

Non-Technical Summary: Application for a Local Enforcement Position to operate prior to a permit variation being issued for a bespoke Installation permit at Attleborough AD Plant

Eco Verde Energy Limited

**Attleborough AD Plant, Ellingham Road, Attleborough, Norfolk,
NR17 1AE**

Prepared by:

Emily Shann Pitts, BSc (Hons), MIEMA, CEnv

Anna Becvar, BSc (Hons), MI Soil Sci, C Sci, FACTS FE/414

ETL573/2021

Earthcare Technical Ltd
Manor Farm
Chalton
Waterlooville
Hants PO8 0BG

Tel: 02392 290 488

emily@earthcaretechnical.co.uk



anna@earthcaretechnical.co.uk

04 March 2022

QUALITY CONTROL

Document Title:	Non-Technical Summary: Application for a Local Enforcement Position to operate prior to a permit variation being issued for a bespoke Installation permit at Attleborough AD Plant
Revision:	V1.0
Date:	04 March 2022
Document Reference:	ETL573/ NTS LEP Request Attleborough AD
Prepared For:	Eco Verde Energy Limited
Project Reference:	ETL573/2022
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Document Author	Emily Shann Pitts	
Quality Reviewer	Anna Becvar	

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1. Introduction

- 1.1. This Non-Technical Summary has been prepared by Earthcare Technical Ltd (ETL) on behalf of Eco Verde Energy Limited. It is in support of a request for a Local Enforcement Position (LEP) to seed and operate the new food waste fed AD extension to the existing permitted Crop fed AD Plant, including the use of resultant biogas, at Attleborough AD Plant, Ellingham Road, Attleborough, Norfolk, NR17 1AE herein termed 'the Site'.
- 1.2. An application to vary the existing standard rules installation permit (SR2012No9) to a bespoke installation permit to facilitate the use of the new food waste AD plant was submitted to the Environment Agency on 27 August 2021. The application, at the time of writing, has not been Duly Made.
- 1.3. The information within this report details the measures in place to control the proposed activities thus supporting the case for commencement of operations prior to determination of the permit variation application.
- 1.4. The plant will be operated by Eco Verde Energy Limited (EVE), herein termed 'the Operator' on behalf of Attleborough Eco Electric Limited and Attleborough AD Plant Ltd, the owners of the existing AD plant and new AD plant areas of the site respectively.
- 1.5. Commissioning of the AD plant will be carried out by BioConstruct GmbH who have built the new site extension. The site operation will be overseen by EVE. Tom Thornton remains the site manager and Technically Competent Manager (TCM) for the Crop-AD part of the site and will work in conjunction with Flavio Ascenco who will be the TCM dedicated to the Waste-AD part of the site. Both hold the correct WAMITAB qualification for their TCM roles.
- 1.6. The original permit for the site was a Standard Rules Waste Operation permit (SR2010No16) issued to S.S Agri Power Limited in November 2012 (EPR/BB3931RA). In October 2015 a variation notice was issued to vary the permit to a standard rules installation permit (SR2012No9). In May 2020 a varied permit was issued to reflect the company name change to Attleborough Eco Electric Limited.
- 1.7. The existing infrastructure for the on-farm AD plant herein termed the 'Crop-AD Plant', includes silage clamps, two feeders, two primary digesters, a secondary digester, a separator, a covered digestate storage lagoon, a flare and a combined heat and power engine (CHP). The Mississippi Dryer, boiler and dirty water lagoon are all being decommissioned. The dirty water lagoon is to be replaced.
- 1.8. The permit variation submitted is to vary the permit to a bespoke installation permit to reflect the addition of land to the permitted area for a food waste anaerobic digestion facility including a building for food waste reception and processing and digestate separation and fibre storage, pasteurisers, three primary digesters and a secondary digester, covered digestate lagoon, surface water lagoon, new dirty water lagoon, gas upgrade equipment, grid entry unit, back-up boiler and a duel fuel flare. The new infrastructure for treating food waste and the resultant biogas is herein termed the 'Waste-AD Plant'.
- 1.9. The Crop-AD plant will operate separately to the new Waste-AD plant with respect to feedstocks, digestate and biogas management however the CHP will provide heat and power

for both AD plants. There is a single secondary containment system built to CIRIA C736 standard around all the tanks. The design considers the requirements of Animal by Product Regulations such that any spillages within the area will be treated within the Waste-AD process by default. The Secondary containment is to be completed prior to seeding of the AD Plant taking place.

- 1.10. The CHP is a MVM V16, rated power (electrical) of 1,560KWe. The thermal input power is 3,786kWth. The CHP was put into operation before 20th December 2018 and is therefore classified as 'existing' with respect to the Medium Combustion Plant Directive.
- 1.11. The application also includes a permit transfer application to change the operator from Attleborough Eco Electric Limited to Eco Verde Energy Ltd. It is also requested to change to name of the site to 'Attleborough AD' as the site name 'Crows Hall AD' on the current permit is no longer used. The permit transfer is currently being undertaken by NPS at time of writing.
- 1.12. Basic pre-application advice was sought from the Environment Agency with respect to this new permit application (Reference EPR/XP3009MH/A001) to ensure that all the relevant supporting documents were provided. Enhanced pre-application advice was not available at the time.
- 1.13. A full Environmental Risk Assessment has been carried out and is provided in Appendix A of the Environmental Management System (EMS) Manual (**ATT-OD-01**) which accompanies this LEP application.

2. Overview

- 2.1. The entire site, comprised of the Crop-AD Plant and Waste-AD Plant is situated approximately 490m northwest of the town Attleborough, Norfolk. A tributary of the River Thet and the A11 trunk road run between the site and the town. The site is accessed via an approximately 600m trackway which runs adjacent to residential properties and St Luke's Hospital and enters the site from the north. The Site Location is shown in Figure 1 - Site Location Plan.
- 2.2. The new Waste-AD Plant is located on an area of land that was occupied by one turkey shed from the adjacent turkey breeding farm and an open storage yard area. Full details of the previous land uses, and site condition can be found in the Site Condition Report which supports the permit application.
- 2.3. The original planning permission for the Attleborough AD plant was obtained on 7th November 2012. The site was built and fully commissioned in 2013.
- 2.4. On the 10th of August 2020, Norfolk County Council granted permission for the expansion of the existing AD plant to increase the maximum throughput to 129,000 tonnes per annum and to include additional tanks and gas upgrade equipment, principally for the Waste-AD plant.
- 2.5. The activity is classified as an 'Installation' and therefore the requirements of the Industrial Emissions Directive apply, since the anaerobic digestion plant has a treatment capacity of more than 100 tonnes per day. The proposed operation will not meet the rules for the

equivalent Standard Rules permit for food waste (SR2012 No11) as the site is within 200 metres of sensitive receptors.

- 2.6. The Environmental Risk Assessment (Appendix A of the EMS Manual (**ATT-OD-01**)) is based upon the generic risk assessment for SR2012 No11. The additional hazards and risks associated with the proximity of sensitive receptors have been considered within the Environmental Risk Assessment.
- 2.7. The proposed Schedule 1 Listed Activity is S5.4 Part A(1)(b)(i)) *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)*. The proposed Directly Associated Activities are detailed in the supporting Permitted Activities document.
- 2.8. The process is depicted in a Process Flow Diagram included as Appendix A of this document. A full process description is provided in Section 5 of the EMS Manual (**ATT-OD-01**) which accompanies this permit application.
- 2.9. The feedstocks for the existing Crop-AD plant are energy crops namely maize and rye silage in addition to silage effluent and dirty water generated on the Crop-AD site.
- 2.10. The feedstocks for the new Waste-AD plant are solid and liquid food wastes. To future proof the operation in terms of feedstock supply, the permit application includes the full list of permitted waste codes found in Appendix B of the Anaerobic Digestion Quality Protocol. These are listed in the supporting Permitted Activities document.
- 2.11. The Crop- AD plant will continue to process in the region of 30,295 tonnes per year of agricultural feedstocks, operating in the thermophilic temperature range.
- 2.12. The Waste-AD plant will process in the region of 90,950 tonnes per annum of solid and liquid food waste, operating in the mesophilic temperature range. The permit application (Part C3) is for 100,000 tonnes per annum in order to future proof the operation for improved process efficiencies. The Waste-AD plant may process more than 10 tonnes per day of animal wastes.
- 2.13. Biogas will be upgraded to biomethane and exported to the National gas network, via a new grid connection. There will be one CHP which will provide the heat for both the AD plants and is already in operation on the Crop-AD site. There will be a back-up boiler which will be used if additional heat is required for the process, should the CHP be down.
- 2.14. The existing site infrastructure (Crop-AD) comprises:
 - Access road
 - Weighbridge
 - 2 x silage clamps (30,000 tonnes capacity total).
 - 2 x solids feeder (20 tonnes capacity each)
 - Mixing pumps
 - 2 x primary digesters (2,000m³ each)
 - 1 x secondary digester (1,500m³)
 - 1 x screw press separator, buffer tank and associated fibre storage bay
 - Gas compressors

- 1 x carbon filter prior to combined heat and power engine (CHP)
- 1 x CHP (1,560kW_e)
- 1 x boiler
- Emergency flare (for Crop-AD plant)
- Heat exchangers
- Control room / site office
- Dirty water lagoon
- Covered digestate storage lagoon (10,000m³)

2.15. The proposed infrastructure comprises:

- 3 x Primary digesters (26.00mØ) 3,823m³ working capacity
- 1 x Secondary digester (26.00mØ) 3,823m³ working capacity
- Technical Building
- Pre-Storage Tank (10.00mØ) 424m³ working capacity
- 3 x small pre-storage tank (3No. @ 3.50mØ) 67m³ working capacity
- 3 x Pasteurisation tanks (30m³ each.)
- Oxygen generator
- Switchboard room
- Weighbridge office
- Site office
- Weighbridge
- Very Small aperture terminal (VSAT) for satellite communication
- Grid Entry Unit (GEU)
- Propane tanks
- Gas upgrading unit
- Back-up boiler
- Heating Buffer Tank
- Switchboard Container
- Gas Processing Unit (GPU)
- Active Carbon Tanks (2No.)
- Reception Building (30.20m x 45.20m) containing:
 - CentriAir air handling and odour abatement system
 - depackaging bunker (30 m³)
 - depackaging plant
 - RUNI Packaging compactor
 - feeding system (60 m³)
 - mixing pit (8m x 6m x 3m (d)) 100 m³
 - water tank (Ø 3 m 7,70 m) 67 m³
 - storage bay (8m x 19m 3m(h)) 456 m³
 - storage bay (10m x 7.5m x 3m(h)) 225 m³
 - sumps (9 No. for Reception Hall and 1 No. deep sump)
- Ferric chloride storage tank (20 m³)
- Dual Fuel Flare with 10.0m Exclusion Zone (for Waste-AD plant)

- Covered Waste-AD plant digestate Lagoon (10,000m³)
- Containment Sumps (7 No. perimeter shallow, 1 No primary)
- Bund Gate (1No.)
- LV Switchboard
- Emergency backup generator
- Condensate Pit
- 1 No. Silage effluent tank (19.8m³); below ground with leak detection
- Replacement covered dirty water lagoon (175m³)
- Surface water lagoon (936m³)

2.16. Changes to the existing infrastructure as a result of ongoing site upgrade works:

- Existing dirty water lagoon taken out of service and replaced
- Mississippi dryer taken out of service
- Flare for Crop-AD to be repositioned
- CHP to be repositioned
- Pipework for existing plant (except services) to be repositioned above ground
- Shute from Crop-AD separator to storage to be covered
- Crop-AD fibre storage bay to contain a covered trailer

2.17. The proposed site layout is shown on Figure 4 - Proposed Site Layout.

2.18. The existing Crop-AD site and associated on-site infrastructure is approximately 2.4 hectares (5.8 acres) in extent. The proposed permit variation is to extend the current site footprint to create a regulated facility with an area of 5.1 hectares (12.6 acres) to encompass all the new proposed infrastructure as detailed above.

3. Commissioning

- 3.1. A commissioning plan has been prepared consisting of an Excel spreadsheet providing key actions and dates for commissioning the Waste-AD plant is provided with this LEP request (**Start Up Plan Attleborough 220228**) and a safe start up procedure (**Safe Start Up Process Attleborough 220217**). Key dates and actions for the LEP requested are summarised below.
- 3.2. The Operator requests they may commence commissioning on the 4th of April 2022 by gradually introducing c.a. 4,200 m³ of cold digestate, sourced from the existing Attleborough crop-AD Plant and/or other AD Plants within the vicinity. This cold non-waste digestate will be used to condition the concrete within 2 No. primary digester and 1 No. secondary digester tanks and 1 No. primary tank to be initially used for end storage of digestate, termed the 'end store'. The End store will be used for initial food waste digestate storage whilst the additional 10,000 m³ onsite digestate lagoon is constructed.
- 3.3. Warm biologically active inoculum digestate will be fed to the digesters from 11th April 2022, in total c.a. 4,100 m³ will be fed over the commissioning period. This will be preferentially taken from the crop-AD digesters on site and imported from other AD plants in the vicinity if required, it would be advantageous if waste biologically active digestate may be used.
- 3.4. The first digester will be gradually warmed from 4th April 2022 followed by the other tanks whose warming, and seeding will be staggered by 1-3 days. The first digester will reach a mesophilic temperature of 38-40°C during this process around 14th April 2022.
- 3.5. The Operator requests that food and industrial waste may be fed to the digesters from 18th April 2022. All waste will be subject to pre-acceptance checks procedures (**EVE-SOP-08**) and Waste acceptance and rejection as well as Waste loading and management procedures (**ATT-SOP-11** and **ATT-SOP-12**) on receipt. Details on the sources of waste will be supplied for approval to the EA prior to use.
- 3.6. This is to establish the correct microbiological population within the tanks to produce biogas of sufficient quality to be sampled, week commencing 16th May 2022, and injected to the gas grid to achieve the Green Gas Support Scheme date of 31st May 2022. The Operator therefore requests that the food waste depackaging equipment be commissioned week commencing 18th April 2022 and food and industrial waste may be fed to the digesters from 18th April 2022.
- 3.7. Initially the tank air will be displaced as the tanks are filled and purged to air via the Pressure Relief Valves (PRVs), it will not be of sufficient quality to flare at this time. The flare will be commissioned week by 25th April 2022 to burn biogas as soon as it is of sufficient quality to be burned generated during the start of the feeding process. The PRVs will then release at higher set pressures than the flare thus minimising the release of unburnt biogas during commissioning.
- 3.8. This Non-Technical Summary highlights the key control measures that will be employed to minimise any impacts from the commissioning and operation of the Waste-AD plant and signposts the reader to the key supporting documents.

4. Key Sensitivities

- 4.1. Human receptors within 1 km of the site are captured in Table 1 below and are shown in Figure 6 – Human Receptor Plan.

Table 1 Human Receptors within 1 km of the site

ID	Location	NGR X	NGR Y	Distance from Site boundary (m)	Direction from Site
H1	Crowshall Veterinary Services	603479	295790	64	NE
H2	Stuart House	603530	295863	135	NE
H3	Houses at Cakes Hill	603486	295927	200	NE
H4	Crowshall Lane	603463	296047	320	NE
H5	Ellingham Road	603296	296176	399	N
H6	Suggit Farm Serv	603174	296152	402	N
H7	St Lukes Hospital	603013	296096	408	N
H8	Cades Hill Farm	602860	296089	492	NW
H9	Shrugg's Lane	602783	295883	440	NW
H10	Lyng Farm	602487	295286	830	SW
H11	WwTW	602861	295200	527	SW
H12	Houses along West Carr Road, Workhouse Common	603119	294819	720	SW
H13	Carver's Lane, Attleborough 1	603528	294910	623	S
H14	Carver's Lane, Attleborough 2	603583	295146	416	S
H15	Carver's Lane, Attleborough 3	603683	295248	343	S
H16	Chapel Road, Attleborough	603966	295468	375	SE
H17	Houses in Baconsthorpe	604061	295923	550	E
H18	Ash Farm	603151	296756	994	N

- 4.2. The site is situated over a Secondary A superficial aquifer and a principal bedrock aquifer. Groundwater vulnerability is classified as medium risk. However, the site is not within a Groundwater Source Protection Zone nor is it within a Drinking Water Protected Area or Safeguard Zone.¹
- 4.3. The site is situated in a location which has a low probability of flooding.²
- 4.4. The site is within a Nitrate Vulnerable Zone.
- 4.5. There are watercourses within proximity to the site. There is a drain which runs to the west of the site access road and is approximately 13m of the permitted site boundary. There is a small watercourse adjacent to the southern boundary of the site which is approximately 35m from the Reception Building. The River Thet runs approximately 200m south of the site in a south westerly direction.¹

¹ <https://magic.defra.gov.uk/MagicMap.aspx> Accessed 1st March 2022

² <https://flood-map-for-planning.service.gov.uk> Accessed 1st March 2022

- 4.6. The only nature and heritage conservation site within the relevant screening distance to the site is Norfolk Valley Fens Special Area of Conservation, which is 2.7 km southwest of the site, within the 10km screening distance.
- 4.7. The following Sites of Special Scientific Interest (SSSi) fall outside the relevant screening distance of 2km:
- Swangey Fens SSSI) 2.7 km southwest of the site; and
 - Old Buckenham Fen SSSI 3.7km to the south of the site.¹
- 4.8. Impacts from the regulated facility on designated nature and conservation sites are assessed in the Air Quality Impact Assessment (impacts of emissions to air) and the Environmental Risk Assessment (impacts of emissions to surface water).
- 4.9. Full details of Environmental Sensitivities can be found in Section 4 of the EMS Manual (**ATT-OD-01**).

