is likely to be medium. Some remedial works may be required in the long term.
Moderate / low risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low, but is not of sufficient concern to be classified as medium. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely.
Low risk	Possible that harm could arise to a receptor. Such harm would at worse normally be mild.
Negligible risk	Low likelihood that harm could arise to a receptor. Such harm unlikely to be any worse than mild.

Form C3 Supporting Information

1 What activities are you applying to vary?

Activities to be included within this installation are provided in Table C3: 1a-1 below. A summary of the activities to be removed from, and added to, the permit is provided above in C2: Table 1 above in response to Form C2, Question 2.

Table C3: 1a-1 – Types of activities

Installation name	Schedule 1 references	Description of the Activity	Activity Capacity	Annex I (D codes) and Annex II (R codes) and descriptions	Hazardous waste treatment capacity	Non-hazardous waste treatment capacity
Esholt STF	Section 5.4 A(1) (b)(i)	**Anaerobic digestion** of indigenous and imported UWWT-derived sludges: Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment	>100 tonnes per day	R3: recycling/ reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)	N/A	Total digester treatment capacity is restricted by the THP treatment capacity of 204,537 m^3 per day (at 16% dry solids), 89.66 tonnes dry solids (TDS) per day. Refer to Appendix 12 for supporting calculations spreadsheet

Directly Associated Activities (including description)	
Import and treatment of sludges prior to digestion, including screening, mixing, thickening, dewatering and thermal hydrolysis	R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
Treatment of digested sludge (including physical handling and dewatering) before being recycled to agriculture, including digestate produced on site or, as a contingency measure, from other YW sites.	R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
As a contingency measure, **storage** of digestate, produced on site or at other YW sites, before removal from site for recovery or, if necessary, disposal.	R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced) D15: Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where the waste is produced)
As a contingency measure, the **interim storage** of undigested sludge produced at Esholt or other YW sites, before treatment on site at Esholt or, if necessary, treatment and recycling or disposal at an alternative site.	R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced) D15: Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where the waste is produced)
Storage and treatment of biogas	R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced) D15 Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where it is produced)
Use of biogas as a fuel	R1: Use principally as a fuel to generate energy
Incineration of biogas	D10: Incineration on land
Raw material (non-waste) **storage**	No applicable waste codes
Surface water collection, including **temporary storage**	No applicable waste codes
Collection and treatment of odorous gases	No applicable waste codes

Total storage capacity (tonnes)	Sludge storage capacity within STF vessels provided in Table 1a-2 overleaf.
Annual throughput (tonnes each year)[10]	**Indigenous primary sludge:** 555,104 tonnes per year (at the minimum 2.4% dry solids) **Indigenous SAS:** 1,330,500 tonnes per year (at the minimum 0.4% dry solids) **Liquid sludge (imported):** 339,273 tonnes per year (at the minimum 2.2% dry solids) **Sludge cake (imported):** 25,948 tonnes (at 21% dry solids)

10 Figures presented here as tonnes per year assume a 1:1 ratio of m3 to tonnes in all cases.

Table 1a-2 – Storage capacities

Vessel	Nominal capacity (m^3)
Liquid import tank (1)	655
Consolation tank 5 (1)	2,500
SAS storage tanks (2)	2,000 each
SAS transfer tanks (2)	400 each
Mixed sludge tanks (2)	1,200 and 1,130
THP feed silos (2)	210 each
THP hopper (1)	16.2
Buffer tank (1)	39.5
Degassing tanks (2)	685 each
Export dewatering feed tanks (2)	1,604 each
Dewatering feed tanks (2)	1,200 and 1,130
Conditioning pad and cake barn	
A maximum storage capacity has been estimated on the basis of available space on the conditioning pad and in the cake barn, taking account of typical sizes and heights of material stockpiles. This is necessarily an estimate. On this basis a figure of 5,500 tonnes has been derived. Under normal circumstances the amount of cake stored will be significantly below this quantity.	

Table C3: 1b-1 – Types of waste accepted - Imported and Indigenous wastes to the sludge AD process (digesters)

Waste Code	Description of the waste
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
19 02	Wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge
19 06	Wastes from anaerobic treatment of waste
19 06 06	Digestate from anaerobic treatment of animal and vegetable waste
19 08	Wastes from waste water treatment plants not otherwise specified
19 08 05	Sludges from treatment of urban waste water

Table C3: 1b-2 – Types of waste accepted - Imported wastes for dewatering/storage only (prior to recovery)

Waste Code	Description of the waste
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
19 02	Wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge.
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge conditioned with sanitised green waste.
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sewage sludge conditioned with wood waste.
19 02 06	Sludges from physico/chemical treatment other than those mentioned in 19 02 05, specifically sludge phyto conditioned.
19 06	Wastes from anaerobic treatment of waste
19 06 06	Digestate from anaerobic treatment of animal and vegetable waste
19 08	Wastes from waste water treatment plants not otherwise specified
19 08 05	Sludges from treatment of urban waste water

2 Point source emissions to air, water and land

A full inventory of emission points is provided in Table C3: 2-1 below and illustrated in Section IV, Figure 3. Proposals for monitoring emissions to air are provided in Table C3: 4a-1.

Refer also to Appendix 12 Medium Combustion Plant Directive requirements for details of Emission Limit Values (ELVs) for emissions to air from boilers and CHP engines following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3:2-1: Emissions Inventory to air

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit		Techniques to minimise emissions
Existing plant – emission points unchanged, currently within permit VP3130GZ	A1 (previously N.A1)	CHP 3 engine exhaust	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A2 (previously N.A2)	Boiler 1 exhaust (gas oil)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Ultra low sulphur gas oil
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
		Boiler 1 exhaust (biogas)		Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
	A3 (previously N.A3)	CHP 4 engine exhaust	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A4 (previously N.A4)	Boiler 2 exhaust (gas oil)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Ultra low sulphur gas oil
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance
		Boiler 2 exhaust (biogas)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx burners
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Boiler servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Boiler servicing and maintenance

[11] Emission limit taken from existing permit VP3130GZ/V004 using reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 5% O_2.
[12] Representative ELV taken from other YW biogas combustion permit conditions using reference conditions: 273 degrees Kelvin, 101.3kPa, dry gas, 5% O_2.

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit		Techniques to minimise emissions
Existing plant – emission points unchanged, currently within permit VP3130GZ	A5 (previously N.A5)	CHP 1 engine exhaust (exhaust via unfired waste heat boiler)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A6 (previously N.A6)	CHP 2 engine exhaust (exhaust via unfired waste heat boiler)	Energy centre	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	500[11]	mgNm	Low NOx combustion controls
				Sulphur dioxide (SO_2)	<350[12]	mgNm	Sludge management techniques
				Carbon monoxide (CO)	1,400[11]	mgNm	Engine servicing and maintenance
				Total VOCs (as carbon)	1,000[11]	mgNm	Engine servicing and maintenance
	A7 (previously N.A7)	Waste gas burner	Adjacent to digester compound	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	150[13]	mgNm	None - abnormal use only
				Carbon monoxide (CO)	50[13]	mgNm	None - abnormal use only
				SO_2	Not quantified[14]		None - abnormal use only. Sludge management techniques
				Total VOCs (as carbon)	10[13]	mgNm	Flame temperature and residence
	A8 (previously N.A8)	Biogas holder 1 (emergency pressure relief valve)	Adjacent to digester compound	Biogas	Not quantified – emergency use only[14]		None - emergency use only
	A9 (previously N.A9)	Biogas holder 2 (emergency pressure relief valve)	Adjacent to digester compound	Biogas	Not quantified – emergency use only		None - emergency use only
New emissions points	A10	Odour control unit 1 (odour extraction and dispersion only)	Liquid import tank	H_2S	Not quantified		Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				NH_3	Not quantified		
				Mercaptans	Not quantified		
				Dimethyl sulphide	Not quantified		
	A11	Odour control unit 2 (odour extraction and dispersion only)	Mixed sludge tanks	H_2S	Not quantified		Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				NH_3	Not quantified		
				Mercaptans	Not quantified		
				Dimethyl sulphide	Not quantified		

[13] Emission limit taken from existing permit VP3130GZ/V004 using reference conditions 273 degrees Kelvin, 101.3kPa, dry gas, 3% O_2.
[14] No ELV for these determinands proposed in permit. No appropriate reference limit value identified.

New / Existing	Emission Point Ref	Source	Location	Emissions parameter	Quantity / unit	Techniques to minimise emissions
New emissions points	A12	Odour control unit 3 (odour extraction and dispersion only)	THP feed silos/hopper	H_2S	Not quantified	Sludge management techniques. OCU to be refurbished and reinstated - refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A13	Odour control unit 4	SAS thickeners	H_2S	Not quantified	Single stage carbon filter OCU in operation and no operational issues are reported. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	A14	Odour extraction and dispersion	Degassing tanks	H_2S	Not quantified	Existing tank air extraction to be routed to biogas system. Biogas from these tanks to be collected and utilised. Refer to proposed improvement programme.
				NH_3	Not quantified	
				Mercaptans	Not quantified	
				Dimethyl sulphide	Not quantified	
	N/A	PRVs - biogas	Digesters and locations on biogas pipelines	Biogas	Not quantified – emergency use only	None - emergency use only
	N/A	PRVs – THP	THP pressure relief valve	Off gases from THP process	Not quantified – emergency use only	None - emergency use only

Emissions to sewer and water

All process liquor and surface water runoff, other than some uncontaminated roof water, is collected and discharged via underground drainage systems to Esholt WwTW for full treatment prior to discharge to the River Aire. Process liquor emissions comprise liquor from raw and digested sludge dewatering processes, condensate e.g. from biogas handling, cleaning washwater and surface water runoff. Discharge points are shown on Figure 3. Key sources are as follows:

- Discharge point S1 comprises surface water runoff and cleaning wash water from local site areas as well as boiler blowdown and biogas condensate.
- Surface water runoff, cleaning wash water, thickener liquors and centrate are discharged to Esholt WwTW via emission point S2
- Liquor from the dewatering centrifuges, cleaning wash water and surface water runoff is discharged to Esholt WwTW via local emission points S3.
- Surface water runoff from the conditioning pad is combined with surface water runoff from the adjacent Biowise composting plant at the leachate pumping and is transferred to Esholt WwTW for full treatment via emission point S1 (refer to Figure 4).
- Uncontaminated roof water from the boiler house and the export barn are discharged to infiltration basins via local emission points W1, W2 and W3.

A copy of the site drainage plan is provided as Figure 4. Site drainage is also shown, overlain on site surfacing, in Figure 5.