5. Management

- 5.1. The site will be operated by EVE, who manage several AD plants nationwide. There is a Site Manager who is responsible for the day-to-day operation of the AD plant and who also acts as the Technically Competent Manager. Under a new staff structure there will be two Site Managers, one focussed on the Crop-AD, and one focussed on the Waste-AD but who will work together to manage four Site Operatives in addition to a Weighbridge Operator to assist in day-to-day operations.
- 5.2. The Site Manager is managed and supported by the wider EVE team which includes the EVE Operations Director, Health, Safety and Environment Director and Manager, the Operations Support Manager and the Feedstock Manager. Roles and responsibilities are summarised in the Staff Organogram (Appendix B) and are detailed in Section 10 of the EMS Manual (**ATT-OD-01**).
- 5.3. There is a contract in place with Ellough Feedstocks Limited to supply all the crop feedstocks and off-take of all digestate produced to be applied to land for agricultural benefit. Waste feedstocks will be sourced by the EVE Feedstock Manager.
- 5.4. The EMS Manual (**ATT-OD-01**) forms part of the permit application and has been developed by ETL in conjunction with EVE. The management system documents to which the EMS Manual refers including management plans, policies and procedures have been developed by EVE and ETL. The Master Document Control File (**EVE-OD-03**) details the documents within the management system, including EVE companywide documents.
- 5.5. There is a full set of operational documents in place for the Crop-AD Plant. There is a set of operational procedures in place for the Waste-AD Plant which will be finalised and trained out to staff prior to the Waste-AD plant commencing operations. These are listed in Section 9, Table 2 of this document. All procedures will be subject to ongoing development and review.

6. Control of Emissions to Land and Water

Crop-AD Plant

- 6.1. The two silage clamps have a concrete / asphalt composite base and concrete walls running longitudinally. The silage clamps are pre-existing and permitted. Clamp surfacing and drainage are under improvement works as part of wider site improvements.
- 6.2. Leachate produced in the clamps drains to an underground sump and from there it is pumped to a below ground silage effluent tank (19.8m³). The leachate tank is below ground but has an opening at surface level. It is constructed of reinforced concrete with all internal walls lined with MDPE and leak detection monitoring points around the tank, extending 1.50m below the base.
- 6.3. A high-level overflow leachate gravity pipe is to discharge water to the adjacent dirty water pond in circumstances where there is no requirement for the leachate water to be used in the process. Otherwise, the leachate tank will discharge via a pumped above ground route to the process area, to be utilised within the various storage tanks, where deemed applicable during site operations.
- 6.4. The three digesters are concrete construction tanks built by FLI Energy which were pressure tested upon commissioning.
- 6.5. The digestate storage lagoon is lined and has a floating cover. Recent maintenance and survey work has shown the lagoon capacity to be 10,000m³.
- 6.6. The 175 m³ capacity lined and covered dirty water lagoon contains dirty water collected from the Crop-AD feeders and silage clamp concrete aprons. Collected dirty water is contained for use within the process and if during a heavy rainfall event storage capacity is on the point of being reached it may be pumped to the Crop-AD digestate storage lagoon for contingency storage.

Waste-AD Plant

- 6.7. The three small Pre-Storage tanks (PST 2-4) are made of vinyl ester resin comprising a chemical barrier layer and structural layers and will be supplied complete, with mixers. A tank integrity CQA report has been provided in support of this LEP (**24727 - Anaerobic Digestion Process Tanks Construction Detail Report**).
- 6.8. The large main pre-storage tank (PST 1), the two primary digesters (DG1-3), post fermenter (PF) and End store (DG2) are all manufactured by Wolf and are made of monolithic reinforced concrete (in-situ) and supplied complete installed with mixers. The roofs are made from a double-membrane gas tight cover manufactured by Baur Folien GmbH.
- 6.9. The mixing pit in the Reception Building is a sub-surface pit constructed of in-situ reinforced concrete. In accordance with advice from drainage consultant Plandescil Ltd a chemical resistant coating will be applied to all internal mixing pit walls, base slab, and sump pit. Coatings and sealants will be inspected and reapplied periodically.

- 6.10. The digestate storage lagoon to be constructed is lined, has leak detection and a floating cover with a storage capacity of 10,000m³.

Secondary Containment

- 6.11. The Crop-AD plant did not previously benefit from secondary containment. As part of the current improvement and expansion works a concrete secondary containment system has been retrofitted around the Crop-AD plant and built around the new Waste AD plant.
- 6.12. Plandescil Consulting Engineers were contracted to design the site secondary containment in accordance with the relevant guidance (CIRIA C736). The Containment Bund Design report that supports their design is Appendix C.
- 6.13. The containment capacity is designed in accordance with CIRIA C736, with the calculations demonstrating 25% of the combined volume to be a greater volume than 110% of the largest tank volume (shown on the calculation spreadsheet within the containment report). The proposed footprint of the containment area allows for the walls to be constructed to a minimum height of 1.75m, which includes 250mm freeboard capacity as per page 85 of CIRIA C736.
- 6.14. All pipes, ducts and cables are fixed on cable trays and stanchions positioned above the concrete containment, to not penetrate the containment floor or walls. This has been designed in accordance with CIRIA C736 to ensure any potential leakages are visible to onsite, operational staff whilst carrying out daily inspections of the containment bund structure.

Drainage

- 6.15. This section provides a summary of the drainage which should be read in conjunction with the Drainage Process Flow Diagram, in Appendix E.
- 6.16. Under the current drainage arrangements for the Crop-AD plant all water on site is treated as dirty water and drains to an underground sump and then to the dirty water lagoon.
- 6.17. As part of the Crop-AD site improvement works the existing dirty water lagoon is to be removed and clean and dirty water handling on site improved with the installation of one new 19.8 m³ leachate tank for silage leachate and a covered dirty water lagoon to collect dirty water from the apron between the clamps and the feeders. Silage leachate can be fed directly to the Crop-AD process or may enter the dirty water lagoon if additional storage capacity above the 18.3m³ provided is required.
- 6.18. The digestate offtake point on the Crop-AD plant from the dedicated lagoon will be improved, with improvements made to the concrete apron and sump for collection of any spillages during digestate offtake.
- 6.19. On the Waste-AD side the entire drainage system for the Reception Building is designated dirty.
- 6.20. Water collecting within the secondary containment will be quality assessed daily in accordance with the Secondary Containment Checking & Emptying Procedure (**ATT-SOP-14**).

- 6.21. If the visual and olfactory checks confirm that there have been no spillages, then the water will be pumped out to the surface water lagoon as clean water. Should there be any doubt regarding water quality then the water will be pumped to the Waste-AD plant for treatment in the Waste-AD process. The source of the contamination will be immediately investigated, and steps taken to resolve.
- 6.22. Condensate from the Crop-AD and Waste-AD plants is collected separately in condensate pits and then recirculated for treatment within the primary digesters of the relevant digestion process.
- 6.23. Underground tanks and pipes have been avoided in the design of the Waste-AD where possible. The majority of pipework will be above ground. The underground pipe carrying waste digestate liquor from the separator in the Waste Reception Building to the waste digestate storage lagoon will be partially underground and, in this section, will have a pipe in pipe design. There will also be a flow meter installed on this pipe.
- 6.24. Whilst the Waste digestate lagoon is to be constructed one of the Primary digester tanks (DG2) will be used as a digestate end store.
- 6.25. All underground pipework for gas or substrate will be pressure tested at 1.5 times the operating pressure prior to commissioning. After commissioning there will be pressure testing carried out every 5 years. There will be a programme of daily and weekly inspections in place for the leak detection systems onsite. Upon completion of current expansion and improvement works there will be an as built drawing showing the route of all sub-surface drains.
- 6.26. Plandescil Consulting Engineers were contracted to design the site drainage in accordance with best practice and industry guidance. The Drainage Design report that supports their design is Appendix D.

7. Control of Emissions to Air

- 7.1. The emission points to air 1-13 inclusive are shown on Figure 3 - Emission Point Plan.
- 7.2. The control of emissions from the combined odour abatement stack (Emission Point 1) is discussed under Control of Amenity Impacts (Section 7).
- 7.3. The control of emissions from the CHP stack (emission point 7) is primarily through planned preventative maintenance and inspection of the engine which is carried out by a specialist third party contractor (GenV).
- 7.4. The emissions from the two flares onsite and the pressure release valves (PRVs) will be controlled through process monitoring and management of biogas production. The AD plant feeding regime will be varied to optimise biogas production and load to the CHP and upgrade plant. Matching production to use correctly ensures that the production of excess biogas and hence emissions of raw biogas through the PRVs and use of the flare is minimised. The PRVs will release at higher set pressures than the flare on both the Crop-AD and Waste-AD Plants. Therefore, emissions of raw biogas will be minimised. Control of gas pressures is described in detail in the BAT Assessment which supports this application (BAT 8, BAT 15 and Indicative BAT requirements for biogas treatment (AD TGN)).
- 7.5. The dual fuel flare for the Waste-AD Plant is a BAT compliant, high temperature, ground enclosed flare. The flare for the Crop-AD Plant is not BAT compliant. On the Crop-AD side, the biogas flare is a ground- enclosed flare which has an ignition temperature of 700°C which is below the 1,000°C stated as Indicative BAT for a waste installation. A derogation from BAT has been stipulated in the Section 3 (Conclusions and recommendations) of the BAT Assessment. This flare will burn biogas from the crop derived feedstocks only.
- 7.6. The flares will only be used during abnormal operations and will be subject to planned preventative maintenance.
- 7.7. The back-up boiler (emission point 9) will only be used periodically during abnormal operations when the CHP is down for prolonged periods. It will be subject to planned preventative maintenance.
- 7.8. The emergency generator (emission point 13) will only be used infrequently during abnormal operations and will be subject to planned preventative maintenance.
- 7.9. Fugitive emissions to air will primarily be controlled through the covering of the silage clamps on the Crop-AD with an impermeable cove and covering of the dirty water and digestate lagoon, with fibre digestate collected to a covered trailer. They will be controlled on the Waste-AD through the storage and treatment of waste within a Reception Building with air handling system and the covering of the digestate storage lagoon.
- 7.10. The Air Quality Assessment (ETL573/AQA/V1.0/Attleborough) which accompanies this application provides a full assessment of potential impacts of emissions to air from the proposed operation upon nearby human and ecological receptors, within the relevant screening distance.

8. Control of Amenity Impacts

- 8.1. As previously noted, the Environmental Risk Assessment (Appendix A of the EMS Manual (**ATT-OD-01**)) is based upon the generic risk assessment for SR2012 No.11. The additional risk factors which determined the need for a bespoke permit, namely the proposed tonnages of waste feedstocks and the proximity of sensitive receptors within 200m have been considered within the Environmental Risk Assessment.
- 8.2. The primary control of odour is at source:
- Silage clamps will be covered and only exposed for removal of feedstocks.
 - All waste feedstocks will be stored and treated within the Reception Building which benefits from a bespoke air handling and odour abatement system.
 - The digestate storage lagoon and the dirty water lagoon will be covered.
- 8.3. Waste derived digestate will be separated and the fibre stored within the Reception Building. On the Crop-AD side, the fibre digestate is not produced or stored inside a building. However, the proposal is that the fibre will fall from the separator via a covered chute into a covered trailer to reduce odour emissions from the digestate fibre. The odour potential of the digestate Crop-AD fibre digestate will be controlled through the limitation of crop-only feedstocks; manure feedstocks which can lead to elevated ammonia emissions from digestate will not be used. In addition, process monitoring, and management is in place to ensure that a stable digestate is produced with a low odour potential. A derogation from BAT has been stipulated in the Section 3 (Conclusions and recommendations) of the BAT Assessment.
- 8.4. Odour emissions from the combined odour abatement stack (emission point 1) will be controlled via adherence to a planned preventative maintenance schedule specified by the manufacturer CentriAir. The system will be operational prior to use of the Reception Building to receive waste.
- 8.5. An Odour Management Plan incorporating the Crop-AD and Waste-AD Plants has been developed by ETL for use as part of the management system once the site is operational.
- 8.6. A Site Specific Bioaerosol Risk Assessment has been undertaken by Redmore Environmental (Appendix F). Their report concludes: *"The results of the assessment indicated residual risk from all sources was determined as low or very low. As such, it is concluded that no further control measures, other than those detailed in the assessment, are required in order reduce the potential for impacts at sensitive locations in the vicinity of the site"*.
- 8.7. The use of a Reception Building for the storage and treatment of waste feedstocks reduces the probability of exposure of other potential amenity impacts such as litter, pests, and scavengers. Pest control is also in place on the Crop-AD.
- 8.8. A Noise Impact Assessment (NIA) incorporating the proposed site expansion and upgrade was carried out by RSK at the planning stage.³ The report concluded that the predicted noise level

³ Noise Impact Assessment, 297703-RSK-RP-001-(05), RSK, March 2020

contribution from the AD facility site on the nearest residential receptors, and with proposed operational parameters observed, will adhere to the low impact criteria set out in BS 4142 for weekday daytime, weekday night and weekend daytime hours between 07.00 and 23.00.

- 8.9. Proposed site operational night-time hours of 23.00 to 07.00 will result in one low to adverse impact at 'Arcadia' during the weekend night-time period, however with an increase of +3.6 dB above background level at this property, this magnitude of impact is considered within the limits of audible subjectivity.
- 8.10. The site layout has changed since the NIA was carried out however, RSK have confirmed (June 2021) that:

Our noise specialist has reviewed both the new location and revised data from the equipment, they agree that it is more concealed and shielded by other site buildings, so it is now in a more convenient spot with potentially less noise emissions emanating in all directions.

They have compared the source data from the consented to the proposed and it does show an improvement on some of the previous noisy items (Compressor biogas and instrument air GUU). Furthermore, they are now also housed inside a sound-reduction container which has reduced their emitted levels considerably.

With this in mind, an update to the original assessment should not be required.

- 8.11. The applicability of BAT 17 requirements is restricted to cases where a noise or vibration nuisance at sensitive receptors is expected and/or has been substantiated. Whilst it is understood that noise or vibration at sensitive receptors is not expected nor has been substantiated, a Noise and Vibration Management Plan (NVMP) in line with BAT requirements has been prepared.
- 8.12. Whilst not restricted under the planning consent, the proposed operating hours are 06:00 to 18:00, Monday to Sunday inclusive. Appropriate noise mitigation measures will be employed were required in accordance with specialist advice.
- 8.13. In accordance with the Environmental Risk Assessment (Appendix A of the EMS Manual (**ATT-OD-01**)), there are no other significant amenity hazards.