Esholt WwTW treats effluent from off site and from the STF, and has consent limits in place covering all outputs. There has been no requirement to separately characterise or assess the outputs from the STF, or any effects of these on receiving waters, separately from the wider WwTW. As such no monitoring data is available at this time.

YW is committed to undertake a 12-month programme of monitoring of process liquors returned to the WwTW to characterise the emissions – refer to Form C2 Q6-8 for details of the proposed monitoring programme.

Table C3: 2-2 – Emissions to sewer and water

Emission Point Ref.	Source	Parameter	Expected Emissions	
			Quantity	Unit
W1	Roof water runoff	Volume	Variable ~ dependent on rainfall	
W2	Roof water runoff	Volume	Variable ~ dependent on rainfall	
W3	Roof water runoff	Volume	Variable ~ dependent on rainfall	
S1	Washwaters Surface water runoff (including cake pad) Condensate Boiler blowdown Surface water runoff from the adjacent composting plant	Suspended solids	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	
		Biological Oxygen Demand (BOD)		
		Ammonia		
		Volume		
S2	Washwaters Surface water runoff Thickener liquors (SAS) Dewatering liquor (raw sludge)	Suspended solids	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	
		Biological Oxygen Demand (BOD)		
		Ammonia		
		Volume		
S3	Washwaters Surface water runoff Dewatering liquor (digested sludge)	Suspended solids	Not yet quantified. Characterisation of emissions will be undertaken in line with BAT – refer to information provided in response to Form C2 Q6-8 for more details.	
		Biological Oxygen Demand (BOD)		
		Ammonia		
		Volume		

3 Operating techniques

3a1 Does your permit (in Table 1.2 Operating Techniques or similar table in the permit) have references to any of your own documents or parts of documents submitted as part of a previous application for this site?

Table S1.2 of the current permit (VP3130GZ /V004) includes reference to documents which are superseded, or are supplemented, by documents contained within this permit variation application. This is summarised in Table C3: 3a1 below.

Table C3: 3a1 – Superseded Documents

Permit ref	Existing document reference (taken from Table 1.2 Operating Techniques)	Reason no longer valid	New document reference
VP3130GZ	Burning of biogas: Environmental risk assessment (EPR-H1) submitted in response to Section 2.7 of Part 2C of the application form	**Supplementary** information provided in this variation application	This risk assessment remains relevant. However, this is supplemented by additional information included within this application: • Response to Form C3, Q 6 Environmental Risk Assessment
VP3130GZ	Import of sewage sludge: Environmental risk assessment (EPR-H1) submitted in response to Section 2.7 of Part 2C of the application form	**Supplementary** information provided in this variation application	This risk assessment remains relevant. However, this is supplemented by additional information included within this application: • Response to Form C3, Q 6 Environmental Risk Assessment
VP3130GZ	Supporting information for Environmental Permit (Substantial Variation) submitted in response to Question 2b - Changes or additions to existing activities, Part C2 of the application form. 2.4.2 Facility Boundary, 2.4.3 Process Flow Diagram. Details submitted in response to Question 5a of Part C2 of the application form	**Superseded** by information provided in this variation application	• Section II: Technical Description • Response to Form C2, Q2 About your proposed changes • Response to Form C3, Q1 What activities are you applying to vary? • Figure 2 Installation Layout
VP3130GZ	Revised site plan	**Superseded** by information provided in this variation application	• Figure 2 Installation Layout • Figure 3 Principal Emissions points • Figure 4 Drainage plan
VP3130GZ	Proposed lists of waste types	**Superseded** by information provided in this variation application	• Response to Form C3, Q1 Types of Waste Accepted

3b General requirements

Fugitive emissions management plan – Leak Detection and Repair (LDAR) programme

YW has a defined maintenance plan for biogas pipework at Esholt STF – this is included as Appendix 14. This includes regular visual inspections, as well as more detailed investigations such as use of a methane detecting camera to identify leaks. Any leaks identified are assigned a priority for repair, the priority recognises potential as both an environmental and safety hazard. Key section headings in the LDAR management procedure (which forms part of the EMS) include:

- Introduction, scope, responsibilities, assurance.
- LDAR considerations including summary of equipment, techniques and approaches.
- Site specific LDAR plan:
  - STF Tanks (Anaerobic Digesters);
  - Pressure Relief Valves;
  - Biogas pipework from AD to biogas treatment and storage;
  - Biogas storage ;
  - Pipework from biogas treatment to flare stack and engine;
  - Biogas Engine;
  - Boilers
  - Flare Stack;

The majority of biogas pipework is within a secure area to reduce the risk of physical damage. A DSEAR review of the site has been completed and installed equipment is appropriate for the zone in which it is installed.

Best Available Techniques: Reducing diffuse (fugitive) emissions to air (*BAT 14*)

The design and operation of Esholt STF ensures diffuse (fugitive) emissions to air are minimised. This includes the following measures:

- Raw sludge and sludge cake is largely contained with displaced air from tanks piped to an odour control unit for treatment prior to release to atmosphere.
- H_2S levels are monitored in the biogas and are recorded.
- Emissions of odour and organic compounds from digested material (post THP/AD) is very low. Refer to the odour impact assessment and odour management plan (Appendices 8 and 10, respectively) for more details.
- All pipework design is subject to Water Industry Mechanical and Electrical Specifications (WIMES), which ensures correct material selection, corrosion prevention and valve type.
- Regular inspections of tanks and pipework undertaken in line with the LDAR programme.
- Biogas pipework largely above-ground, allowing easy inspection/leakage detection.
- Sludge and sludge cake is wet at all times and therefore potential for generation of dust is very limited. This is not an issue of concern (see bioaerosol risk assessment, Section 6).
- Traffic speed limits of 10pm are enforced on site.

3c Types and amounts of raw materials

Table C3: 3c-1 – Types and amounts of raw materials

Description of raw material	Use	Maximum storage capacity	Annual throughput[15]	Main hazards	Alternative
Polymer (liquid)	Coagulant used for raw sludge thickening	10 m^3 bulk storage tank plus IBC storage (~5 m^3)	~90,000 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Polymer (powder)	Coagulant used for digested sludge thickening	55 m^3	~75,051 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Antifoam	Digester antifoaming agent	IBC storage (~5 m^3)	<5 m^3	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Sodium hydroxide [NaOH]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Oxygen scavenger [Sodium bisulphite + Cobalt catalyst]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Corrosion inhibitor [Amine based]	Boiler treatment chemical	220 litres	<220 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Sodium chloride (NaCl)	Boiler water softener	100 kgs	<100 kgs	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Glycol	Antifreeze	2 m^3	<2 m^3	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Lubrication oil	Equipment lubricant	1 m^3	2,800 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative

[15] Raw materials data is provided on the basis of a combination of 2020 data, where available, and estimates based on typical storage volumes at this and other YW STF sites.

Description of raw material	Use	Maximum storage capacity	Annual throughput[15]	Main hazards	Alternative
Propane	Boiler starter fuel	1,410 kgs	1,000 kgs approximately	Potential impact on local and global atmosphere	No viable alternative
Diesel	Fuel for mechanical loaders	2,500 litres	29,105 litres [16]	Polluting to watercourses in the event of a spillage/loss	No viable alternative
Gas oil	Boiler fuel	108,000 litres	1,643,893 litres	Polluting to watercourses in the event of a spillage/loss	No viable alternative

4 Monitoring

4a Describe the measures you use for monitoring emissions

Proposals for monitoring point source emissions to air and sewer are shown in Table C3: 4a-1.

Refer also to Appendix 12 Medium Combustion Plant Directive requirements for details of monitoring proposals for emissions to air from boilers and CHP engines following phase in of MCP Directive controls, in accordance with applicable timescales.

Table C3: 4a-1 Proposed emissions monitoring requirements

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
Emissions to air				
A1 (previously N.A1) CHP 3	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A2 (previously N.A2) Boiler 1	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual

[16] Annual throughput data includes use outside of installation boundary (within the wider Esholt WwTW)

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A3 (previously N.A3) CHP 4	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A4 (previously N.A4) Boiler 2	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A5 (previously N.A5) CHP 1	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A6 (previously N.A6) CHP 2	418749, 439544	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual
		Sulphur dioxide (SO_2)	Extractive emissions testing in line with TGN M1 and EN 14791	Annual

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual
A7 (previously N.A7) Waste gas burner	418536, 439417	NOx (NO and NO_2 expressed as NO_2)	Extractive emissions testing in line with TGN M1 and BS EN 14792	Annual (only required if operational for more than 876 hours in a year)
		CO	Extractive emissions testing in line with TGN M1 and BS EN 15058	Annual (only required if operational for more than 876 hours in a year)
		Total VOCs	Extractive emissions testing in line with TGN M1 and EN 12619:2013	Annual (only required if operational for more than 876 hours in a year)
A8 (previously N.A8) Waste gas burner	418566, 439441	No monitoring of this source is required under current permit VP3130GZ/V004 and none is proposed.		
A9 (previously N.A9) Waste gas burner	418572, 439445	No monitoring of this source is required under current permit VP3130GZ/V004 and none is proposed.		
A10 Odour control unit 1 (odour extraction and dispersion only)	418579, 439515	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A11 Odour control unit 2 (odour extraction and dispersion only)	418619, 439484	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A12 Odour control unit 3 (odour extraction and dispersion only)	418708, 439501	YW is committed to refurbishing the existing OCU at this emission point. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		
A12 Odour control unit 4	418537, 439347	YW is committed to complete an assessment of the effectiveness of this OCU. Monitoring will be carried out in accordance with BAT 8 and the Esholt STF Odour Management Plan (refer to Appendix 10 for more details).		

Emission point	Grid ref.	Parameter	Monitoring technique	Monitoring frequency
A14 Degassing tanks odour extraction	418652, 439449	YW is committed to covering the degassing tanks and routing gases to the biogas system / relevant assets. Therefore, it is proposed that this emission point will be removed.		
PRVs – Biogas	Various	No emissions monitoring proposed due to nature of release point as an essential safety mechanism with very occasional and short duration use.		
PRVs - THP	Various	No emissions monitoring proposed due to nature of release point as an essential safety mechanism with very occasional and short duration use.		
Emissions to sewer				
S1	418193, 440273	No monitoring data is currently available. YW is committed to undertake a period of monitoring in order to fully characterise the liquors returned to the WwTW – refer to Q 6-8 Assessment of point source emissions to sewer for more details. Any ongoing monitoring requirements will be established after this initial monitoring, and subsequent analysis and assessment, has been completed.		
S2	418603, 439372			
S3	418857, 439189			
Emissions to ground				
W1	419142, 438895	No specific monitoring programme proposed. Discharge of clean roof water only.		
W2	419098, 438862			
W3	418762, 439546			

Selected process monitoring parameters are illustrated in Table C3: 4a-2. The site is operated under full PLC SCADA control with data logging and interrogation of key parameters to maintain safe, efficient and low emissions operation.