9. LEP Request

- 9.1. The Operator is requesting a LEP to seed, feed and carry out associated site operational activities on the waste-AD extension to the existing site prior to issue of the Substantial permit variation requested, which was submitted 27th August 2021.
- 9.2. To accompany the LEP application we have provided a series of key documents to demonstrate an operational Environmental Management System will be in place in addition to the Safe Start up Plan provided by BioConstruct GmbH for the commissioning period. Overarching documents and standard operating procedures pertinent to the Waste-AD activities are listed in Table 2 below.
- 9.3. There are site specific procedures preceded by 'ATT' and Eco Verde Energy company wide procedures denoted by 'EVE' within Table 2.
- 9.4. The Operator requests that commissioning may start 4th April 2022 with cold crop digestate, and crop based biologically active digestate inoculum. The Crop-AD operation on site will be preferentially used as the donor site but will not meet the entire demand so crop digestate and inoculum may be imported other suitable AD sites within the vicinity, subject to agreement by the Environment Agency.
- 9.5. The Operator requests that food waste reception, preparation and treatment be operated from week commence 18th April 2022. An application for the Approval to Treat Animal By-Products and/or Catering Waste in a Biogas Plant and a supporting Hazard and Critical Control Point (HACCP) plan has been prepared and submitted to Animal and Plant Health Agency (APHA).
- 9.6. The Operator requests food and industrial waste may be fed to the primary digesters from 18th April 2022 to establish the correct microbiological population within the tanks to produce gas of sufficiently quality to be sampled week of 16th May 2022 and injected to grid to achieve the Green Gas Support Scheme Gas to Grid date of 31st May 2022.
- 9.7. The time scale that the LEP may be required is dependent on the permit application determination process; there are factors outside the control of the Operator that will influence the date of issue of the permit variation notice. Therefore, we feel that is prudent to request a 12-month period for the LEP i.e., up to and including the 4th of April 2023. Any requests for further information with respect to the permit application will be managed in a timely manner.
- 9.8. We are happy to provide any further information if needed to assist with this request.

Table 2 Key operational documents pertinent to the Waste-AD Plant on site

Document Reference	Document Title
Overarching Documents	
ATT-OD-01	Environmental Management System Manual
ATT-OD-02	Master Document Control File
ATT-OD-03	Process Flow Diagram
ATT-OD-04	Odour Management Plan
ATT-OD-05	Accident Management Plan
ATT-OD-08	DSEAR zoning plans & risk assessment
ATT-OD-10	Staff Organogram
Procedures	
ATT-SOP-03	Process Monitoring Procedure
ATT-SOP-04	Monitoring Procedure
ATT-SOP-05	Fugitive Emissions Plan
ATT-SOP-09	Odour monitoring procedure
ATT-SOP-10	Liquid reception procedure
ATT-SOP-11	Waste acceptance and rejection procedure
ATT-SOP-12	Waste loading and management procedure
ATT-SOP-13	Housekeeping procedure
ATT-SOP-14	Secondary containment checking and emptying procedure
EVE-SOP-01	Document Control Procedure
EVE-SOP-02	Complaints Procedure
EVE-SOP-03	Change control Procedure
EVE-SOP-04	Training Procedure
EVE-SOP-07	Spill Control Procedure
EVE-SOP-08	Waste Pre-acceptance Procedure
Form Templates	
EVE-FT-01	Accident and Incident Report Form
EVE-FT-02	Change control Form
EVE-FT-03	Feedstock rejection Form
EVE-FT-04	Odour complaint Form

Figures

Figure 1: Site Location Plan, Plandescil (24727 - 150 Rev E)

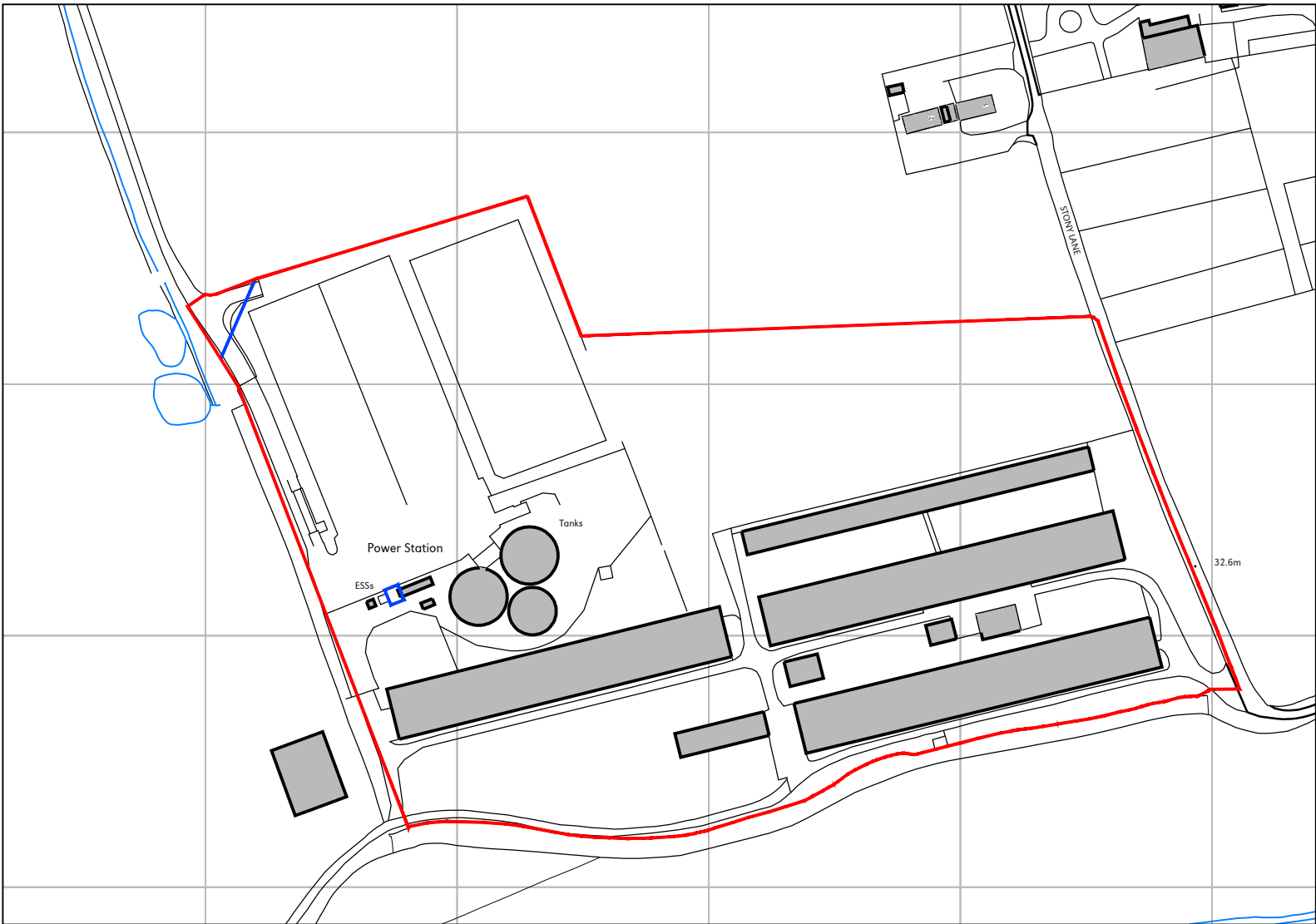
Figure 2: Proposed Permit Boundary Plan, Plandescil (24727 - 600 Rev 0)

Figure 3: Emission Point Plan, BioConstruct (B202103 / A15)

Figure 4: Proposed Site Layout, Plandescil (24727/550 Rev 0)

Figure 5: Proposed Drainage Layout, Plandescil (24727/552 Rev 0)

Figure 6: Human Receptor Plan (1km), Earthcare Technical (ETL573/EPR02)



OS Location Plan
Scale 1:2500

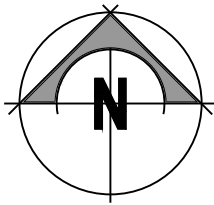


Site Location Plan 1
Not to Scale



Site Location Plan 2
Not to Scale

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 7. All setting out to be coordinated by the Contractor and to be checked onsite prior to construction.



Key	
—	Site Boundary (Area - 67,594.50m ² / 6.75945 Ha)
—	Land Registry Land Divisions

APPROVAL & COMMENT				
E	22-07-21	AF	OAJ	Site Boundary Amended
D	13-07-21	AF	OAJ	Minor Amendments
C	30-04-21	JHB	OAJ	Minor Amendments
B	13-01-20	MJP	OAJ	Client Name Amended
A	10-01-20	MJP	OAJ	Second Issue
O	26-07-19	-	OAJ	First Issue
Rev	Date	Rev By	Chkd	Description

plandescil
consulting engineers

Connaught Road Attleborough Norfolk NR17 2BW
Telephone: (01953) 452001 Fax: (01953) 456955
E-mail: pd@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

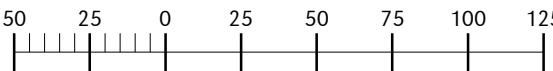
Client
Attleborough AD Plant Limited

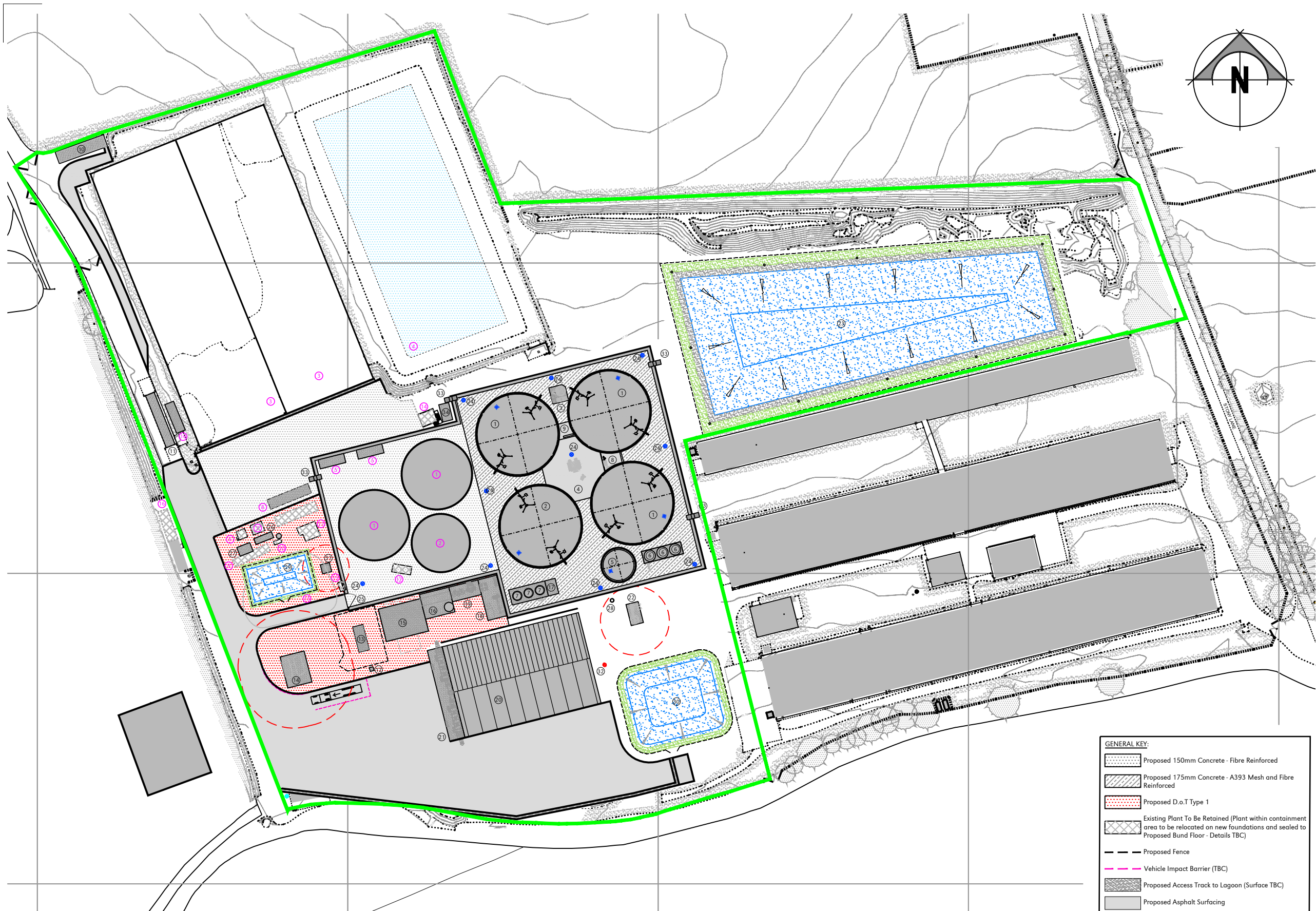
Project
**Attleborough AD Plant,
Attleborough, Norfolk,
NR17 1AE**

Drawing Title
Site Location Plan

Scale	U.N.O.	Date	Drawn By
As Noted (A3)		July 2019	MJP
Drawing No.	24727/150	Rev	E

1:2500 - DRAWING SCALE REFERENCE (m)





- EXISTING PLANT KEY:
- 1 Digester (2No.) (23mØ)
 - 2 Fermenter (19mØ)
 - 3 Silage Clamp (2No.) (30m x 95m)
 - 4 Covered Lagoon
 - 5 Feedhopper (2No.) - To Be Repositioned
 - 6 Substation
 - 7 Transformer
 - 8 CHP Engine - To Be Repositioned
 - 9 Storage Container - To Be Repositioned
 - 10 Chiller & Oil Container
 - 11 Technical Container
 - 12 Boiler
 - 13 Dirty Water Holding Lagoon - To Be Regraded/Relined
 - 14 Separator
 - 15 Flare - To Be Removed
 - 16 Welfare Facility / Site Office - To Be Repositioned

- PROPOSED PLANT KEY:
- 1 BioConstruct Fermenter (3No. @ 26.00mØ)
 - 2 BioConstruct Post-Fermenter (26.00mØ)
 - 3 Reception Tank
 - 4 Technical Building
 - 5 Pre-Storage Tank (10.00mØ)
 - 6 Pre-Storage Tank (3No. @ 3.50mØ)
 - 7 Pasteurisation Tank (3No.)
 - 8 Oxygen Generator
 - 9 Switchboard Room
 - 10 Site Office
 - 11 Weighbridge
 - 12 VSAT
 - 13 Grid Entry Unit
 - 14 Propane Tanks
 - 15 Gas Upgrading Unit
 - 16 Boiler, Heating Buffer Tank
 - 17 Switchboard Container
 - 18 Gas Processing Unit
 - 19 Active Carbon Tanks (2No.)
 - 20 Reception Building (30.20m x 45.20m)
 - 21 Odour Control Filter (1No.)
 - 22 Flare - BioConstruct (10.00m Exclusion Zone)
 - 23 Digestate Storage Lagoon (10,000m³ Storage)
 - 24 Containment Sump (8No.) - TBC
 - 25 Bund Gate (1No.)
 - 26 LV Switchboard
 - 27 Emergency Generator
 - 28 Condensate Pit
 - 29 Dirty Water Holding Lagoon (175m³ Storage)
 - 30 Surface Water Attenuation Lagoon (936m³ Storage)
 - 31 Flare - EVE (7.50m Exclusion Zone TBC By Client)
 - 32 Borehole - Position TBC
 - 33 Stair Access (4No.)
 - 34 Leachate Tank (20,000l - Capacity TBC)

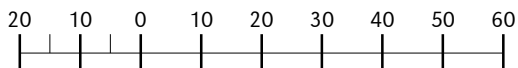
- GENERAL KEY:
- Proposed 150mm Concrete - Fibre Reinforced
 - Proposed 175mm Concrete - A393 Mesh and Fibre Reinforced
 - Proposed D.o.T Type 1
 - Existing Plant To Be Retained (Plant within containment area to be relocated on new foundations and sealed to Proposed Bund Floor - Details TBC)
 - Proposed Fence
 - Vehicle Impact Barrier (TBC)
 - Proposed Access Track to Lagoon (Surface TBC)
 - Proposed Asphalt Surfacing

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Key
Permit Boundary (49,139m² / 4.9139 Ha)

1:1250 - DRAWING SCALE REFERENCE (m)



plandescil
consulting engineers

Connaught Road Attleborough Norfolk NR17 2BW
Telephone: (01953) 452001 Fax: (01953) 456955
E-mail: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