Table C3: 4a-2 Key process monitoring provisions

Emission point / description	Parameter	Monitoring approach	Monitoring frequency
Sludge intake	Intake volume	SCADA	Continuous during unloading operations
	% dry solids	SCADA	Continuous during unloading operations
CHP (A1, A3, A5, A6)	Operating hours	SCADA	Continuous data logging
	Electricity generated	SCADA	Continuous data logging
	Load required / actual (%)	SCADA	Continuous data logging
	Biogas flow / pressure to CHP	SCADA	Continuous data logging
	Heat circuit temperatures (deg. C)	SCADA	Continuous data logging
Boilers (A2, A4)	Load required / actual (%)	SCADA	Continuous data logging
	Biogas / natural gas flow / pressure to boiler	SCADA	Continuous data logging
	Heat circuit temperatures (deg. C)	SCADA	Continuous data logging
	Heat circuit flow	SCADA	Continuous data logging
Flare compound (A7)	Biogas to flare (m^3)	SCADA	Continuous data logging
	Run hours	SCADA	Continuous data logging
Dispersion stacks (A10, A11, A12, A14)	Operational status	SCADA	Indication
OCU 4 (A13)	Operational status	SCADA	Indication
Biogas storage (A8, A9)	Gas level (%)	SCADA	Continuous data logging
	Gas pressure (mb)	SCADA	Continuous data logging
	Methane %	SCADA	Continuous data logging
THP	Temperature (deg. C)	SCADA	Continuous data logging
	Pressure	SCADA	Continuous data logging
Digesters	Volume	SCADA	Continuous data logging
	Volatile Fatty Acids (VFAs)	Manual	Periodic
	Alkalinity	Manual	Periodic
	Process temperature	SCADA	Continuous data logging
	% solids (intake)	SCADA	Continuous data logging
	Retention (hours)	SCADA	Continuous data logging
	Temperature	SCADA	Continuous data logging
	H_2S (ppm)	SCADA	Continuous data logging
Centrifuges	Dry solids (%)	SCADA	Continuous data logging
	Flow	SCADA	Continuous data logging

4b Point source emissions to air only

The proposed sampling locations and facilities are assessed in Table C3: 4b-1, based on the requirements and recommendations provided in BS EN 15259 and Environment Agency M1[17]. The most recent MCERTS accredited stack emission test[18] carried out at the site reported:

"The sampling location meets all the requirements specified in EA Guidance Note M1 and EN 15259, and therefore there are no improvement recommendations."

Table 4b-1: BS EN 15259 / TGN M1 Assessment - Sampling Requirements

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Sample plane location	6.2	As far downstream or upstream from any disturbance, which could produce a change in direction of flow (e.g. bends, fans).	Sampling ports are installed on a straight section of stack, substantially downstream and upstream of 90 degree bends where horizontal hot gas ductworks exits the boilers or enters the windshield. A constant cross-sectional area is present within the flues.
	6.2	In a section of duct with constant shape and cross-sectional area.	
	6.2	Recommend five hydraulic diameters* upstream and two hydraulic diameters downstream (or five hydraulic diameters from the top of the stack)	
Sample plane orientation	6.2	Installation of sample plane in vertical stacks is preferred to horizontal ducts	The sampling plane is horizontal due to the boiler house and stack configuration.

[17] Environment Agency Technical Guidance Note (Monitoring) M1 (2010), now superseded by online resource 'Guidance: Monitoring stack emissions: measurement locations'
[18] Element Materials Technology (2021), Job Reference Number EMT00508

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Exploratory survey	6.2	It is advised that an exploratory velocity traverse is carried out before committing to installation	The ports are installed and reported as compliant. Due to the narrow diameter, homogeneity testing in line with the requirements set out in BS EN 15259 is not required, as per guidance[19].
Flow criteria	6.2	Angle of gas flow less than 15° to duct axis.	The recent monitoring exercise reports no deviations to the required standards.
	6.2	No local negative flow.	
	6.2	Minimum velocity (a differential pressure of 5Pa, which equates to 3 ms-1).	
	6.2	Ratio of the highest to lowest gas velocity less than 3:1.	
Measurement ports	6.2	Planned at detailed design stage because retrofitting can be expensive (for example ducts may have protective linings).	The number, location and type of measurement ports were designed having regard to TGN M1; the recent monitoring exercise reports no deviations to the required standards.
	6.2	Allows access to sample points.	A temporary sampling platform is installed which allows compliant sampling from all ports
	Annex A	It is recommended that for small stacks (less than 0.7m diameter) a socket of 75mm is acceptable.	Sample ports are sized appropriately to the equipment to be used for monitoring. The ports are accessible via the platform for maintenance.

[19] Method Implementation Document for EN 15259:2007, Environment Agency, v3, May 2019

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
	-	The port socket must not project into the gas stream.	The recent monitoring exercise reports no deviations to the required standards.
	Annex B	Additional ports may be required to allow access for measurement of other quantities (for example velocity and water vapour)	N/A
	6.2	Additional ports for CEMS (if applicable)	No CEMS is installed or proposed – not applicable.
	-	The operator must maintain the ports in good condition and free them up prior to work being undertaken	The ports are accessible
Identification	6.2	Clearly identified and labelled measurement section	The ports are clearly identifiable.
Load bearing capacity	6.2	Permanent and temporary working platforms must have a load bearing capacity sufficient to fulfil the measurement objective	A temporary working platform is provided when required; the structure is designed for appropriate loading for all sampling and maintenance activities.
Position and working space	6.2	Sufficient working area to manipulate probe and operate the measuring instruments, without equipment overhanging guardrails	A suitable temporary working platform is provided, which facilitates manipulation of probes and operation of measuring instruments.
	6.2	A sufficient depth of the working area is given by the internal diameter or depth of the duct and the wall thickness plus 1.5 m	

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
	6.2	If two opposite measurement ports are installed for one measurement line, a correspondingly smaller working area is required	N/A
	6.2	Its recommended that vertical ducts have a working height from the platform to the ports of 1.2 to 1.5m	A temporary working platform is provided when required; the structure is designed for appropriate loading for all sampling and maintenance activities.
	-	Removable chains or self-closing gates at the platform to prevent workers falling through access hatches or ladders.	Safe access is provided, including fall protection.
Fall prevention	-	Upper handrails at a minimum of 950mm (910mm allowed for old handrails). Gaps in rail no bigger than 470mm. Toe boards required	Fixed guard rails are reported to be provided on the temporary platform (at 0.5m and 1m); vertical base boards are also provided (Elements, 2021)
	-	Consider installing personal protection systems on vertical ladders	
Access	6.3	Easy and safe access available	Temporary access provisions are reported by the MCERTS contractors as 'safe' and 'easy'
	-	Consider installing work restraint systems on vertical ladders	
Power supply	6.3	Single phase 110V electrical power of a suitable current provided by a suitable number of sockets at the platform	Adequate and safe electrical supply provisions are made.

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Lifting equipment	6.3	Lifting systems for raising and lowering of equipment, where access to the sampling platform is by vertical, or steeply inclined, ladders or stairs	Not applicable
	-	Lifting systems (for example, hoists) and attachments (for example, eyes) must be inspected and maintained by a competent person	
	-	Installation of a support structure for securing portable lifting systems (handrails are not usually suitable for supporting lifting systems)	
Monorails	-	Consider sampling monorails above the sampling ports to enable certain designs of sampling train to be suspended.	Not applicable
Exposure to gas	6.3	Avoid areas of sources which emit unexpectedly, for example rupture discs, overpressure valves and steam discharges.	Compliant
Exposure to stack gas	6.3	Avoid areas of significant positive pressure.	Monitoring takes place internally, but the building has adequate natural (passive) ventilation.
Awareness	6.3	Consider how stack emission monitoring personnel are informed of operating faults that may endanger them?	All monitoring works would be under a permit to work scheme, which includes a detailed Risk Assessment and Method Statement (RAMS).
Ventilation	-	Well ventilated.	Monitoring takes place internally, but the building has adequate natural (passive) ventilation.

M1 Characteristic	BS EN 15259 relevant clauses	Requirement	Commentary
Heat and dust	6.3	Protection of the working area from heat and dust.	No dust sources within working space. Twin walled flue design (internal flues with windshield), no specific personnel protection required for heat above normal safe site working conditions.
Weather protection	6.3	Protective measures (for example, weather protection and heating to ensure conditions are appropriate for personnel and equipment).	Internal sampling
Lighting	-	Artificial lighting or facilities for temporary lighting.	Internal sampling, area and task lighting as required.

6 Resource efficiency and climate change

6a Describe the basic measures for improving how energy efficient your activities are

YW consumption and generation data is collated and stored within a web-based energy database. This enables the business to produce bespoke reports as required by internal stakeholders.

Monthly energy consumption hubs are held to review ongoing energy use and performance. These are supported with discussions regarding how asset operation can be modified, or capital intervention made, to reduce energy use. This is further supported by YW requirements under the Energy Saving Opportunity Scheme (ESOS) compliance programme. YW conducts energy surveys that are discussed with the site operational teams. The findings of the surveys are collated into a final report and presented to senior management.

YW have published performance commitments in relation to the amount of biogas that is derived from the sludge processed. The higher the efficiency of biogas production the greater the potential for electricity generation. There is a daily generation hub that seeks to identify any generation issues and rectify them promptly.

Overall annual energy and carbon performance is publicly shared via the company annual report as part of the Streamlined Energy and Carbon Reporting (SECR) requirements.

Energy is monitored and managed on a regular basis through the Energy and Recycling Team. Energy consumption and energy generation reports are run and reviewed regularly and are recorded on YW's Performance Zone. YW also participates in a number of mandatory and voluntary carbon reporting schemes. YW sets itself targets for energy consumption and energy generation at both a strategic and operational level. YW has dedicated teams which focus on:

- Maximising renewable energy generation; and
- Implementing strategic and site-specific energy efficiency projects.

Table C3: 6a-1 below describes the measures taken on site to minimise energy use.