Client

Attleborough AD Plant Limited

Project

Attleborough AD Plant, Attleborough,
Norfolk, NR17 1AE

Drawing Title

Proposed Permit Boundary
Site Layout Overlay

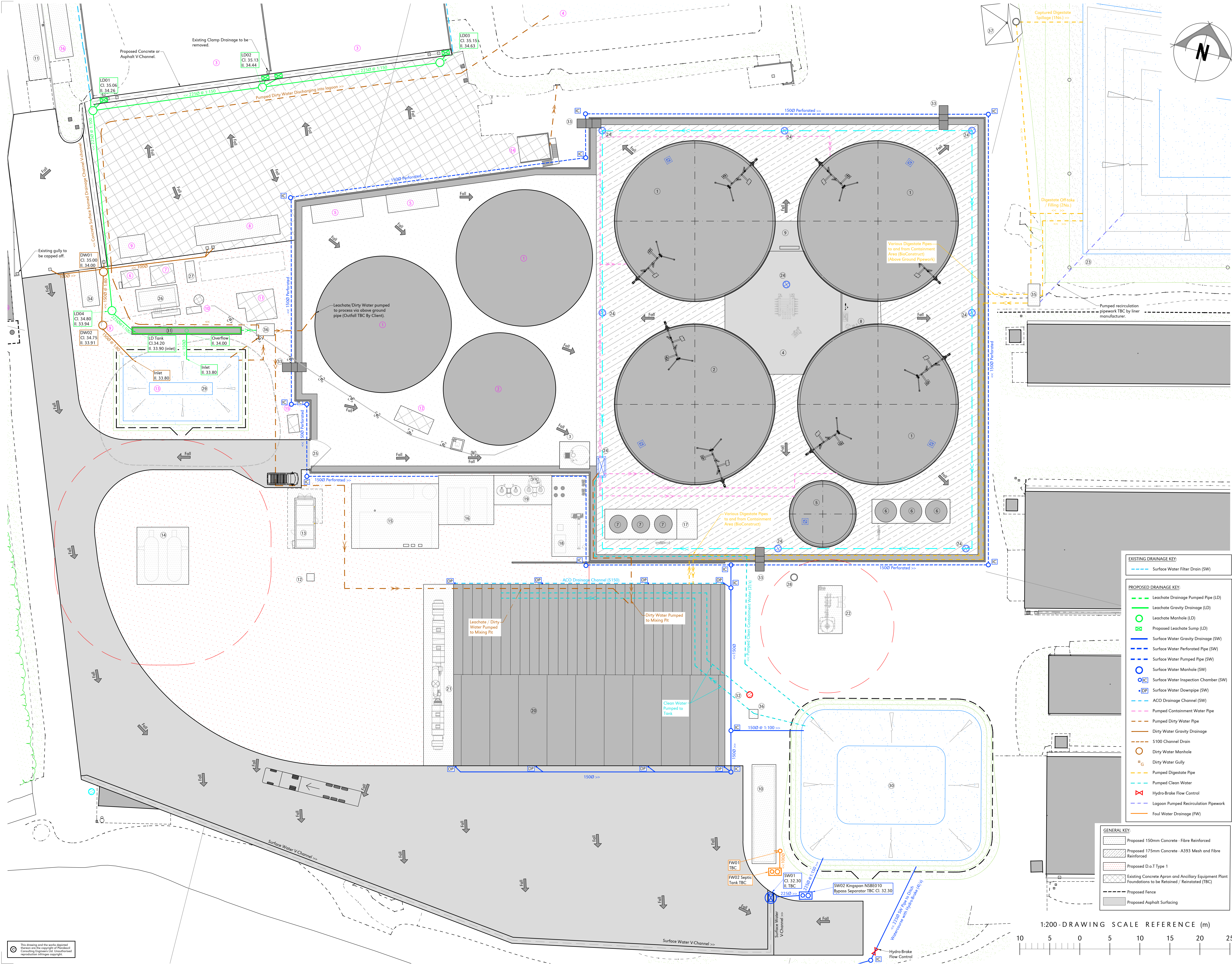
Rev	Date	Rev By	Chkd	Description
0	27-07-21	-	OAJ	First Issue

Scale U.N.O. Date Drawn By
1:1250 (A3) July 2021 AF

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- Refer to Plandescil Ltd Dwg 24727 - 001 Rev 0 - Topographical Survey undertaken in April 2021.
- Proposed Site Layout received from BioConstruct. Refer to EXPORT pipe system_Attleborough_JAS_210825.dwg

- EXISTING PLANT KEY:
- 1 Digester (2No.) (23mØ)
 - 2 Fermenter (19mØ)
 - 3 Silage Clamp (2No.) (30m x 95m)
 - 4 Covered Lagoon
 - 5 Feedhopper (2No.) - To Be Re-positioned
 - 6 Substation
 - 7 Transformer
 - 8 CHP Engine - To Be Re-positioned
 - 9 Storage Container - To Be Replaced and Re-positioned
 - 10 Chiller & Oil Container
 - 11 Technical Container
 - 12 Boiler
 - 13 Dirty Water Holding Lagoon - To Be Regraded/Relined
 - 14 Separator
 - 15 Flare - To Be Retained (EVE)
 - 16 Welfare Facility / Site Office - To Be Re-positioned

- PROPOSED PLANT KEY:
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 - 3 Ferric Chloride Tank
 - 4 Technical Building
 - 5 Pre-Storage Tank (10.00mØ)
 - 6 Pre-Storage Tank (3No. @ 3.50mØ)
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 - 13 Grid Entry Unit
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 - 24 Containment Sump - Size Varies
 - 25 Bund Gate (1No.)
 - 26 LV Switchboard
 - 27 Emergency Generator
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 - 30 Surface Water Attenuation Lagoon (936m³ Storage)
 - 31 Leachate Tank (20m³ Storage)
 - 32 Borehole
 - 33 Stair Access (4No.)
 - 34 BioConstruct Container
 - 35 Digestate Pump
 - 36 Leachate and Clean Water Pumps (2No.)
 - 37 Digestate Removal Station

APPROVAL & COMMENT

Rev	Date	Rev By	Chkd	Description
0	01-12-21		OAI	First Issue

plandescil
consulting engineers

Cornough Road Attleborough Norfolk NR17 2BW
Telephone: (01953) 455001 Fax: (01953) 456955
E-mail: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

Client:
Attleborough AD Plant Limited

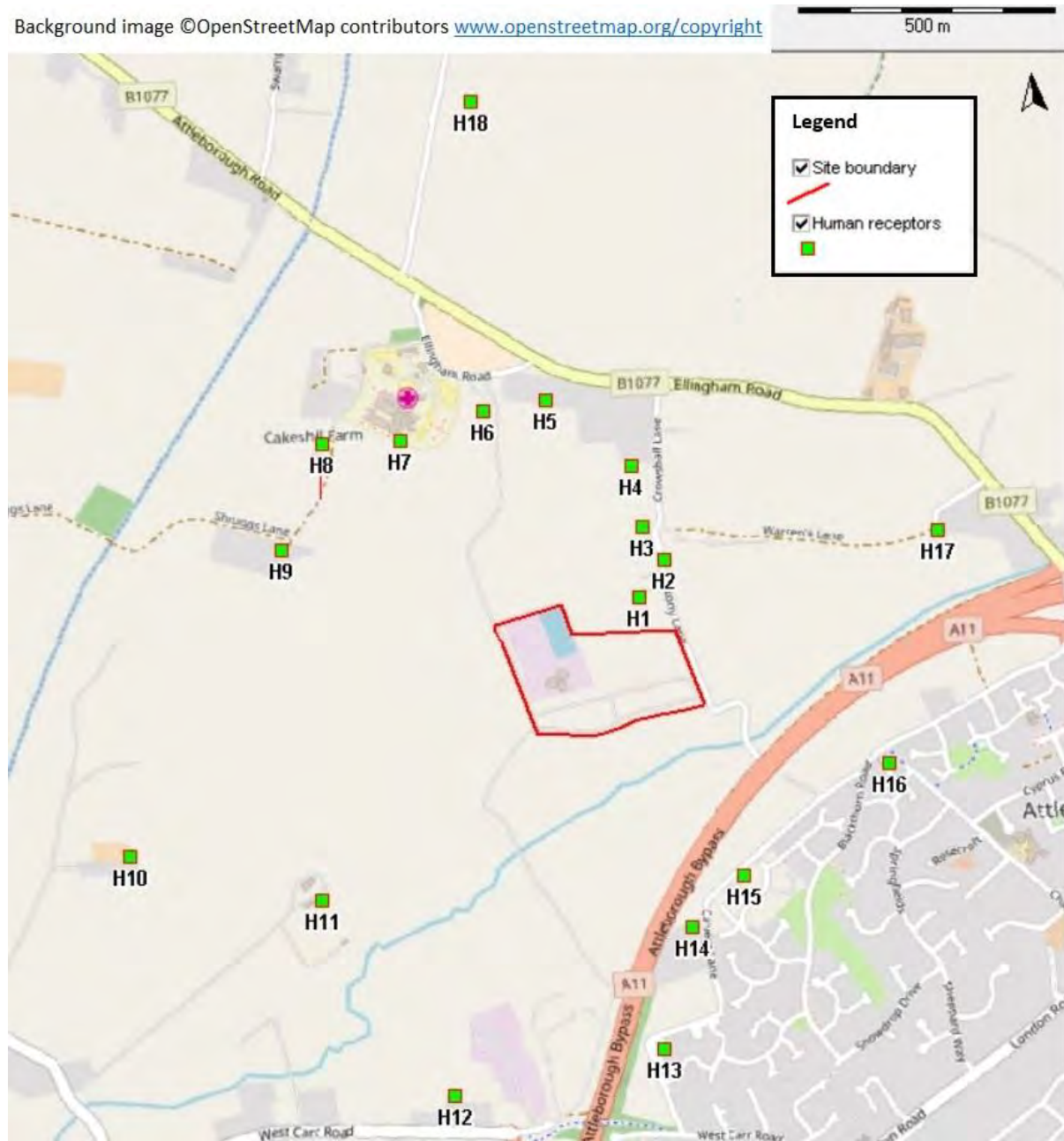
Project:
**Attleborough AD Plant,
Attleborough, Norfolk,
NR17 1AE**

Drawing Title:
Proposed Drainage Layout

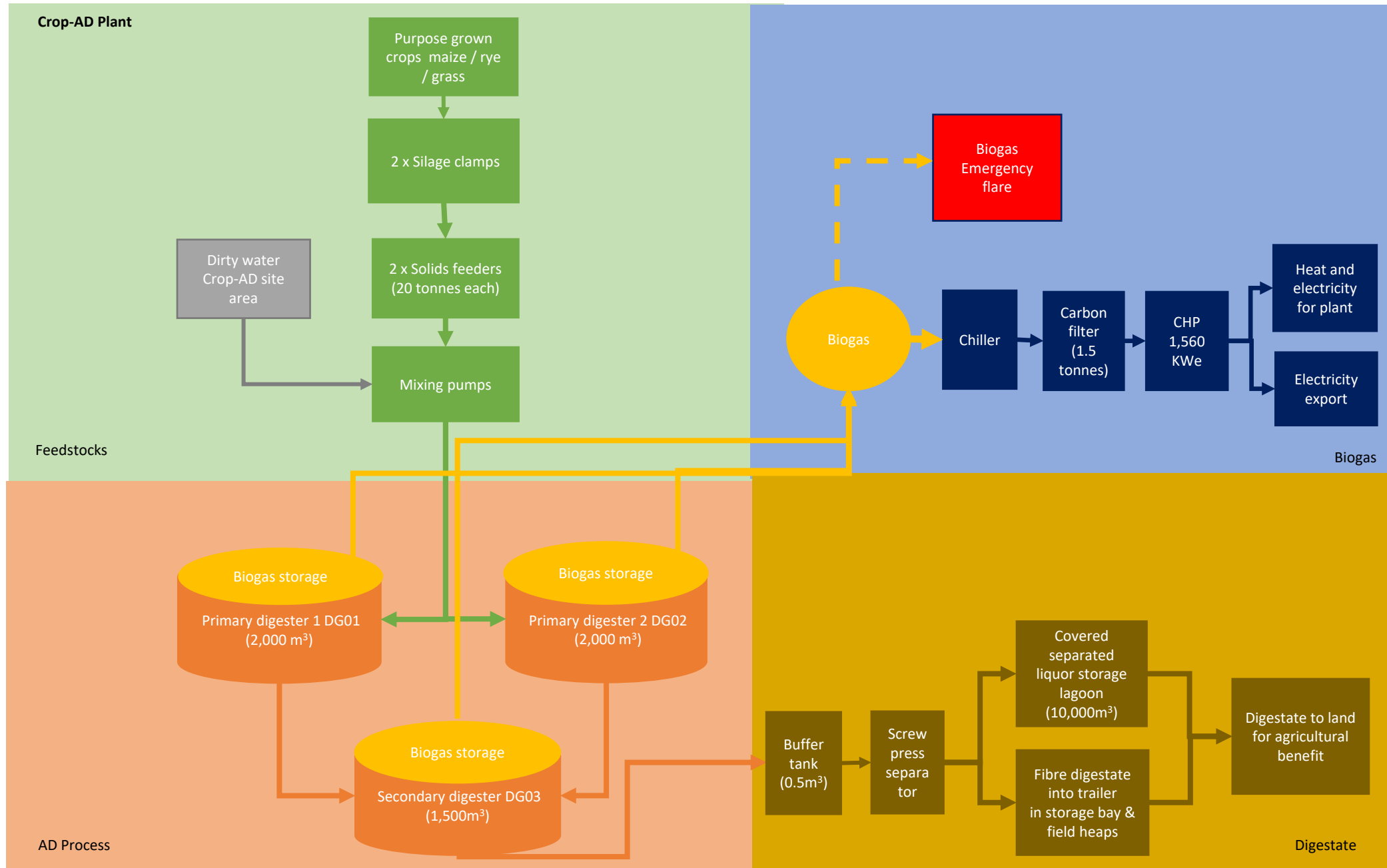
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ETL573/EPR02/ Human Receptors (1km)

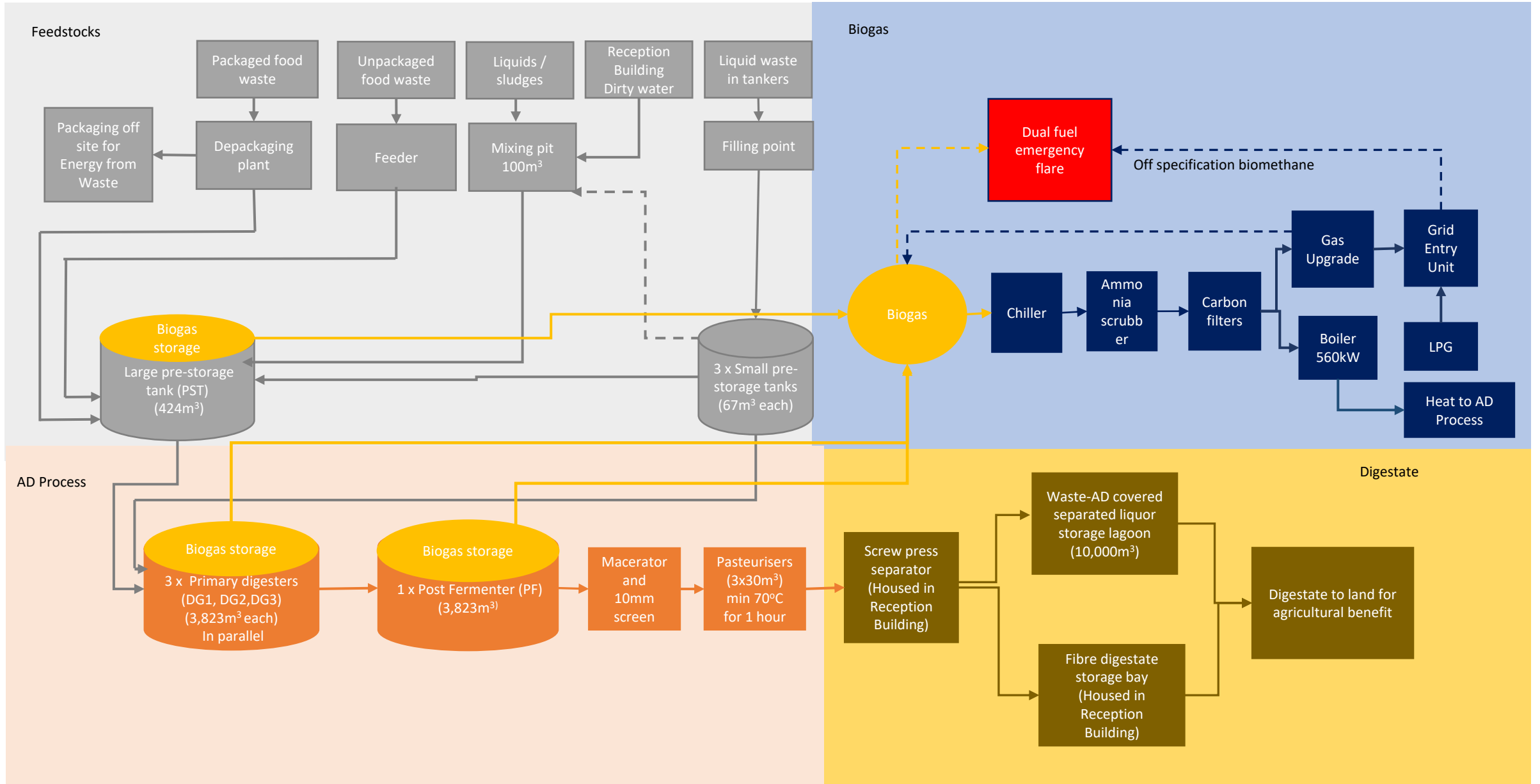
Background image ©OpenStreetMap contributors www.openstreetmap.org/copyright



Appendix A – Process Flow Diagram

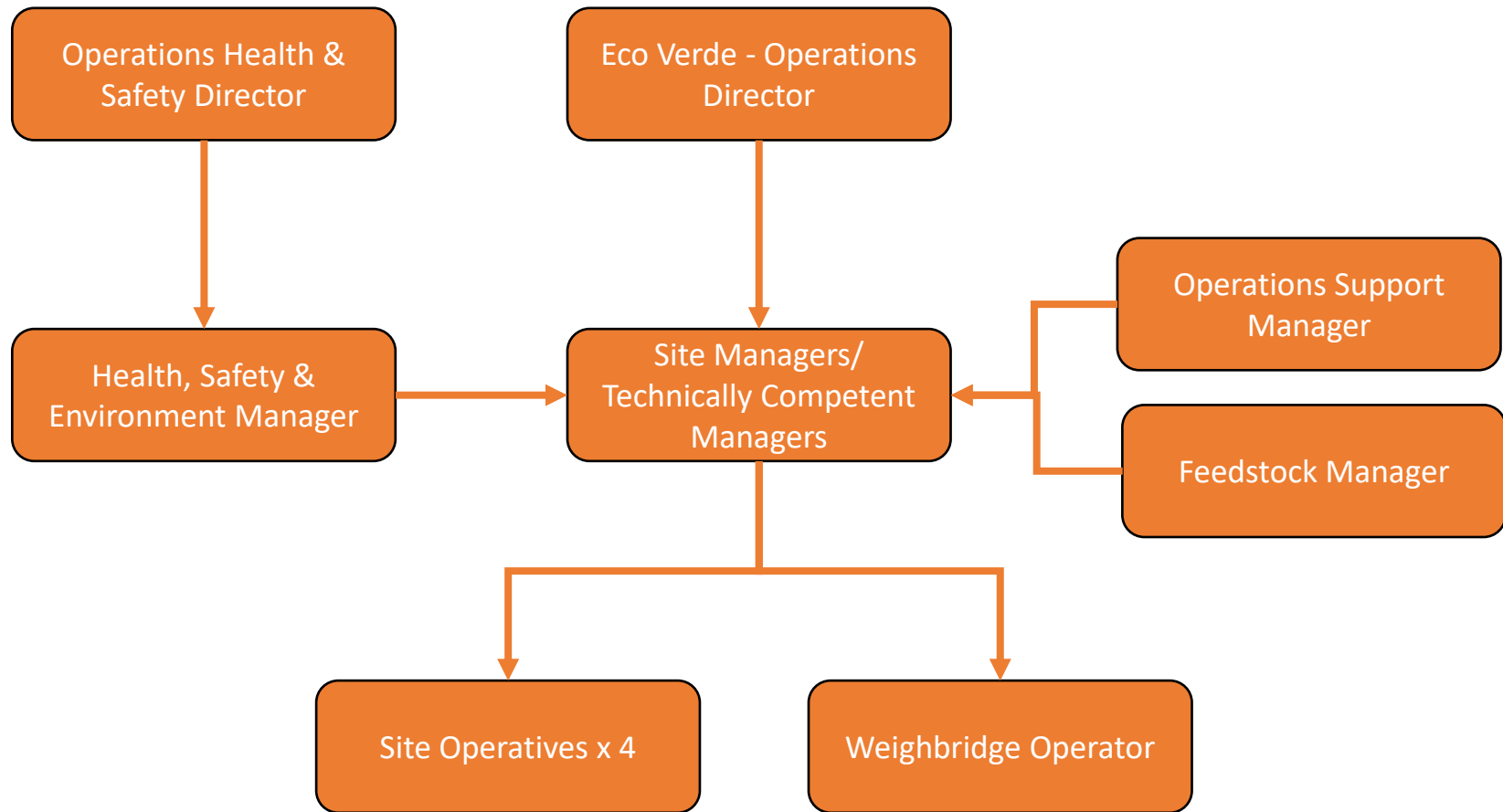


Waste-AD Plant



Appendix B – Staff Organogram

Attleborough AD
Staff Organogram - ATT-OD-10



Appendix C – Containment Design Report

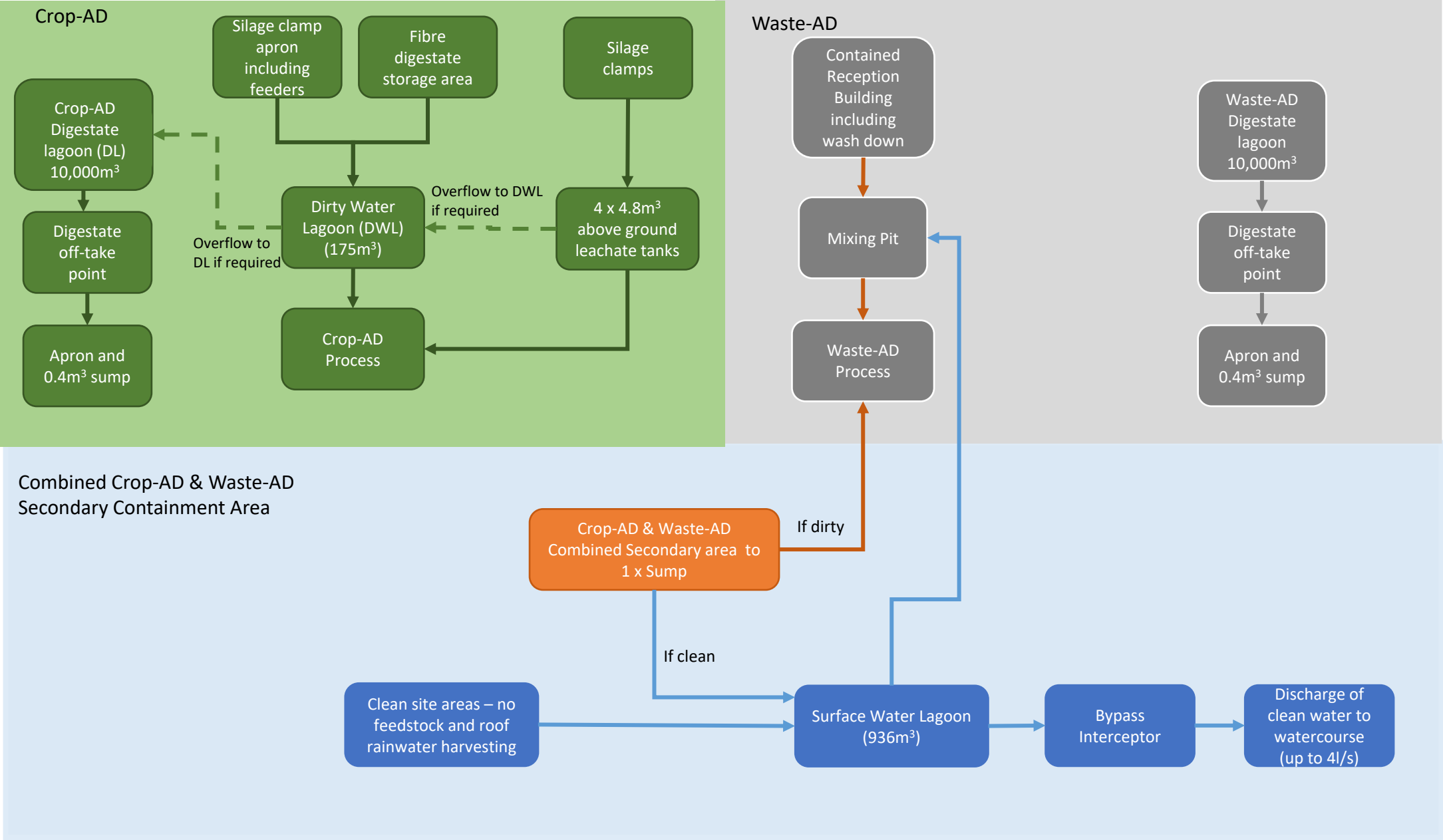
See separate document

Appendix D – Drainage Design Report

See separate document

Appendix E – Drainage Process Flow Diagram

ATT-OD-02 Attleborough AD, Drainage Process Flow Diagram V1.0



Appendix F - Site Specific Bioaerosol Risk Assessment

Bioaerosol Risk Assessment
Attleborough Anaerobic Digestion Plant

Client: Earthcare Technical Ltd

Reference: 4820r3

Date: 27th August 2021



Report Issue

Report Title: Bioaerosol Risk Assessment - Attleborough Anaerobic Digestion Plant

Report Reference: 4820

Field	Report Version			
	1	2	3	4
Prepared by	Ger Parry	Ger Parry	Ger Parry	
Position	Associate Director	Associate Director	Associate Director	
Reviewed by	Pearl Hutchinson	Pearl Hutchinson	Pearl Hutchinson	
Position	Principal Air Quality Consultant	Principal Air Quality Consultant	Principal Air Quality Consultant	
Date of Issue	20 th August 2021	23 rd August 2021	27 th August 2021	
Comments	Draft for comment	Updated draft	-	

Taylor Road, Urmston, Manchester, M41 7JQ

info@red-env.co.uk | 0161 706 0075 | www.red-env.co.uk

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Earthcare Technical Ltd to undertake a Bioaerosol Risk Assessment in support of a Substantial Variation Environmental Permit Application for Attleborough Anaerobic Digestion (AD) plant, Ellingham Road, Attleborough, Norfolk, NR17 1AE.

1.1.2 During the operation of the facility there is the potential for bioaerosol emissions and associated impacts at sensitive receptor locations in the vicinity of the site. A Risk Assessment has therefore been undertaken to identify potential emission sources and evaluate effects in the local area.

1.1.3 The purpose of this Bioaerosol Risk Assessment is to:

- Establish the likely sources of bioaerosols arising from proposed operations at the site;
- Assess the potential for significant risk of impact at sensitive locations due to emissions from the identified sources; and,
- Identify any additional mitigation required to control potential effects.

1.2 Site Location and Context

1.2.1 Attleborough AD plant is located on land off Ellingham Road, Attleborough, Norfolk, at approximate National Grid Reference (NGR): 603330, 295630. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The site currently operates as an AD facility under an Environmental Permit (No. EPR/BB3931RA) issued by the Environment Agency (EA). Existing operations include the reception and storage of crop feedstocks followed by treatment within an AD plant. Biogas generated by the process is combusted within a Combined Heat and Power (CHP) unit in order to generate electricity and heat. The site also features a flare for emergency venting of biogas during abnormal operation.

1.2.3 A Substantial Variation Environmental Permit Application is currently being made to the EA in order to authorise a number of changes to operations. These include construction of

a new AD plant which will be used to process food wastes and industrial waste waters. This will comprise the following infrastructure:

- A fully enclosed reception building;
- An odour control system which will be used to treat extract air from the reception building and other process areas within;
- Three primary digesters each with 3,823m³ working capacities;
- One secondary digester with a 3,823m³ capacity;
- One pre-storage tank with a 424m³ working capacity;
- Three pre-storage tanks each with 67m³ working capacities;
- Three pasteurisation tanks each with a 30m³ working capacity;
- A biogas gas upgrading and grid entry unit; and,
- A covered liquid digestate lagoon.

1.2.4 It should be noted that this is not an exhaustive list and reference should be made to Figure 2 for a full inventory of the relevant infrastructure.

1.2.5 The proposed changes also include removal, relocation or upgrade of a number of existing items at the site. These are summarised as follows:

- The existing crop feed hoppers will be relocated to the north of the current AD tanks;
- The existing CHP unit will be relocated northwards;
- The existing dirty water lagoon will be taken out of service and replaced by a new covered store;
- The existing flare will be repositioned;
- A cover will be fitted to the chute of the existing digestate separator;
- Four new leachate storage tanks will be installed;
- The existing Mississippi digestate dryer will be taken out of service; and,
- The existing solid digestate storage area will be changed from a bay to a covered trailer.

1.2.6 The operation of the AD plant following implementation of the proposed changes may result in bioaerosol emissions from a number of activities. These have the potential to cause impacts at sensitive locations within the vicinity of the site and have therefore been assessed within this report.

2.0 PROCESS DESCRIPTION

2.1 Introduction

- 2.1.1 A brief summary of proposed operations incorporating the changes which are subject to the Substantial Variation Environmental Permit Application is provided in the following Sections. Reference should be made to Figure 2 for a site layout plan.

2.2 Management

- 2.2.1 The overall management responsibility for the plant will lie with Eco Verde Energy Limited. The day to day facility management will be undertaken by an appointed Manager who will deal specifically with the operation of the plant.
- 2.2.2 Daily checks and maintenance will be undertaken by the Manager. A range of spare parts will be kept on site. If additional items are required these will be available within a 24-hour period. In addition, there is certain amount of redundancy factored into the plant operation which allows for some items to be out of action temporarily but for the remainder of the facility to continue operating normally.

2.3 Feedstock Delivery and Storage

- 2.3.1 The facility will operate using a range of biodegradable feedstocks. A summary of the types and tonnages of materials that will be processed is provided in Table 1.

Table 1 Feedstock Types and Quantities

Feedstock Type	Quantity (t/yr)
Maize silage	27,375
Rye	2,920
Packaged food waste	8,000 ^(a)
Kerbside collected food waste	33,000 ^(a)
Liquid food waste	22,000
Bakery waste	17,000 ^(a)

Feedstock Type	Quantity (t/yr)
Industrial waste waters	10,950

Note: (a) The sizing of the bays and mixing pit within the Reception Building dictate that there will be no more than a total of 204t of solid waste stored within the building at any one time. This is based on 681m³ storage in bays (total), 100m³ in mixing pit and a typical solid food waste density of 0.26t/m³ (Source: Environment Agency Waste Conversion Spreadsheet).

2.3.2 A summary of the delivery and storage procedures for the feedstocks is provided in the following Sections.

Maize Silage and Rye

2.3.3 Maize silage and rye will be transferred to the facility using a tractor and trailer or Heavy Goods Vehicles (HGVs) during typical harvest periods and deposited within two existing clamps located on the northern section of the site.

2.3.4 The clamps will be compacted and covered using protective plastic sheeting. This will form an airtight layer to minimise emissions and preserve the feedstock throughout the year. It should be noted that any decomposition of the material would affect its effectiveness as a feedstock. As such, the protective sheeting will be specified to prevent water and air reaching the material and hence avoid any unwanted breakdown with associated emissions.

2.3.5 The cover on the clamps will be slightly open at one end during cutting phases in order to allow access to the feedstock for removal and transportation to the AD plant feed hoppers. It is anticipated that there will typically be two cutting phases per working day. The sheeting will be replaced at the end of each phase in order to protect the feedstock and minimise the potential for emissions.

2.3.6 Any leachate generated by maize silage and rye during storage will be transferred to the storage tanks prior to incorporation into the AD process. Air displaced from the tanks during filling will be discharged directly to atmosphere from vent near to the top of the vessels.