Table C3: 6a-1 – Energy efficiency measures

Operating and maintenance	Documented measures in place	
Regular testing and maintenance of biogas systems for leaks, seals, and condensate traps	Yes	Maintenance/servicing undertaken by qualified technicians and registered organisations. Records are maintained on site.
Operation of motors and drives	Yes	Regular inspections/lubrication & maintenance undertaken by qualified technicians and specialist contractors. Records are retained.
Compressed air systems	Yes	On-going leak detection and repair programme undertaken by qualified technicians.
Hot water systems	Yes	Digester system monitored constantly and inspected and tested regularly by an operator and recorded.
Lubrication to avoid high friction losses	Yes	Technicians and specialist contractors carry out regular lubrication, including CHP engine oil change, and records are maintained.
Boiler maintenance e.g. optimising excess air	Yes	Carried out as per legislative requirements and YW procedures.
Physical measures	**Documented measures in place**	
Sufficient insulation of heated vessels and pipework	Yes	Inspection and housekeeping to check condition of insulation; repair or replacement carried out as necessary
Provision of sealing and containment methods to maintain temperature	Yes	Anaerobic digesters are enclosed.
Other appropriate measures	Yes	Daily operational inspections are conducted to check for aspects such as leaking tanks and pipework
Building services	**Documented measures in place**	
Energy efficient lighting is in place	Yes	There are limited building service requirements on site, energy efficient options are provided where readily available, and when equipment comes up for renewal
Space heating	Yes	
Hot water	Yes	
Temperature control	Yes	
Ventilation	Yes	
Draft proofing	Yes	
BAT conclusions for energy recovery	**Documented measures in place**	
Heat recovery (please specify where from and add more lines if appropriate)	Yes	Heat recovered from CHP engines via boiler economisers used for steam raising for THP operations as well as feeding the low temperature hot water (LTHW) ring main. This is exported to provide space heating for the adjacent Esholt Hall owned and operated by YW as well as pre-heating biogas feed to the CHPs.

Heat exchangers (explain where fitted and add more lines if appropriate)	Yes	Heat exchangers are used in the CHP engine and boiler economisers. The LTHW ring main is fed from the boilers and also receives heat from the engine jacket and oil cooling systems through plate heat exchangers. This is exported to provide space heating for the adjacent Esholt Hall (owned and operated by YW) as well as pre-heating biogas feed to the CHPs.
Re-use of spent cooling water	N/A	
Minimisation of water use and re-circulating water systems for energy saving	Yes	Preference is given to the use of final treated effluent rather than mains water where water quality demand allows.
Good insulation	Yes	All boilers, anaerobic digesters and pipework are insulated
Plant layout to reduce pumping distances	Yes	Where existing layout allows

6b Provide a breakdown of any changes to the energy your activities use up and create

The main site energy sources are electricity from the public supply, gas oil (used to fire boilers 1 and 2 only) and biogas generated by the anaerobic digesters which is combusted in the CHP engine to generate electricity. Heat is also recovered from the CHP and used in the two composite boilers and waste heat boiler to generate steam for the THP and hot water for the LTHW ring main. The LTHW ring main in term provides space heating for the adjacent Esholt Hall as well as pre-heating biogas feed to the CHPs. Biogas is also used as back-up fuel supply for the composite boilers.

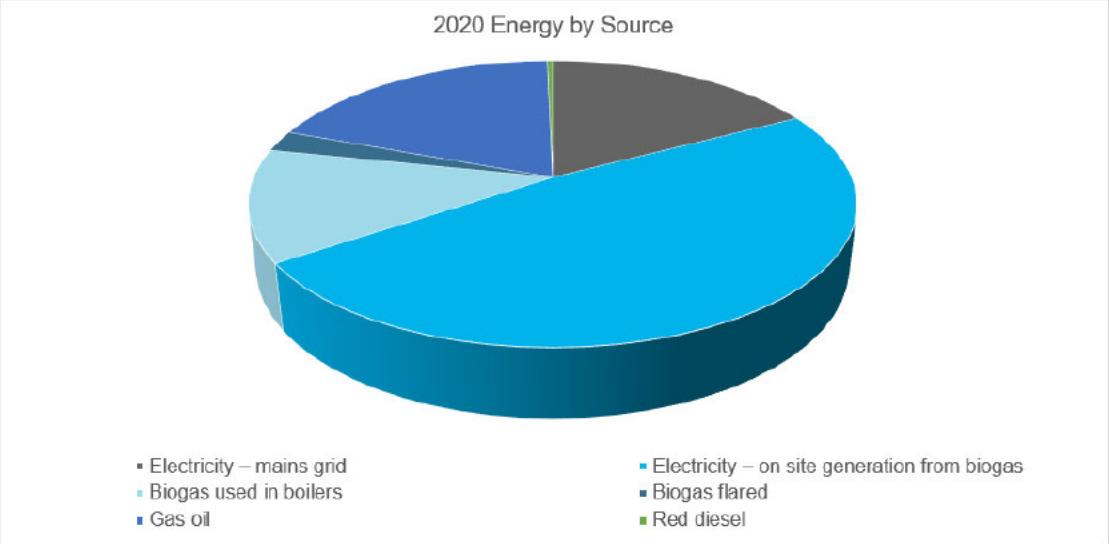
Table C3: 6b-1 shows the energy balance for the site. Electricity generated on site is used to power site equipment. There is currently no facility to export any excess to the national grid. To maintain control of energy consumption, and improve it where possible, electricity and fuel consumption is reported and reviewed on a regular basis.

YW is currently investigating the option of bringing a gas connection onto site to provide mains gas for operation of these steam raising boilers. This solution would replace gas oil as the main fuel source.

Table C3: 6b-1 – Typical annual energy use

Energy Source	Energy Consumption MWh [20]		
	Delivered	Primary	% of total (primary)
Electricity – mains grid [21]	6,697	16,074	17.3
Electricity – on site generation from biogas [22][23]	15,017	44,809	48.3
Biogas used in Boilers[24]	11,739	11,739	12.6
Biogas flared[24]	2,211	2,211	2.4
Gas oil used in boilers [25]	17,665	17,665	19.0
Diesel [26]	313	313	0.3

Figure C3: 6b-1 – 2020 energy by source



[20] Using 2020 data
[21] Electricity imported includes the use for the whole site not just the permitted activities due to metering arrangements.
[22] Delivered value is recorded electricity generation (net of exported value of 231MWh).
[23] Primary value is calculated from measured biogas used in the CHP, measured average biogas methane content of 63% and the calorific value of methane 37.706 MJ per m3 (OFGEM 2016 / ISO 6976:1995).
[24] Figures derived from measured biogas use, measured average biogas methane content of 63% and the calorific value of methane 37.706 MJ per m3 (OFGEM 2016 / ISO 6976:1995).
[25] Gas oil is the primary fuel source for the steam raising boilers (with biogas as back-up fuel). 1,643,893 litres consumption, energy derived using DUKES 2019 calorific values of fuels.
[26] A small amount of road diesel is used in off-road vehicles e.g. cake handling on pad. 29,100 litres consumption, energy derived using DUKES 2019 calorific values of fuels.

Global warming potential (GWP)

The CHPs are operated as renewable energy generation plant; therefore there are no direct emissions of carbon dioxide (a greenhouse gas) resulting from the combustion of biogas in the CHPs. However, there are direct CO_2 emissions as a result of combustion of gas oil in the two composite boilers. There are also indirect emissions of CO_2 resulting from the use of imported electricity. At present, due to metering arrangements, it is not possible to apportion electricity usage to just the permitted activities within the installation, therefore site wide (Esholt WwTW) usage is reported in this section. The CO_2 equivalent (CO_2e) emissions for the plant are set out in Table C3: 6b-2, together with overall GWP calculation.

There will be some losses of biogas (methane) from the plant (a substance with a high global warming potential, at least 21 times higher than CO_2), resulting from unquantified fugitive losses from the biogas system (see LDAR programme). These have not been included in the GWP calculation as no data is available.

Table C3:6b-2 – Global warming potential

Substance	Energy source	Energy Consumption in 2020– Primary (MWh)	CO_2 emission factor (T/MWh) [27]	Mass CO_2 released (tonnes/yr)	Global warming potential	Overall Global Warming Potential (TCO_2 / yr) [28] [29]
Carbon dioxide	Electricity (mains) imported	16,074	0.166	2,668	1	2,668
	Biogas	66,177	0	0	0	0
	Gas oil	17,665	0.25	4,416	1	4,416
	Diesel	313	0.25	78	1	78
Total GWP						7,163

6c Have you entered into, or will you enter into, a climate change levy agreement?

No, the activities are not eligible to take part in the CCL Scheme.

The production and use of biogas to produce heat (which is used in the process) and electricity used on site, is the single greatest measure which allows the site to minimise its use of fossil fuels and maximise the use of energy, whilst recovering biological wastes. Biogas may be used in any of the four CHP or two composite boilers on site and therefore biogas flaring is rarely required.

[27] Factors from https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-global-warming
[28] These calculations do not consider the CO_2 equivalent amount which is avoided through the avoidance of releasing methane which has a much higher GWP than CO_2
[29] Does not include fugitive losses of methane, which are considered low and are not quantified (see LDAR)

6d Explain and justify the raw and other materials, other substances and water that you will use

Information related to raw materials use and selection is provided above in response to Q3c.

Water minimisation

Water use within the installation is not significant due to the nature of operations/activities undertaken within the installation. Water is used in small quantities for domestic use within control buildings and is also used as make up fluid for chemicals (polymer), for sludge dewatering processes, as boiler feed water and for some cleaning activities i.e. sludge intake screens, thickener drums, washdown in some areas.

Measures are in place to ensure that water is used only where necessary and preference is given to the use of final treated effluent rather than mains water. The primary water users are listed below, along with the source of water.

Table C3:6d-1 – Water use

Use	Source
Domestic use within control / welfare building	Mains potable water
General cleaning/hosing of external hardstanding surfaces	Final treated effluent and potable for internal cleaning activities
Sludge import screen washing (automated)	Final treated effluent and potable
Imported sludge cake re-wetting	Final treated effluent
Mixing with liquid polymer for sludge thickening and dewatering processes	Mains potable water used for product make-up. Final effluent is used as the carrier water during dosing.
Digester anti-foam washwater spray	Final treated effluent
Boiler feed water	Mains potable water

6e Describe how you avoid producing waste in line with Council Directive 2008/98/EC on waste

Waste Minimisation

The site is designed and operated as a waste recovery plant and as such minimises waste generation from its own operations. Other than sludge cake, generation of waste is generally minimal and, largely limited to packaging or scrap materials associated with engineering projects. Where practical materials are transported to site and stored in bulk or containers are returned to the supplier.