Solid Food Wastes

- 2.3.7 Solid food wastes will be transferred to the facility in enclosed HGVs. These will drive directly into the new reception building on the southern section of the site and deposit loads within dedicated storage bays.
- 2.3.8 The delivery areas of the reception building will feature fast-acting roller shutter doors which will be utilised to maintain a sealed environment as far as practicable. In addition, air will be extracted from the delivery area of reception building at a rate equivalent to at least 3 air changes per hour in accordance with Environment Agency (EA) guidance¹. The extract air will be transferred to a Centriair ColdOx combined UV and activated carbon abatement system for treatment prior to discharge to atmosphere via a common stack.

Liquid Wastes and Industrial Waste Waters

- 2.3.9 Liquid food wastes and industrial waste waters will be delivered to the site using vacuum tankers. Following arrival, the materials will be transferred directly into one of four new pre-storage tanks using a mechanical pumping system. The pumping arrangement is a closed system and therefore the materials will not be exposed to atmosphere.
- 2.3.10 Air displaced from the tanks during filling will vent to the digesters. As such, there will be no emissions to atmosphere as part of the liquid food waste and industrial wastewater reception process.

2.4 Preliminary Processing of Feedstocks

- 2.4.1 A summary of the preliminary feedstock processing operations is provided in the following Sections.

Maize Silage and Rye

- 2.4.2 Maize silage and rye will be transferred from the storage clamps to the relocated feed hoppers using a bucket loader or similar. These will macerate and blend the material prior

¹ How to comply with your environmental permit. Additional guidance for Anaerobic Digestions, EA, 2013.

to processing within the Crop AD plant. It is anticipated that the hoppers will be loaded twice daily.

Solid Food Wastes

- 2.4.3 Packaged food wastes will be transferred to a de-packaging unit located within the reception building. This will remove plastics and any other contaminants. Air will be extracted from the de-packaging area using a ventilation hood at a rate equivalent to at least 3 air changes per hour. The extract air will be transferred to the Centirair ColdOx UV and activated carbon abatement system for treatment prior to discharge to atmosphere via the common stack.
- 2.4.4 The de-packaged material will be transferred to the mixing pit where it will be macerated and blended to facilitate pumping to the Waste AD plant.
- 2.4.5 Unpackaged food wastes will be removed from the relevant storage areas within the reception building and transferred to the mixing pit for maceration and blending prior to transfer to the Waste AD plant.
- 2.4.6 Air will be extracted from the mixing pit and transferred to a Centriair DEO-500 regenerative catalytic conversion and sulphured pellet abatement system for treatment prior to discharge to atmosphere via the common stack.

Liquid Wastes

- 2.4.7 Liquid wastes will be transferred from the external storage tanks to the mixing pit using a mechanical pumping system. The pumping arrangement is a closed system and therefore the feedstocks will not be exposed to atmosphere.

2.5 AD Plant Operation

- 2.5.1 The crop feedstocks will be digested within three existing sealed AD tanks. Food wastes and industrial waste waters will be processed in four new fermenters. All AD tanks include all necessary non-return valves and pumps to ensure there are no losses from any part of the process. The facility will be fully automated to maintain maximum efficiency at all times.

- 2.5.2 The biogas produced by the Waste AD plant, a mixture of methane (CH₄) and carbon dioxide (CO₂), will be collected in domes above the digesters prior to upgrade for injection into the gas grid. This involves stripping out impurities, mainly CO₂, specific volatile organic compounds (VOCs) and hydrogen sulphide (H₂S), before treatment with an odorant and transfer off-site. Exhaust gases generated by the upgrading process will be discharged to atmosphere via dedicated vent. The upgrade plant also features an emergency release valve to avoid over pressure.
- 2.5.3 Biogas produced by the Crop AD plant process will be transferred to the existing relocated CHP unit where it will be combusted for the generation of electricity and heat. Exhaust gases from the plant will be dispersed to atmosphere via a dedicated stack.
- 2.5.4 The site will feature two automatic back-up flares that burn gas in a controlled manner if the upgrade system or CHP unit stop temporarily, or if plant maintenance is required. Should the flares fail for any reason the digester tanks are fitted with emergency release valves to avoid over pressure. These are a necessary safety feature. A record of their use will be kept and the reason for utilisation fully documented.
- 2.5.5 Frequent or extended use of the pressure release valves would indicate the plant is not being managed correctly and would have financial consequences for the operator due to loss of biogas and potential impacts to the digester conditions. It is therefore in their best interest to ensure they are utilised as infrequently as possible.

2.6 Digestate

- 2.6.1 The AD process will create digestate in liquid and solid form which can be used as a biofertiliser.
- 2.6.2 Digestate generated by the Crop AD plant will be divided into solid and liquid fractions using a screw separator. Solid digestate will be discharged from the separator via an enclosed chute into a covered trailer where it will be stored prior to removal from the site. The liquid fraction will be transferred to the existing lagoon for holding prior to removal from the facility using vacuum tankers. This features a floating cover in order to provide containment of digestate and reduce the potential for any associated emissions to atmosphere.

- 2.6.3 Digestate generated by the Waste AD plant will be heat treated in one of three pasteurisation units before being pumped to a screw separator located within the reception building. Air displaced from the pasteurisers during filling will vent directly to the gas line. As such, there will be no bioaerosol release to atmosphere from these sources during normal operation.
- 2.6.4 Solid digestate will be discharged from the separator via a chute into a trailer where it will be stored prior to removal from the site. Air will be extracted from the trailer room and transferred to a Centriair DEO-500 regenerative catalytic conversion and sulphured pellet abatement system for treatment prior to discharge to atmosphere via the common stack.
- 2.6.5 The liquid fraction will be transferred to the proposed lagoon for holding prior to removal from the facility. This will feature a floating cover in order to provide containment of digestate and reduce the potential for any associated emissions to atmosphere.
- 2.6.6 Liquid digestate will be transported off site in vacuum tankers. These will couple to an outlet point on the lagoons using a hose before material is transferred using a mechanical pumping system. The pumping arrangement is a closed system and as such the digestate will not be exposed to atmosphere. Air displaced from the tankers during filling will vent directly to atmosphere.

3.0 BIOAEROSOL BACKGROUND

3.1 Bioaerosol Definition

3.1.1 Bioaerosol is a general term for microorganisms suspended in the air. These microorganisms include fungi and bacteria, as well as their components such as mycotoxins, endotoxins and glucans. Bioaerosols are generally less than 100µm in size and are not filtered out by hairs and specialised cells that line the nose. Due to their airborne nature and small size, many bioaerosols can penetrate the human respiratory system, resulting in inflammatory and allergic responses.

3.1.2 Although bioaerosols are ubiquitous, operations involving biodegradable materials provide environments that are conducive to their growth. Bioaerosols are therefore likely to be associated with AD feedstocks and products, and in particular, handling activities, which release the microorganisms into the air.

3.2 Health Risks from Bioaerosols

3.2.1 Exposure to bioaerosols has been associated with human health effects, symptoms can include inflammation of the respiratory system, coughs and fever. Inhalation of bioaerosols may also cause or exacerbate respiratory diseases². They have been known to cause gastrointestinal illness, eye irritation and dermatitis.

3.2.2 Possible links have also been made between exposure to bioaerosols and organic dust toxic syndrome. This is an acute disease that causes symptoms resembling those of influenza, such as shivering, an increase in body temperature, dry cough and muscle and joint pains. Of particular relevance to waste management facilities are infections caused by *Aspergillus fumigatus*. Invasive aspergillosis is a particularly severe infection, which may be fatal and is primarily a concern with at risk and immuno-suppressed patients.

3.2.3 Although some data is available, one of the major knowledge gaps for bioaerosols is their associated dose-response relationships. It is not currently possible to state with any certainty that a given concentration will result in a particular health impact. This is due to

² Guidance on the evaluation of bioaerosol risk assessments for composting facilities, EA, undated.

the number of bioaerosols that are naturally present within the environment as well as the complexities associated with human responses to different microorganisms.

3.3 Bioaerosol Emissions from Waste Management Operations

3.3.1 Most scientific research on bioaerosol emissions from waste management operations focusses on open windrow and In-Vessel Composting (IVC) systems. Although it is recognised that there are fundamental differences between composting and AD processes, there are similarities between the types of feedstocks, handling activities and infrastructure utilised. As such, a review of relevant research has been undertaken in order to inform the assessment. The findings are detailed in the following Section.

3.3.2 The EA document 'Health Effects of Composting - A Study of Three Compost Sites and Review of Past Data'³ summarises the findings of emissions measurement work undertaken at three composting facilities, including two open air turned windrow sites and one IVC plant. The results from the work indicated a well-defined decline in concentrations of bioaerosols with increased distance from source. In most cases, measured concentrations were at or below background levels within 250m of the sources assessed.

3.3.3 The ADAS report 'Bioaerosol Monitoring and Dispersal from Composting Sites'⁴ provides a summary of the findings from measurement work undertaken at three composting sites. Sampling for bioaerosols was undertaken downwind of a wide range of composting activities including shredding, turning, loading, unloading and screening. The results indicated that 91% of all micro-organisms sampled across all three sites were below 1,000cfu/m³ at a downwind distance of 125m.

3.3.4 The Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) report 'Measurement and Modelling of Emissions from Three Composting Sites'⁵ provides a summary of the findings from monitoring work undertaken at three composting sites, which included two IVC facilities and one open windrow system. The findings indicated that there is the potential for seasonal variation in ambient concentrations of the mould of *Aspergillus fumigatus*, with concentrations being the highest in the autumn. In most

³ Health Effects of Composting - A Study of Three Compost Sites and Review of Past Data, EA, 2001.

⁴ Bioaerosol Monitoring and Dispersal from Composting Sites, ADAS, 2005.

⁵ Measurement and Modelling of Emissions from Three Composting Sites, SNIFFER, 2007.

cases, levels of all bioaerosols assessed were at or below background equivalent concentrations within 250m of the sources assessed.

3.3.5 The Department for Environment Food and Rural Affairs (DEFRA) research report 'Bioaerosols and odour emissions from composting facilities'⁶ focusses on the comparability of different sampling methodologies and the influence of spatial and temporal variation on ambient bioaerosol concentrations. Measurements were undertaken at four different composting facilities in England, which represent a range of system types. The results of the study corroborate existing research and suggest that concentrations of bioaerosols generally return to background levels within 250m of the source.

3.3.6 The findings of the review have been considered as appropriate throughout the assessment.

3.4 Legislative Control

3.4.1 Atmospheric emissions from industry are controlled in the UK through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. The operation of an AD plant is included within the Regulations and as such the facility is required to operate in accordance with an Environmental Permit issued by the EA.

3.5 Environment Agency Policy

3.5.1 The EA Regulatory Position Statement (RPS) 'Bioaerosol monitoring at regulated facilities - use of M9: RPS 209'⁷ outlines the conditions that apply to facilities in relation to bioaerosol emissions.

3.5.2 The RPS states that if a regulated facility is located within 250m of a sensitive receptor (a place where people live or work for more than 6-hours at a time), the operator must:

⁶ Bioaerosols and odour emissions from composting facilities, DEFRA, 2013.

⁷ Bioaerosol monitoring at regulated facilities - use of M9: RPS 209, EA, 2018.

- Monitor bioaerosols in accordance with EA guidance 'M9: environmental monitoring of bioaerosols at regulated facilities'⁸; and,
- Undertake a site specific Bioaerosol Risk Assessment.

3.5.3 The conditions outlined within the RPS have been considered as appropriate throughout the assessment.

3.6 Benchmark Levels

3.6.1 In the absence of dose-response data, the EA have adopted a precautionary risk-based approach in determining guidance levels for bioaerosols. The EA position statement 'Composting and potential health effects from bioaerosols: our interim guidance for permit applicants'⁹ specifies the following criteria for acceptable concentrations of *Aspergillus fumigatus* and total bacteria at sensitive receptor locations:

- *Aspergillus fumigatus* - 500cfu/m³; and,
- Total bacteria - 1,000cfu/m³.

3.6.2 The relevant benchmark levels have been considered as appropriate throughout the assessment.

3.7 Technical Guidance

3.7.1 The EA guidance 'How to comply with your environmental permit. Additional technical guidance for: Anaerobic Digestion'¹⁰ sets out indicative Best Available Technique (BAT) or appropriate measures for the AD of organic materials. The document provides practical guidance on how and why bioaerosol emissions occur, as well as measures that can be employed to prevent or minimise release.

3.7.2 The requirements of the guidance have been considered throughout the assessment.

⁸ M9: environmental monitoring of bioaerosols at regulated facilities, EA, 2018.

⁹ Composting and potential health effects from bioaerosols: our interim guidance for permit applicants, EA, 2010.

¹⁰ How to comply with your environmental permit. Additional technical guidance for: Anaerobic Digestion, EA, 2013.

4.0 PROBLEM DEFINITION

4.1 Introduction

4.1.1 The first stage of any risk assessment is to clearly set out the problem, including what will be addressed and what will not. This determines the scope, level of detail and focus. In particular, the temporal and spatial scales, contaminants to be assessed, persons at risk and the endpoint are identified. These factors are considered in the following Sections.

4.2 Conceptual Model

4.2.1 A summary of the conceptual model utilised as part of the assessment is provided in Table 2.

Table 2 Conceptual Model

Criteria	Comment
Source	Feedstocks and products on the site as outlined in Section 4.3
Hazard	Potential adverse health impacts as outlined in Section 3.2
Transport Mechanism	Airborne
Medium of Exposure	Inhalation, ingestion, absorption, injection
Receptor	Human receptors at the proposed site as outlined in Section 4.5

4.3 Sources

4.3.1 The operation of the facility may result in bioaerosol emissions from a number of activities. The following potential sources were identified based on a review of existing and proposed operations:

- Exposed maize silage and rye during delivery and storage within the clamps;
- Exposed maize silage and rye during transfer to the feed hoppers;
- Exposed material within the feed hoppers;
- Fugitive emissions from the reception building;
- Air displaced from the leachate storage tanks;
- Air released from the common stack serving the Centriair abatement systems;

- Air released from the upgrade system CO₂ vent;
- Fugitive emissions from the covered solid digestate storage trailer serving the Crop AD plant;
- Fugitive emissions from the covered liquid digestate storage lagoons;
- Fugitive emissions from the covered dirty water lagoon; and,
- Air expelled from the liquid digestate tankers.

4.3.2 As stated previously, the actual AD process itself is sealed and therefore does not form a source of bioaerosols under normal operation. The digesters will feature release valves to avoid over pressure. Any gases released from the valves are likely to contain bioaerosols as a result of the digestion processes. However, releases from these sources are expected to be extremely infrequent and short-term as they would only occur in an emergency situation. As such, the risk of impact from these emissions is not considered to be significant and they have not been evaluated further in the context of this assessment.

4.3.3 The CHP unit and flare stacks will only emit products of combustion which do not contain any bioaerosols. As such, they have not been considered further in this report.

4.3.4 The potential for bioaerosol emissions from each remaining source is considered further in the following Sections.

Exposed Maize Silage and Rye During Delivery and Storage

4.3.5 Maize silage and rye will be transferred to the facility using a tractor and trailer or HGVs during typical harvest periods. The feedstocks will be deposited within the existing storage clamps located on the northern section of the site. Disturbance of the material during delivery may cause bioaerosol release. However, the seasonal nature of deliveries and short amount of time required to deposit loads is likely to minimise potential exposure durations.

4.3.6 Following delivery, the crop feedstocks will be compacted and covered with protective sheeting. This will help to minimise bioaerosol release during storage.

4.3.7 The cover on the clamps will be slightly open at one end during cutting phases in order to allow access to the feedstock for removal and transportation to the Crop AD plant feed hoppers. It is anticipated that there will typically be two cutting phases per working day.

The sheeting will be replaced at the end of each phase in order to protect the feedstock and minimise the potential for emissions. The area of uncovered material during transfer to the hopper will be kept to a minimum at all times in order to limit the potential for surface wind stripping of microorganisms.

- 4.3.8 The clamps will be inspected on a daily basis to ensure the sheeting is intact and providing effective coverage of the feedstock material.