A summary of waste generated as a result of activities undertaken within the Esholt STF is provided in Table C3 6e-1 below.

Table C3 6e-1 – Waste streams

Waste Type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production (tonnes)[30]
Sludge screenings	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Landfill	450
Waste oil	Hazardous	Stored within bunded container prior to collection by approved waste contractor	Recycle	1.9
General waste	Non-hazardous	Stored within a dedicated container prior to collection by approved waste contractor	Recycle or energy from waste	10
Metals	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Recycle	5
Mixed recycling	Non-hazardous	Stored within a dedicated container prior to collection by approved waste contractor	Recycle (or if contaminated may be energy from waste)	1.2
Wood	Non-hazardous	Stored within a skip prior to collection by approved waste contractor	Recycle (or if contaminated may be energy from waste)	4
Empty IBCs	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.3

[30] Waste data is estimated on the basis of waste arisings data for Esholt WwTW as a whole and from waste data for comparable YW STF sites.

Waste Type	Nature of material	Storage arrangements	Treatment / disposal method	Annual production (tonnes)[30]
Oil contaminated absorbents	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.2
Oil filters	Hazardous	Stored in a dedicated container prior to collection by approved waste contractor	Recycle	0.1

Best Available Techniques: Waste storage, handling and transfer (*BAT 4 and 5*)

IMS procedures specify appropriate measures to ensure compliance with applicable legislation and to control and minimise pollution risks. Controls to minimise environmental risks associated with waste storage, handling and transfer include:

- Waste materials are stored on site for the shortest practicable period of time, in suitable, fit for purpose containers located on areas of hardstanding and away from sensitive receptors such as the River Aire. Waste containers are clearly labelled with their intended contents and container storage capacities are not permitted to be exceeded. Site housekeeping inspections are undertaken to ensure these standards are maintained.
- Very limited quantities of hazardous waste are generated by site activities. This is limited to items such as batteries, aerosols, waste oil and fluorescent tubes. Hazardous waste is always stored in secure containers, away from sensitive receptors and segregated from other waste types.
- Procedures are in place to ensure waste 'duty of care' requirements are met including ensuring that waste is only removed from site by contractors properly licenced and approved for use and accompanied by a fully completed waste transfer or hazardous waste consignment note. Waste transfer and consignment note records are retained electronically or as paper copies on site. Effective implementation of these procedures is supported by training for YW personnel as appropriate.
- Controls are in place to prevent pollution as a result of sludge storage and handling. Following reception on site, sludge is fully contained within tanks and pipework until it is deposited, as digested sludge cake on the cake pad. Surface water runoff from the cake pad is fully contained and is discharged back to Esholt WwTW for treatment. Sludge storage and handling areas are located away from sensitive receptors such as the River Aire.

Form C6 Supporting Information

3 How much do you want to discharge?

3b, c, d and f

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the Esholt WwTW for full treatment prior to discharge to the River Aire.

YW do not currently undertake any routine monitoring of this discharge. It is noted that these discharges include surface water runoff from hardstanding areas within the installation, including the cake pad and therefore discharges will vary according to rainfall.

Calculations have been used to estimate the volume of effluent returned to Esholt WwTW. These values have been provided for indicative purposes and not for the purpose of deriving any permit conditions at this time. The estimated figures presented have been calculated as follows:

Figure C6: 3-1 – Process return calculation

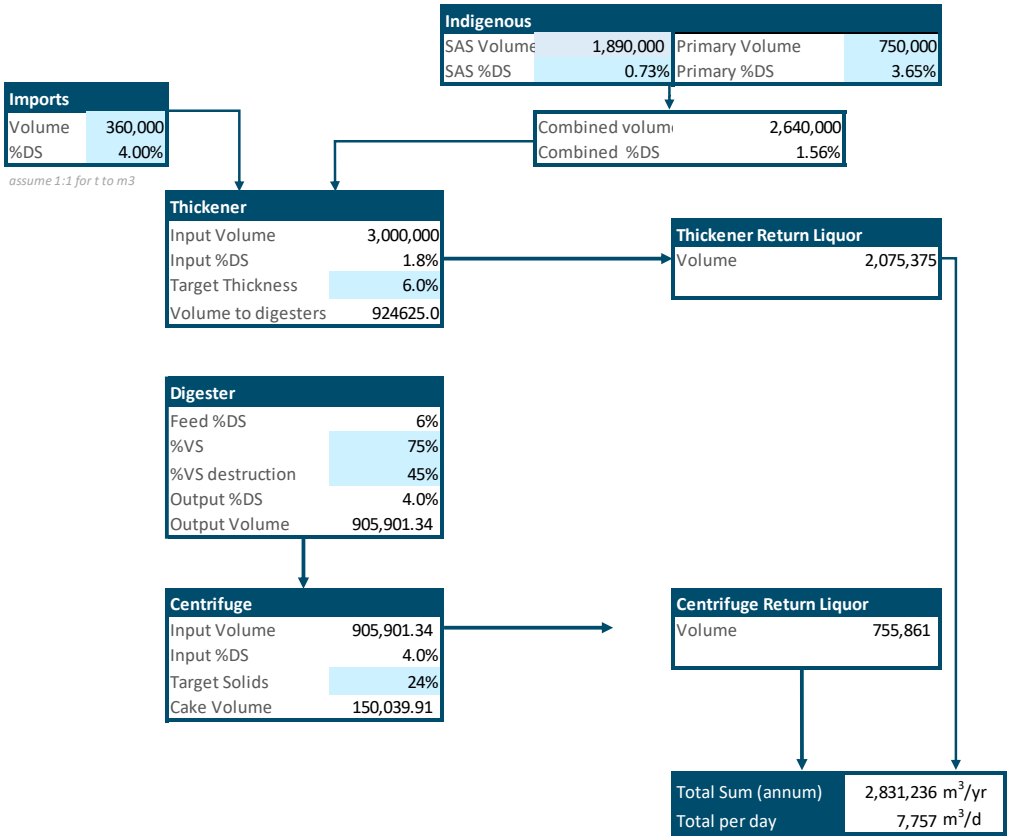


Figure C6: 3-2 – Rainfall plus process return calculation

Main AD area	1,000	m^2
Dewatering Area	810	m^2
Cake pad surface area	455	m^2
Average Rainfall (annum)	1000	mm

Source: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/north-east-england_-climate---met-office.pdf

Source: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/north-east-england_-climate---met-office.pdf

Highest monthly rainfall (mm)	92	mm
Daily rainfall (mm) (averaged)	3.07	mm
Cake pad surface area	455.00	m^2

Expected cake pad runoff (annum)	2,265,000	Litres	≈	6.21 M^3/d
Estimated cake pad runoff per day (based on highest monthly rainfall data)	1,395.33	l/d		
Highest run off (cubic metres per day)	1.40	m^3/d		
+				
Process returns	7757	m^3/d		
=				
Sum worst case cake pad run off and process returns	**7758.21**	**m^3/d**		

5a, b2 Should your discharge be made to the foul sewer?

Form C6 directs YW to answer questions 5a and 5b2. These questions cannot be answered by YW as the STF is co-located on site with the WwTW. These questions appear to be directed at applicants who wish to discharge to surface water or groundwater, which does not apply to YW (all effluent/contaminated water is returned to the WwTW).

No further information is therefore provided in relation to these specific questions.

6a, b, c How will the effluent be treated?

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the co-located Esholt WwTW for full treatment prior to discharge to the River Aire. YW do not undertake effluent treatment within the STF installation boundary.

7b, c, d, e, f, g What will be in the effluent?

All liquor from raw and digested sludge thickening and dewatering processes, condensate (e.g. from biogas handling), cleaning / washdown effluent and all surface water runoff, other than roof water from two buildings on site, is collected and discharged via underground drainage systems to the Esholt WwTW for full treatment prior to discharge to the River Aire. This position has been managed for a long period within YW without a requirement for a formal discharge consent between the YW STF and the YW WwTW. The WwTW treats effluent from off site and from the STF, and has consent limits in place covering all outputs. Therefore, there has been no requirement to separately characterise or assess the outputs from the STF, or any effects of these on receiving waters, separately from the wider WwTW. As such there is no such information available at this time.

YW is committed to undertake a period of monitoring in order to characterise the liquors returned to the WwTW. The programme of monitoring is identified in response to Form C2, Q6-8. Samples will be taken manually from a suitable location(s) upstream of the WwTW inlet, and will be submitted to a laboratory facility that can test to the appropriate standard. It is proposed this sampling will be carried out for a period of 12 months. The data will be used to complete an environmental impact assessment in accordance with Environment Agency guidance. The findings of the monitoring, analysis and impact assessment will be provided to the Environment Agency within 18 months of permit issue (refer to Proposed Improvement Programme below).

8d, e, f Environmental risk assessments and modelling

Refer to information provided above in response to question 7.

9a, b, d, e, f, h, i Monitoring arrangements

YW do not currently undertake any routine monitoring of effluent discharged to the co-located Esholt WwTW. There is no flow monitoring and sampling equipment currently in place or proposed at this time. The grid reference of emission points and proposed sampling points for S1, S2 and S3 (refer to Figure 3) are as follows:

Table C6: 9-1 – Location of emissions and sampling points

Emission Point Ref	Location	
	Emission point	Proposed sampling point
S1	418193, 440273	418193, 440273
S2	418603, 439372	418608 439363
S3	418857, 439189	418857 439189
N/A – sampling point for waste water emissions from the adjacent composting operation	N/A	418959 439030

10a, b, c Where will the effluent discharge to

Form C6 directs YW to answer questions 10a, b and c. These questions cannot be answered by YW as there is no option that applies to discharges from the installation. These questions appear to be directed at applicants who wish to discharge treated effluent to the receiving environment, which does not apply to YW (all effluent/contaminated water is returned to the WwTW).

No further information is therefore provided in relation to these specific questions.

Proposed Improvement Programme

IP Ref.	Related Section	Requirement	Time from receiving permit
1	Q6-3	Implement measures to reduce emissions and odour from diffuse and (non-combustion) point sources (refer to the summary of emissions abatement proposals provided in the table below).	End of 2024
2	C2: Q6-6	Undertake further bioaerosol monitoring and assessment.	18 months
3	C2: Q6-8	Complete return liquors monitoring programme followed by data analysis and assessment.	18 months
4	Appendix 11 (Containment Risk Assessment)	Engineering feasibility assessments and detailed design in respect of identified containment enhancements.	End of 2024

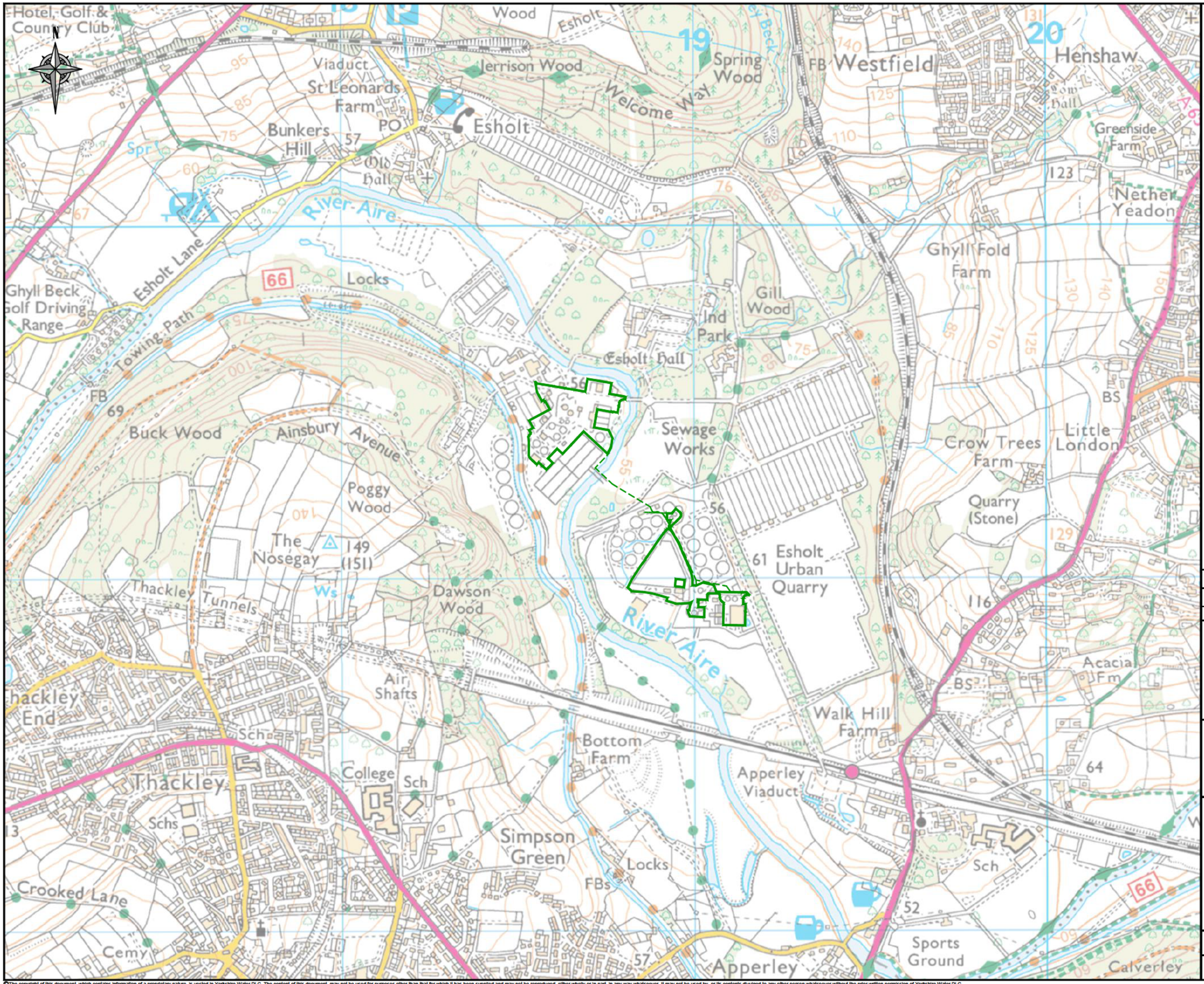
Summary of emissions abatement proposals

Sludge source	Proposed emissions abatement
Odour dispersion stack for sludge screen feed tank (OCU 1)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source.
Consolation tank 5	YW will install a fixed tank cover and extract and treat odour in a new OCU.
Odour dispersion stack for mixed sludge tanks (OCU 2)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source.
Sludge cake reception storage vessels	YW will connect the sludge cake reception storage vessels to an existing OCU (OCU 3).
SAS storage tanks (2 no.)	YW commit to • Undertake emission monitoring at these tanks (as minimum this will include H2S, ammonia, TVOCs and methane). The purpose of the monitoring is to confirm that emissions from these SAS tanks are consistent with low emissions measured at other YW sites. • Assuming low emissions can be confirmed, cover these tanks with floating plastic balls.
OCU 4 (SAS thickeners)	Single stage OCU in operation and no operational issues are reported. However, no monitoring data is currently available. An assessment of the effectiveness of this OCU will be carried out. YW will undertake any refurbishment work that may be required in order to ensure effective OCU operation.
SAS transfer tanks (2 no.)	YW commit to • Undertake emission monitoring at these tanks (as minimum this will include H2S, ammonia, TVOCs and methane). The purpose of the monitoring is to confirm that emissions from these SAS tanks are consistent with low emissions measured at other YW sites. • Assuming low emissions can be confirmed, cover these tanks with floating plastic balls.
Thickener liquor sump	YW will install a fixed tank cover and extract and treat odour in an existing OCU (OCU 4). Refer to proposed improvement programme.

Sludge source	Proposed emissions abatement
Centrate pumping station – raw sludge centrifuges	YW will install a fixed cover and extract and treat odour in an existing OCU (OCU 3).
Odour dispersion stack for THP feed silos and THP hopper (OCU 3)	YW will refurbish / reinstate this OCU to ensure effective treatment of odours from this source. .
Dispersion stack for degassing tanks	Existing tank air extraction to be routed to biogas system. Biogas from these tanks to be collected and utilised.
Dewatering feed tanks (4 no.)	Cover tanks with floating plastic balls. It is noted that digested sludge sources are inherently lower emissions generation potential and that these tanks are located a significant distance from the biogas system.
Liquor pumping station – Export centrate sump	YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.
Leachate pumping station	YW will install a fixed cover for this sump. It is noted that digested sludge sources have inherently lower emissions generation potential and therefore no emissions treatment is required.
Liquor balancing tanks (digested sludge liquor) (2 no.)	Cover tanks with floating plastic balls. It is noted that digested sludge sources are inherently lower emissions generation potential

Section IV: Figures

Figure 1 Site Location Plan



KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- INDICATIVE RETURN LIQUOR ROUTE

VERSION	DRWN	CHKD	REVD		DATE
B	MD	AW	ES	FOR PERMIT PLANNING	01.23
A	MD	SW	ES	FOR PERMIT PLANNING	06.21

YorkshireWater

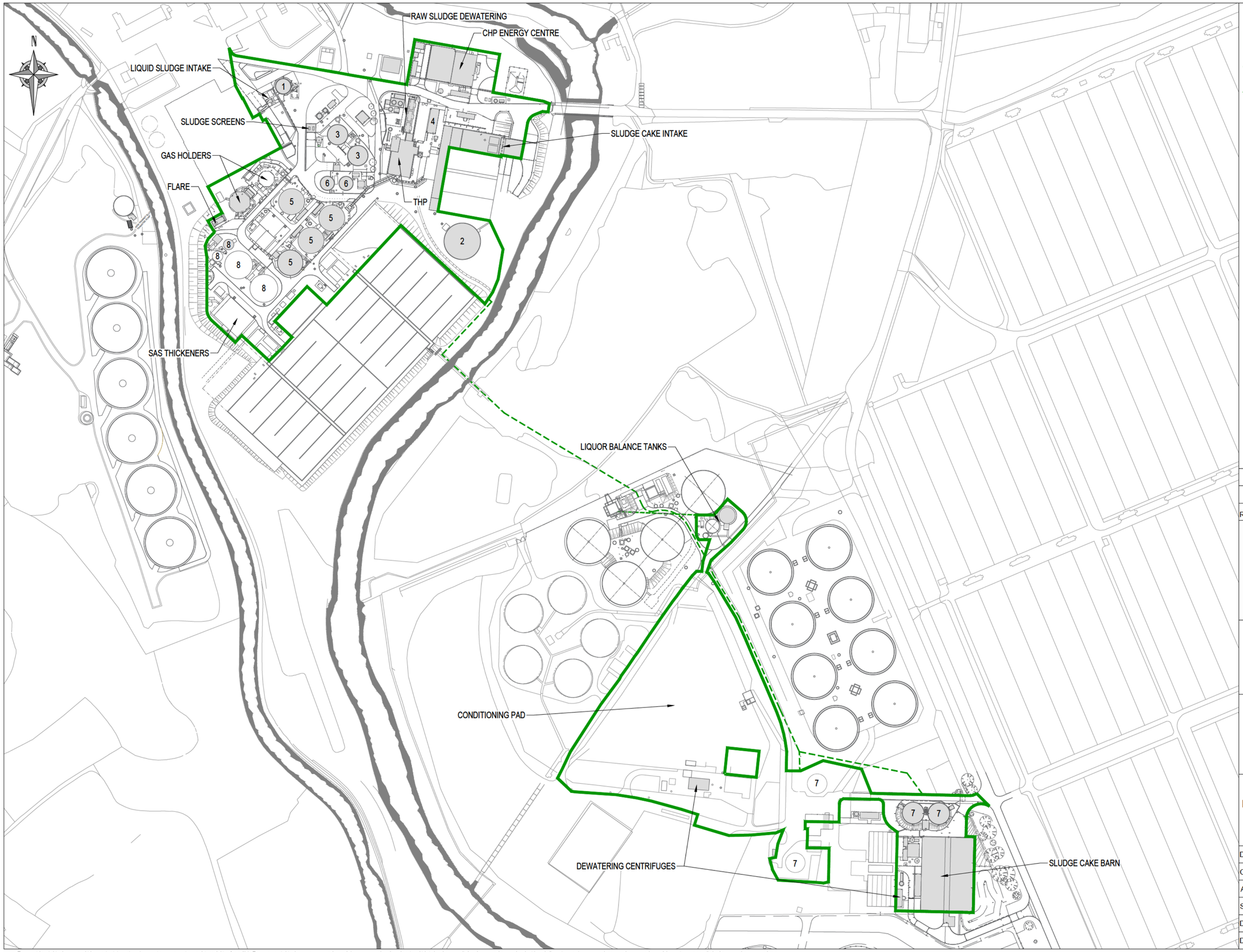
Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY

SCALE	SHEET SIZE
1:10,000	A3
DRAWING NUMBER: FIGURE 1 - SITE LOCATION PLAN	REVISION: B

Figure 2 Site Layout Plan



KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- INDICATIVE RETURN LIQUOR ROUTE

1	- SLUDGE SCREEN FEED TANK
2	- CONSOLIDATION TANK 5
3	- MIXED SLUDGE TANKS
4	- THP FEED SILOS
5	- ANAEROBIC DIGESTERS
6	- DEGASSING TANKS
7	- DEWATERING FEED TANKS
8	- SAS TANKS

Rev	Date	Drawn	Description	Ch'k'd	App'd
B	17.01.23	MWD	FOR PERMITTING	SW	ES
A	23.06.21	MWD	FOR PERMITTING	SW	ES

YorkshireWater

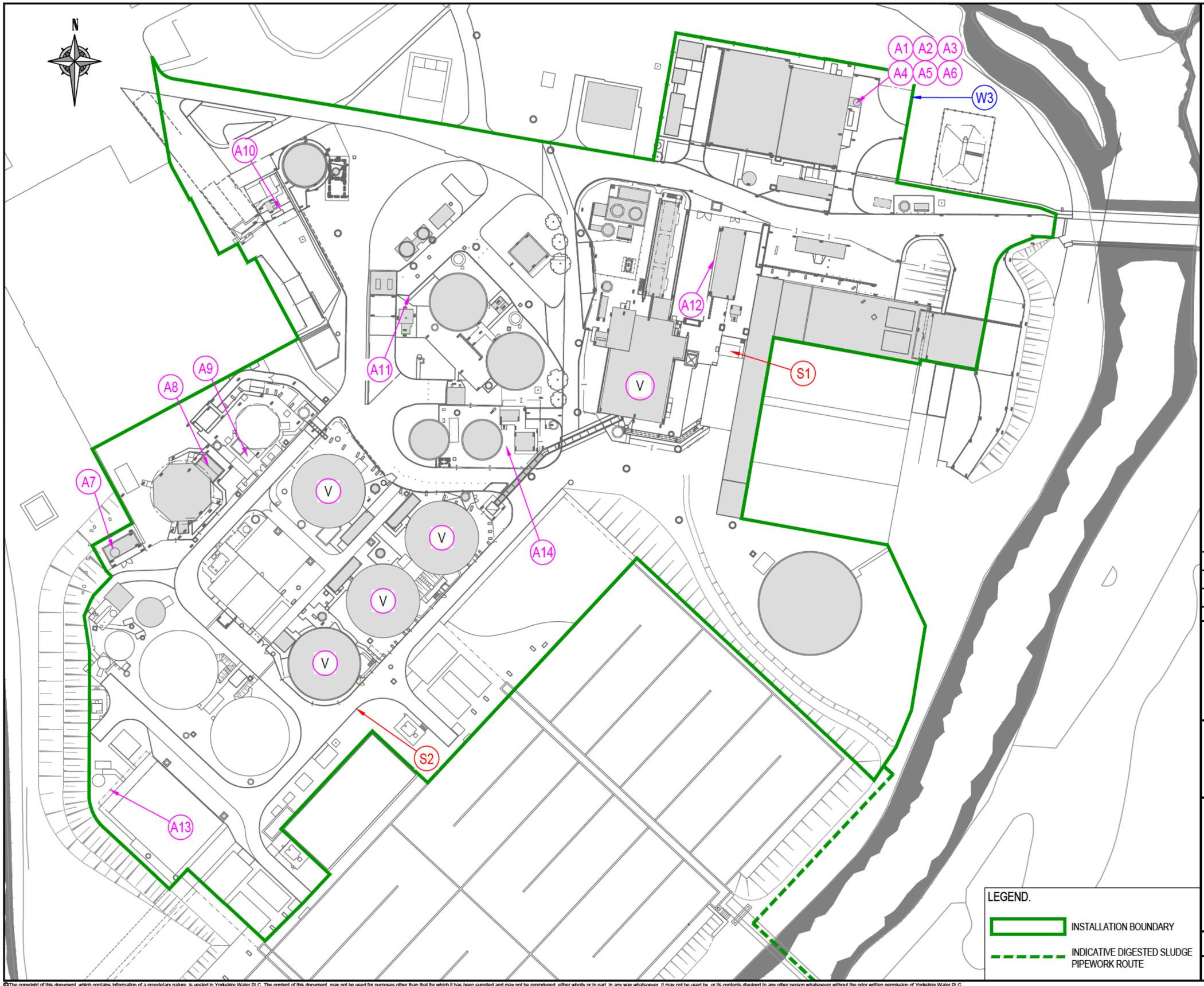
Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY INSTALLATION LAYOUT OVERVIEW

Drawn	MWD	17/01/2023	
Checked	SW	17/01/2023	
Approved	ES	17/01/2023	
Scale @ A2	1:2000	Paper Size	A2
Drawing Status	FOR PERMITTING	Rev	B
Drawing No.	FIGURE 2 - SITE LAYOUT PLAN		

Figure 3 Principal emission points



KEY.

- S1 DISCHARGE TO WwTW
- S2 DISCHARGE TO WwTW
- W3 ROOF WATER DISCHARGE
- A1 CHP 3
- A2 BOILER 1
- A3 CHP 4
- A4 BOILER 2
- A5 CHP 1
- A6 CHP 2
- A7 WASTE GAS BURNER
- A8 BIOGAS HOLDER 1
- A9 BIOGAS HOLDER 2
- A10 OCU 1
- A11 OCU 2
- A12 OCU 3
- A13 OCU 4
- A14 ODOUR DISPERSION STACK
- V PRESSURE RELIEF VALVES

LEGEND.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE

VERSION	DRWN	CHKD	REVD		DATE
C	MD	AW	ES	FOR PERMITTING	01.23
B	MD	SW	ES	FOR PERMITTING	11.22
A	MD	SW	ES	FOR PERMITTING	06.21

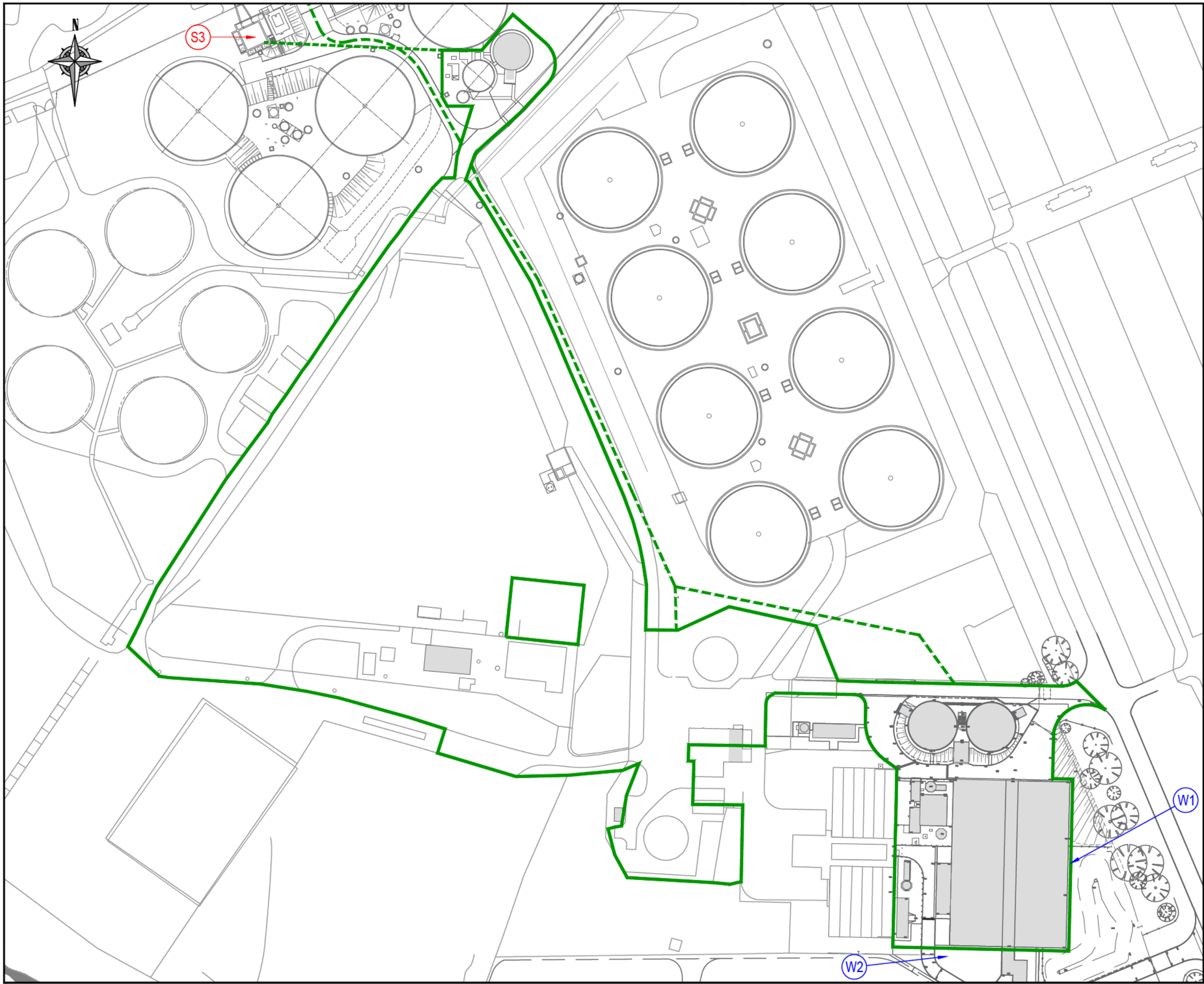
YorkshireWater

Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY
INSTALLATION LAYOUT SHOWING
PRINCIPAL EMISSION POINTS
SHEET 1 OF 2

SCALE	SHEET SIZE
1:1000	A3
DRAWING NUMBER	REVISION
FIGURE 3 - PRINCIPAL EMISSION POINTS	C



KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- INDICATIVE RETURN LIQUOR ROUTE
- S3 DISCHARGE TO WwTW
- W1 ROOF WATER DISCHARGE
- W2 ROOF WATER DISCHARGE

VERSION	DRWN	CHKD	REVD		DATE
C	MD	AW	ES	FOR PERMITTING	01.23
B	MD	SW	ES	FOR PERMITTING	11.22
A	MD	SW	ES	FOR PERMITTING	06.21

YorkshireWater

Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY
INSTALLATION LAYOUT SHOWING
PRINCIPAL EMISSION POINTS
SHEET 2 OF 2