Exposed Maize Silage and Rye During Transfer

- 4.3.9 Maize silage will be transferred from the storage clamps using a bucket loader or similar and then deposited into the relocated feed hoppers.
- 4.3.10 There is the potential for bioaerosol release during removal of maize silage from the clamps and loading into the hoppers. As such, all reasonable measures will be undertaken to minimise disturbance of the material during this operation. In addition, the shortest transfer routes will be utilised in order to limit potential exposure durations.
- 4.3.11 Full training will be provided to the bucket loader operative to avoid material spillage during transfer. Any spilled material will be cleared within the working day.

Feed Hoppers

- 4.3.12 The feed hoppers will macerate and blend the maize silage prior to processing within the Crop AD plant. Bioaerosol emissions may occur during operation of the hoppers. As such, potential releases have been considered further as part of the assessment.

Fugitive Emissions from the Reception Building

- 4.3.13 The reception building will utilise fast acting roller shutter doors in order to promote effective containment of bioaerosols. In accordance with EA guidance¹¹, the delivery area of the reception building will feature a ventilation system which is capable of achieving an extraction rate equivalent to 3 air changes per hour. This will help to ensure

¹¹ How to comply with your environmental permit. Additional technical guidance for: composting and aerobic treatment sector, EA, 2013.

that negative pressure is maintained within the building and reduce the potential for fugitive emissions when the roller shutter doors are opened to allow vehicle access.

Leachate Tank Vent

- 4.3.14 Air displaced from the leachate storage tanks during filling will exhaust directly to atmosphere via vents near to the tops of the vessels. This may contain bioaerosols. As such, potential impacts associated with emissions from the source have been considered further as part of the assessment.

Centriair Abatement System Stack

- 4.3.15 Air extracted from the reception building will be transferred to a Centriair ColdOx combined UV and activated carbon abatement system for treatment. Air extracted from the mixing pit and digestate separation room will be transferred to Centriair DEO-500 regenerative catalytic conversion and sulphured pellet abatement units. Treated air from all systems will be released to atmosphere via a common stack at a height of 14m.
- 4.3.16 The proposed abatement systems are likely to provide beneficial reductions in bioaerosol concentrations between inlet and outlet air due to the following:
- UV radiation is mutagenic to bacteria and is therefore likely to lead to death or inactivation of components within the reception building extract air;
 - Secondary treatment using activated carbon housed within the ColdOx unit is likely to result in the inactivation of fungi and residual viable bacterial components not removed by the UV stage; and,
 - The catalytic oxidation process is heat assisted and is therefore likely to result in the thermal deconstruction of microorganisms present within air.
- 4.3.17 Although it is considered that the stated control mechanisms will provide effective reductions in bioaerosol concentrations, it is recognised that there is the potential for the release of residual microorganisms. As such, emissions have been evaluated further as part of the assessment.
-

Upgrade System Vent

- 4.3.18 Biogas which is upgraded to biomethane for injection into the gas grid will be passed through an activated carbon filter to remove specific compounds before CO₂ is stripped through selective membranes and vented to atmosphere. The system is likely to provide beneficial reductions in bioaerosol concentrations between inlet and vented air due to the impaction of microorganisms onto the carbon media during operation. However, there may be the potential for the release of residual components which pass straight through the filter. As such, emissions have been evaluated further as part of the assessment.

Solid Digestate

- 4.3.19 Digestate generated by the Crop AD plant will be divided into solid and liquid fractions using an existing screw separator on the central section of the site. Solid digestate will be discharged from the separator via an enclosed chute into a covered trailer. Although the AD process will reduce the quantities of some bioaerosols, particularly pathogens¹², there is the potential for emissions from this part of the process.
- 4.3.20 Solid digestate will remain covered within the trailer during storage in order to reduce the exposed surface area of material and limit the potential for surface wind stripping of microorganisms. In addition, the material will be removed from site daily to avoid storage of significant amounts and the associated potential for bioaerosol release. However, residual emissions may occur and have therefore been considered further as part of the assessment.
- 4.3.21 As stated previously, digestate generated by the Waste AD plant will be divided into solid and liquid fractions using a screw separator located within the reception building. Solid digestate will be discharged from the separator via a chute into a trailer where it will be stored prior to removal from the site. Air will be extracted from the trailer room and transferred to a Centriair DEO-500 regenerative catalytic conversion and sulphured pellet abatement system for treatment prior to discharge to atmosphere via the common stack.

¹² Anaerobic digestion, storage, oligolysis, lime, heat and aerobic treatment of livestock manures, FEC Services Ltd, 2003.

Liquid Digestate Lagoons

4.3.22 The liquid digestate generated by the Crop and Waste AD processes will be stored within two lagoons (one existing and one proposed). Both lagoons will feature floating covers in order to provide containment of materials and minimise the potential for associated emissions to atmosphere.

4.3.23 Although the floating covers are anticipated to provide effective control of bioaerosol emissions, there is the potential for residual fugitive releases. As such, emissions have been evaluated further as part of the assessment.

Digestate Tanker

4.3.24 Liquid digestate will be transported off site in vacuum tankers. These will couple to an outlet point on the lagoons using a hose before material is transferred using a mechanical pumping system. The pumping arrangement is closed and therefore digestate will not be exposed to atmosphere during transfer.

4.3.25 Emissions from the digestate tanker are associated with the air being expelled during filling. The bioaerosol release potential depends largely on the material previously being transported rather than the digestate itself.

4.3.26 Tankers are most commonly used to transport liquids and semi-solid materials which generally have a low emission potential. As such, releases from this source are not considered to be significant. However, emissions have been considered further as part of the assessment in order to provide a comprehensive appraisal of potential impacts.

4.4 Other Sources of Bioaerosols

4.4.1 There is agricultural land use in the immediate vicinity of the site. Arable fields may form further sources of bioaerosols if fertilised with animal manures or slurries, as well as during crop harvest periods. However, likely impacts associated with these releases are not considered to be significant and would be expected for any rural location within the UK.

4.5 Receptors

- 4.5.1 EA guidance 'M9: environmental monitoring of bioaerosols at regulated facilities'¹³ defines a sensitive receptor as follows:

"Nearest sensitive receptor means the nearest place to the permitted activities where people are likely to be for prolonged periods. This term would therefore apply to dwellings (including any associated gardens) and to many types of workplaces. We would not normally regard a place where people are likely to be present for less than 6 hours at one time as being a sensitive receptor. The term does not apply to those controlling the permitted facility, their staff when they are at work or to visitors to the facility, as their health is covered by Health and Safety at Work legislation, but would apply to dwellings occupied by the family of those controlling the facility."

- 4.5.2 A desk-top study was undertaken in order to identify any sensitive receptors in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 3.

Table 3 Sensitive Receptors

Receptor		NGR (m)		Distance from AD Plant Boundary (m)	Direction from AD Plant
		X	Y		
R1	Commercial - Crowshall Veterinary Services	603479	295790	70	North-east
R2	Residential - Stuart House	603530	295863	140	North-east
R3	Residential - Cakes Hill	603486	295927	200	North-east
R4	Residential - Crowshall Lane	603463	296047	300	North
R5	Residential - Ellingham Road	603296	296176	400	North
R6	Residential - Ellingham Road	603174	296152	410	North
R7	St Luke's Hospital	603013	296096	410	North-west
R8	Residential - Cades Hill Farm	602860	296089	500	North-west

¹³ M9: environmental monitoring of bioaerosols at regulated facilities, EA, 2018.

Receptor		NGR (m)		Distance from AD Plant Boundary (m)	Direction from AD Plant
		X	Y		
R9	Residential - Shrugg's Lane	602783	295883	440	North-west
R10	Residential - Lyng Farm	602487	295286	830	South-west
R11	Industrial - Wastewater Treatment Works	602861	295200	530	South-west
R12	Commercial - West Carr Road	603119	294819	720	South
R13	Residential - Carver's Lane	603528	294910	620	South
R14	Residential - Carver's Lane	603583	295146	420	South-east
R15	Residential - Carver's Lane	603683	295248	370	South-east
R16	Residential - Chapel Road	603966	295468	450	East
R17	Residential - Baconsthorpe	604061	295923	540	North-east
R18	Residential - Ash Farm	603151	296756	1,000	North

4.5.3 Reference should be made to Figure 3 for a visual representation of the identified receptors.

4.6 Prevailing Meteorological Conditions

4.6.1 The potential for bioaerosol emissions to impact at sensitive locations depends significantly on the meteorology, particularly wind direction, during release. In order to consider prevailing conditions at the site review of historical weather data was undertaken. Norwich Airport meteorological station is located at NGR: 622041, 313948, which is approximately 26.1km north-east of the facility. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

4.6.2 Meteorological data was obtained from Norwich Airport meteorological station over the period 1st January 2015 to 31st December 2019 (inclusive). The frequency of wind from the eight sectors which best describe the directions which may cause impacts in the vicinity of the site is shown in Table 4. Reference should be made to Figure 4 for a wind rose of the meteorological data.

Table 4 Wind Frequency Data

Wind Direction (°)	Frequency of Wind (%)
337.5 - 22.5	9.28
22.5 - 67.5	7.62
67.5 - 112.5	7.79
112.5 - 157.5	5.87
157.5 - 202.5	16.00
202.5 - 247.5	24.17
247.5 - 292.5	20.52
292.5 - 337.5	6.32
Sub-Total	97.57
Calms	1.46
Missing/Incomplete	0.98

4.6.3 All meteorological data used in the assessment was provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of meteorological data within the UK.

4.6.4 As shown in Table 4, the prevailing wind direction at the AD facility is from the south-west with significant frequencies from the west. Winds from the north and east are relatively infrequent, which is indicative of conditions throughout the majority of the UK.

5.0 RISK ASSESSMENT METHODOLOGY

5.1 Overview

5.1.1 The Bioaerosol Risk Assessment has been undertaken in accordance with the general principles of EA document 'Guidance on the evaluation of bioaerosol risk assessments for composting facilities'¹⁴. This included consideration of the following:

- Receptor - what is at risk? What do I wish to protect?
- Source - what is the agent or process with potential to cause harm?
- Harm - what are the harmful consequences if things go wrong?
- Pathway - how might the receptor come into contact with the source?
- Probability of exposure - how likely is this contact?
- Consequence - how severe will the consequences be if this occurs?
- Magnitude of risk - what is the overall magnitude of the risk? and,
- Justification for magnitude - on what did I base my judgement?

5.1.2 Based on the Bioaerosol Risk Assessment outcomes potential mitigation and control options were identified.

5.1.3 Further explanation for the key assessment areas is provided below.

5.2 Receptor

5.2.1 The first step was to consider how the activity could harm the environment. This involved identifying 'receptors' that may be affected by bioaerosol emissions from the facility and for the purpose of the assessment focussed on relevant sensitive human receptor locations in the vicinity of the site, as set out in Section 4.5.

5.3 Probability of Exposure

5.3.1 The probability of exposure was defined based on the likelihood of exposure of the specific receptor to the identified sources. This depended on several factors, such as:

¹⁴ Guidance on the evaluation of bioaerosol risk assessments for composting facilities, EA, undated.

- Distance between source and receptor;
- Dispersion potential of emission;
- Duration of emission; and,
- Frequency of emission.

5.3.2 Probability was categorised in accordance with the following criteria:

- High - exposure is probable, direct exposure likely with no/few barriers between source and receptor;
- Medium - exposure is fairly probable, barriers less controllable;
- Low - exposure unlikely, barriers exist to mitigate; or,
- Very low - exposure very unlikely, effective and multiple barriers.

5.4 Harm

5.4.1 The severity of harm from a risk depends on:

- How much a person or part of the environment is exposed; and,
- How sensitive a person or part of the environment is.

5.4.2 Some parts of the environment can be very sensitive. For example, serious health effects can occur if humans are exposed to certain chemicals for only short periods of time.

5.4.3 Harm can be described as follows:

- High - severe consequences, evidence that exposure may result in serious damage;
- Medium - significant consequences, evidence that exposure may result in damage that is not severe and is reversible;
- Low - minor consequences, damage not apparent, reversible adverse changes possible; and,
- Very low - negligible consequences, no evidence for adverse changes.

5.5 Magnitude of Risk

5.5.1 The level of risk is a combination of:

- How likely a problem is to occur; and,
- How serious the harm might be.

5.5.2 Risk is highest where both the likelihood of a problem is high and the potential harm is severe. Risk is lowest where a problem is unlikely to occur and the harm that might result is not serious.

5.5.3 Risk was defined based on the interaction between the probability of exposure and potential harm, as outlined in Table 5.

Table 5 Magnitude of Risk

Probability of Exposure	Potential Harm			
	Very Low	Low	Medium	High
High	Low	Medium	High	High
Medium	Low	Medium	Medium	High
Low	Low	Low	Medium	Medium
Very Low	Very Low	Low	Low	Medium

5.6 Further Requirements

5.6.1 Based on the outcomes of the risk assessment the EA document provides guidance on further requirements for different risks. These can be summarised as follows:

- High risks - additional assessment and active management;
- Medium risks - likely to require further assessment and may require either active management or monitoring; and,
- Low and very low risk - will only require periodic review.

5.6.2 Mitigation to reduce risk can also be applied to avoid the requirement for further assessment and/or monitoring.

6.0 RISK ASSESSMENT

6.1.1 The Bioaerosol Risk Assessment is shown in Table 6.

Table 6 Risk Assessment

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Exposed maize silage during delivery and storage	<p>Medium at R1 to R3 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and containment of feedstocks during storage</p> <p>Low at R4 to R18 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and containment of feedstocks during storage</p>	Medium	Medium	<p>All reasonable measures will be undertaken to reduce the drop height of materials during unloading of the delivery vehicles</p> <p>Feedstocks will be stored under sheeting following delivery</p> <p>The area of uncovered material will be kept to a minimum during storage and will only be exposed when cutting and transfer to the AD plant is required. This will help to limit the potential for surface wind stripping of microorganisms</p> <p>The clamps will be inspected on a daily basis to ensure the sheeting is intact and providing effective containment of emissions</p> <p>Training in the use of relevant equipment will be provided to all staff</p> <p>Any spilled material will be cleared by a site operative on the same working day</p>	Low	The seasonal nature and short duration of delivery activities, as well as full implementation of the stated control measures is considered to result in a low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Exposed maize silage during transfer to the feed hoppers	<p>Low at R1 to R3 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and the limited duration of transfer operations</p> <p>Very Low at R4 to R18 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and the limited duration of transfer operations</p>	Medium	Medium or Low	<p>All reasonable measures will be undertaken to minimise disturbance of the feedstocks during removal from the clamp area and transfer to the hoppers</p> <p>The shortest transfer routes will be utilised in order to limit potential exposure durations</p> <p>Full training will be provided to the bucket loader operative to avoid material spillage during transfer</p> <p>Any spilled material will be cleared by a site operative within the working day</p>	Low	The distance between source and receptors, as well as and full implementation of the stated control measures, is considered to result in a low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Exposed material within the feed hoppers	<p>Low at R1 to R3 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and frequency of operation</p> <p>Very Low at R4 to R18 due to the separation distance between the receptors and source and frequency of operation</p>	Medium	Medium or Low	<p>The feed hoppers will only operate twice daily</p> <p>Where practicable the drop height of material will be minimised in order to reduce release potential</p> <p>Full training will be provided to the bucket loader operative to avoid material spillage during transfer</p> <p>Any spilled material will be cleared by a site operative within the working day</p>	Low	The distance between source and receptors, as well as and full implementation of the stated control measures, is considered to result in a low residual risk of impact occurring
Fugitive emissions from reception building	Very Low due to effective containment of emissions within the building and the distance between source and receptors	Medium	Low	<p>The reception building will feature fast-acting roller shutter doors. These will remain shut at all times except for when vehicles require access to the building</p> <p>The delivery area of the building will feature a ventilation system capable of achieving an extraction rate equivalent to 3 air changes per hour. This will help to ensure that negative pressure is maintained within the building and reduce the potential for fugitive bioaerosol emissions when the roller shutter doors are opened to allow vehicle access</p>	Very Low	Full application of the proposed control measures is considered to result in a very low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Air expelled from the vents serving the leachate storage tanks	Very low due the distance between source and receptors and the low release potential	Medium	Low	Leachate is likely to have a low release potential due to associated moisture content The low volume of air displaced from the tank during filling will limit mass emissions	Very low	The low release potential of leachate is considered to result in a very low residual risk of impact occurring
Air released from the common stack serving the Centriair abatement system	Very low due the distance between source and receptors and the limited residual release potential	Medium	Low	The proposed abatement system is likely to provide beneficial reductions in bioaerosol concentrations between inlet and outlet air due to the use of UV radiation and thermally assisted catalytic oxidation. In addition, impaction of microorganisms onto carbon media housed within the ColdOx units is likely to contribute to reductions Discharge or treated air to atmosphere via a 14m stack will help to promote effective dilution and dispersion of any residual components	Very Low	Full application of the proposed control measures is considered to result in a very low residual risk of impact occurring
Air expelled from the upgrading unit CO ₂ vent	Very low due the distance between source and receptors and the limited release potential	Medium	Low	The carbon filter serving the gas upgrading system is likely to provide beneficial reductions in bioaerosol concentrations between inlet and vented air due to the impaction of microorganisms onto the media during operation. It is anticipated that the residual release potential will be limited	Very Low	Full application of the proposed control measures is considered to result in a very low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Solid digestate generated by the Crop AD process below the separator	Very low due the distance between source and the receptors, the limited quantity of solid digestate below the separator, containment provided by the cover fitted to the trailer and minimal disturbance of material during storage	Medium	Low	<p>Solid digestate will remain covered within the trailer during storage in order to reduce the exposed surface area of material and limit the potential for surface wind stripping of microorganisms</p> <p>Solid digestate will be removed from site daily to avoid storage of significant amounts and associated emissions</p> <p>The material will remain static during storage with minimal mechanical agitation</p> <p>All reasonable measures will be undertaken to minimise disturbance of the material during loading</p>	Very Low	Full application of the proposed control measures is considered to result in a very low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Fugitive emissions from the covered liquid digestate storage lagoons	<p>Low at R1 to R3 due to the separation distance between the receptors and source, the frequency of winds blowing towards the receptors and containment of emissions</p> <p>Very Low at R4 to R18 due to the separation distance between the receptors and source and containment of emissions</p>	Medium	Medium or Low	Both lagoons will feature floating covers. These are expected to provide effective containment of materials and limit any associated bioaerosol emissions to atmosphere	Low	Containment provided by the floating covers is considered to result in a low residual risk of impact occurring
Fugitive emissions from the covered dirty water lagoon	Very low due the distance between source and receptors and the limited release potential	Medium	Low	<p>The water will not be agitated during storage in order to reduce the potential for atomisation of microorganisms</p> <p>The lagoon will feature a cover. This is expected to provide effective containment of materials and limit any associated bioaerosol emissions to atmosphere</p>	Very low	Containment provided by the cover is considered to result in a very low residual risk of impact occurring

Source	Probability of Exposure	Harm	Magnitude of Risk	Control Measures	Residual Risk	Justification for Residual Risk
Air expelled from the liquid digestate tankers	Very low due the distance between source and receptors and the short duration of tanker filling operations	Medium	Low	The infrequent nature and short duration of tanker filling events is likely to limit the potential for impacts	Very Low	The short duration of filling operations as well as the low release potential of residual material within the tanker is considered to result in a very low residual risk of impact occurring

6.1.2 As shown in Table 6, the results of the assessment indicated residual risk from all sources was determined as very low or low. As such, it is concluded that no further control measures, other than those specified, are required in order reduce the potential for impacts at sensitive locations in the vicinity of the site.

7.0 CONCLUSION

7.1.1 Redmore Environmental Ltd was commissioned by Earthcare Technical Ltd to undertake a Bioaerosol Risk Assessment in support of a Substantial Variation Environmental Permit Application for Attleborough AD plant, Ellingham Road, Attleborough, Norfolk, NR17 1AE.

7.1.2 During the operation of the AD facility there is the potential for bioaerosol emissions and associated impacts at sensitive receptor locations in the vicinity of the site. A Risk Assessment has therefore been undertaken to identify potential emission sources and evaluate effects in the local area.

7.1.3 The following potential bioaerosol emission sources were identified:

- Exposed maize silage and rye during delivery and storage within the clamps;
- Exposed maize silage and rye during transfer to the feed hoppers;
- Exposed material within the feed hoppers;
- Fugitive emissions from the reception building;
- Air displaced from the leachate storage tanks;
- Air released from the common stack serving the Centriair abatement systems;
- Air released from the upgrade system CO₂ vent;
- Fugitive emissions from the covered solid digestate storage trailer serving the Crop AD plant;
- Fugitive emissions from the covered liquid digestate storage lagoons;
- Fugitive emissions from the covered dirty water lagoon; and,
- Air expelled from the liquid digestate tankers.

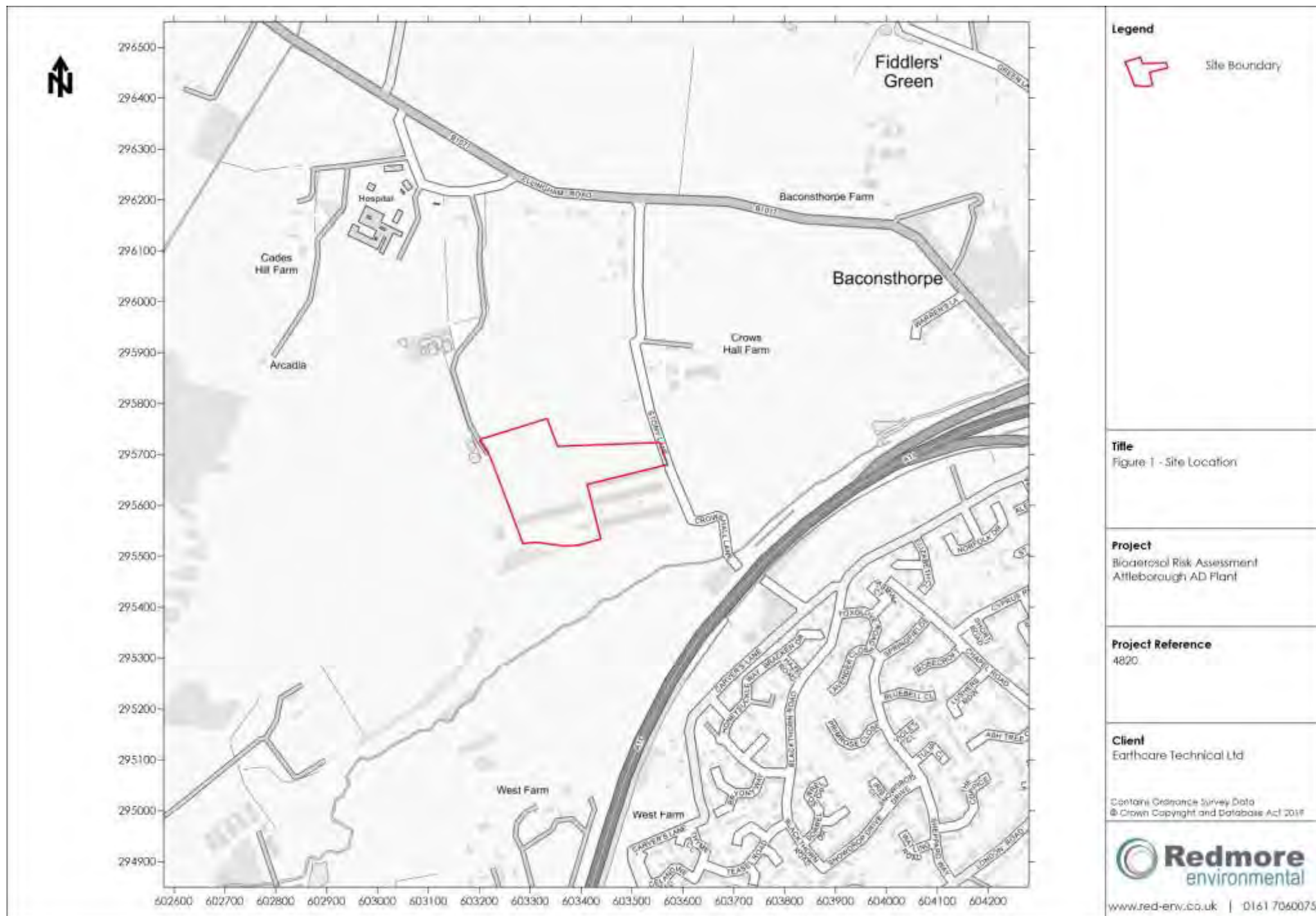
7.1.4 The risk of significant bioaerosol impact at sensitive locations in the vicinity of the site for each of the identified sources was assessed using a source - pathway - receptor approach. This considered the nature of the potential emission, any barriers to dispersion and the severity of harm.

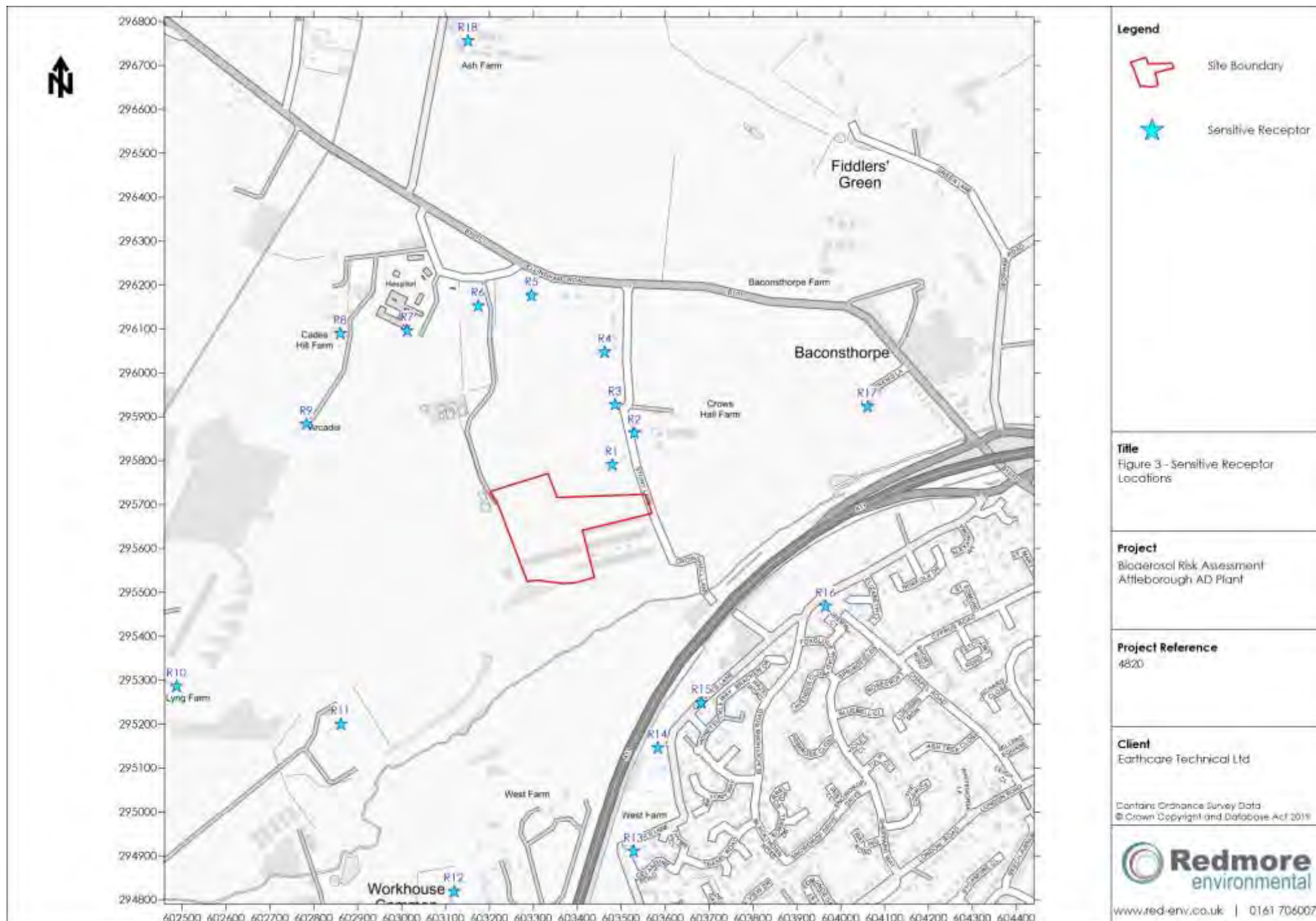
7.1.5 The results of the assessment indicated residual risk from all sources was determined as low or very low. As such, it is concluded that no further control measures, other than those detailed in the assessment, are required in order to reduce the potential for impacts at sensitive locations in the vicinity of the site.

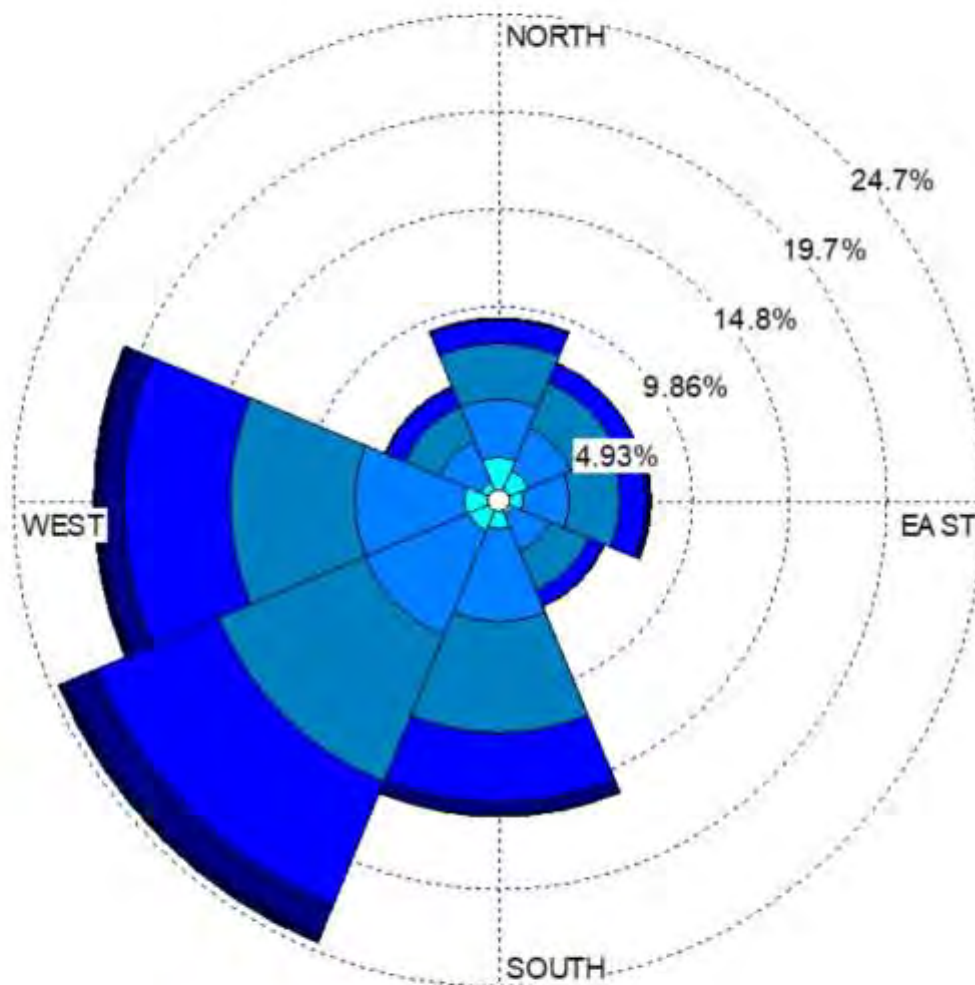
8.0 ABBREVIATIONS

AD	Anaerobic Digestion
CH ₄	Methane
CHP	Combined Heat and Power
CO ₂	Carbon dioxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
HGV	Heavy Goods Vehicle
H ₂ S	Hydrogen sulphide
IVC	In-Vessel Composting
NGR	National Grid Reference
RPS	Regulatory Position Statement
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
UV	Ultra Violet
VOC	Volatile Organic Compound

Figures







Legend

WIND SPEED
(m/s)



Calms: 1.46%

Title

Figure 4- Wind Rose of 2015 to 2019
Norwich Airport Meteorological Data

Project

Bioaerosol Risk Assessment
Attleborough AD Plant

Project Reference

4820

Client

Earthcare Technical Ltd



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