SCALE	SHEET SIZE
1:1250	A3
DRAWING NUMBER	REVISION
FIGURE 3 - PRINCIPAL EMISSION POINTS	C

Figure 4 Drainage Plan

KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- PROCESS LIQUOR / DRAINAGE TO WwTW
- ROOF WATER
- S1 — DISCHARGE TO WwTW
- S2 — DISCHARGE TO WwTW
- W3 — ROOF WATER DISCHARGE

VERSION	DRWN	CHKD	REVD		DATE
C	MD	AW	ES	FOR PERMITTING	01.23
B	MD	SW	ES	FOR PERMITTING	10.22
A	MD	SW	ES	FOR PERMITTING	06.21

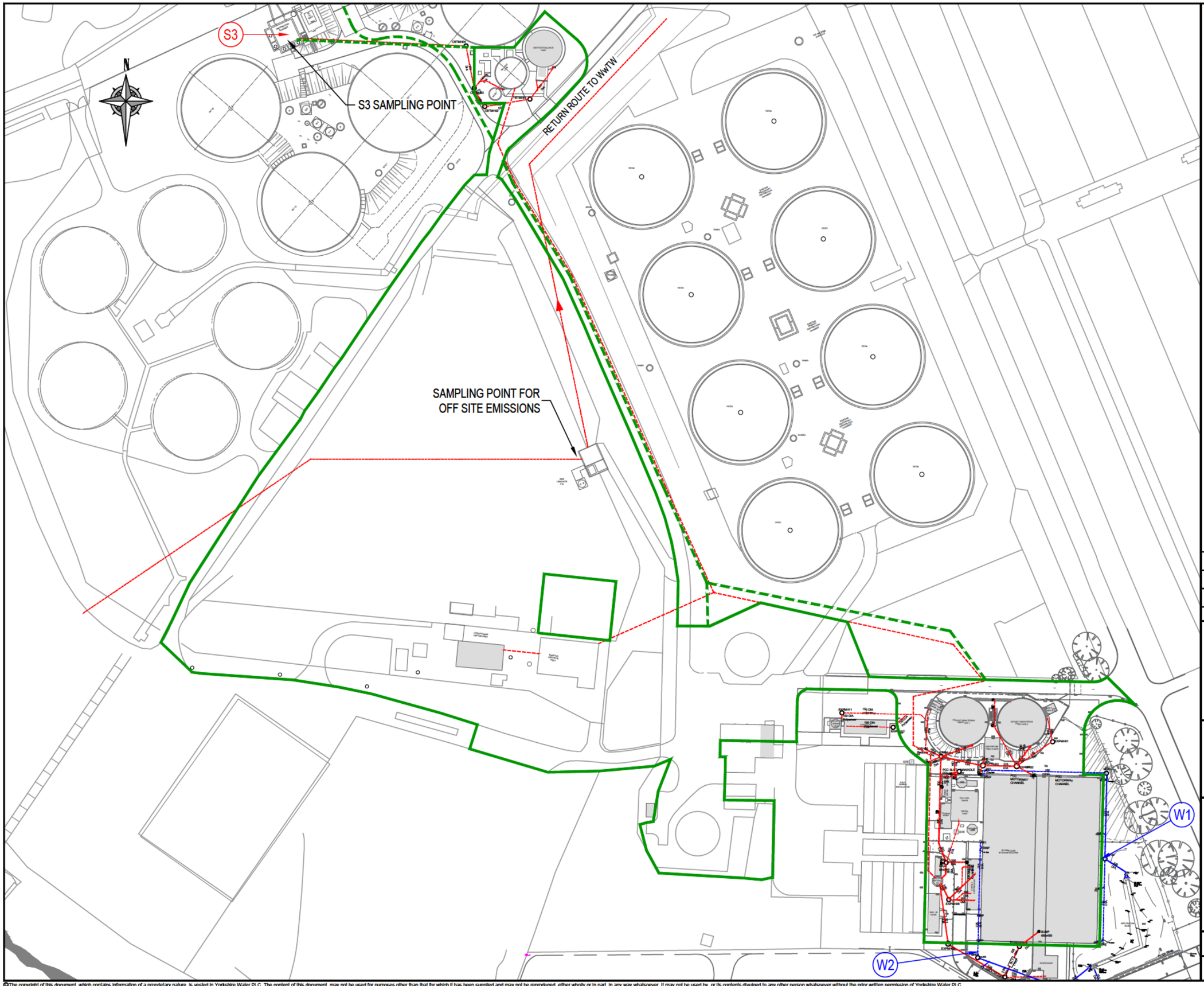
YorkshireWater

Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY
KEY DRAINAGE ROUTES
SHEET 1 OF 2

SCALE	SHEET SIZE
1:1000	A3
DRAWING NUMBER	REVISION
FIGURE 4 - KEY DRAINAGE ROUTES	C



KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- INDICATIVE RETURN LIQUOR ROUTE
- PROCESS LIQUOR / DRAINAGE TO WwTW
- ROOF WATER
- S3 — DISCHARGE TO WwTW
- W1 — ROOF WATER DISCHARGE
- W2 — ROOF WATER DISCHARGE

VERSION	DRWN	CHKD	REVD		DATE
C	MD	AW	ES	FOR PERMITTING	01.23
B	MD	SW	ES	FOR PERMITTING	10.22
A	MD	SW	ES	FOR PERMITTING	06.21

YorkshireWater

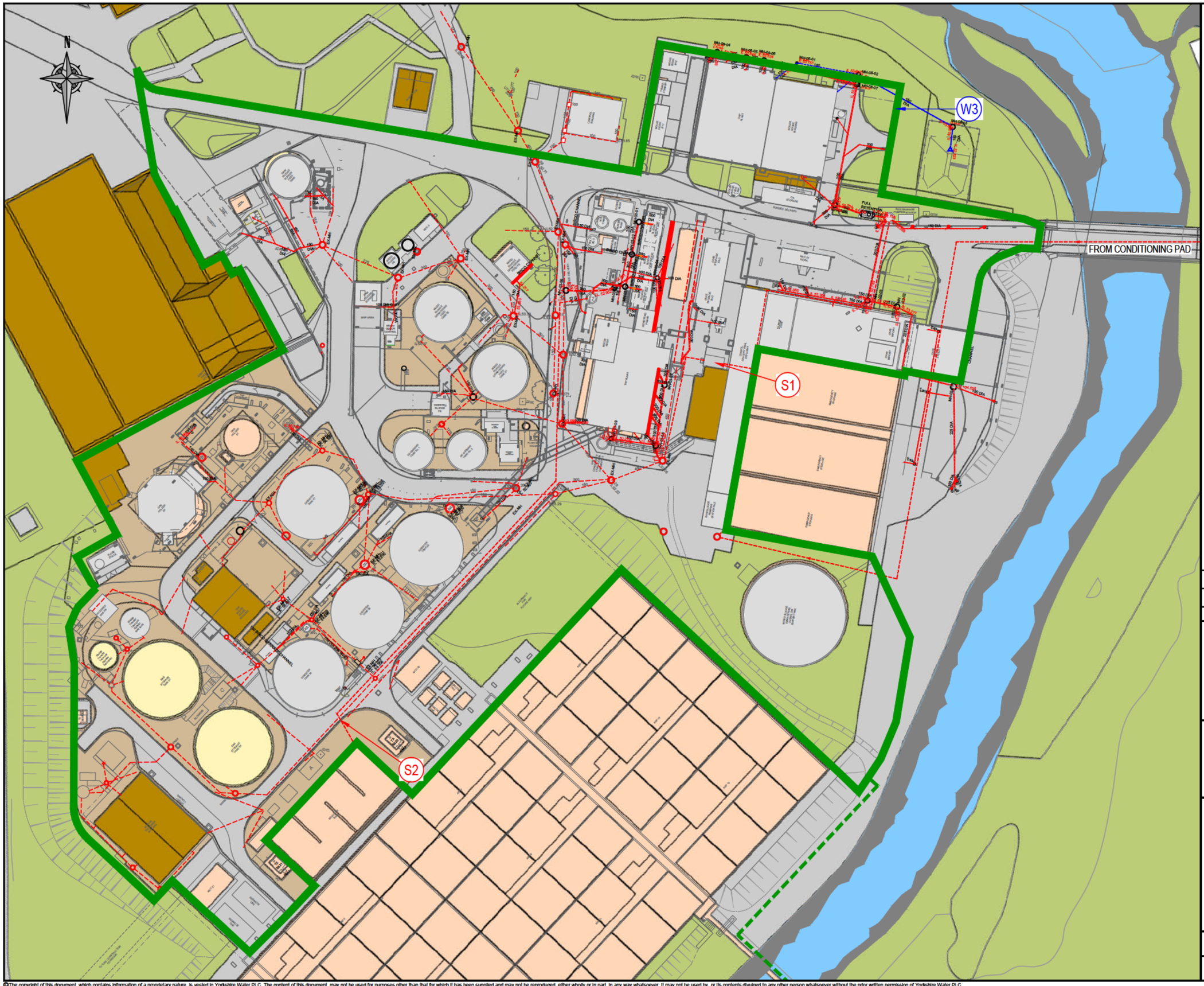
Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY
KEY DRAINAGE ROUTES
SHEET 2 OF 2

SCALE	SHEET SIZE
1:1250	A3
DRAWING NUMBER	REVISION
FIGURE 4 - KEY DRAINAGE ROUTES	C

Figure 5 Drainage and Surfacing



KEY.

- INSTALLATION BOUNDARY
- INDICATIVE DIGESTED SLUDGE PIPEWORK ROUTE
- PROCESS LIQUOR / DRAINAGE TO WwTW
- ROOF WATER
- IMPERMEABLE HARDSTANDING
- TANKS
- GRASS
- OTHER STF ASSETS
- LAGOON
- BUILDINGS

S1 DISCHARGE TO WwTW

S2 DISCHARGE TO WwTW

W3 ROOF WATER DISCHARGE

VERSION	DRWN	CHKD	REVD		DATE
B	MD	AW	ES	FOR PERMITTING	01.23
A	MD	SW	ES	FOR PERMITTING	07.22

YorkshireWater

Stantec

YORKSHIRE WATER SERVICES LTD
ENVIRONMENTAL PERMITTING

ESHOLT SLUDGE TREATMENT FACILTY
DRAINAGE & SURFACING
SHEET 1 OF 2

SCALE	SHEET SIZE
1:1000	A3
DRAWING NUMBER	REVISION
FIGURE 5 - DRAINAGE & SURFACING	B