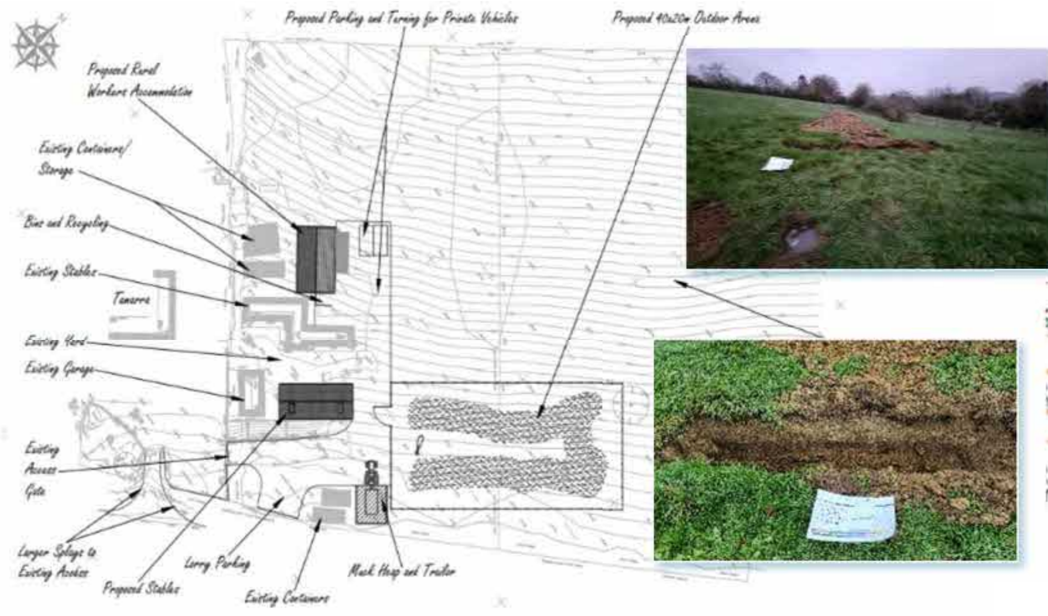

Foul Effluent Drainage Scheme

Tamarra Stud

Old Wells Road, Egford, BA11 3JR

On Behalf of

AGM Planning

Quality Management

Prepared by:	Isobel Zelly MSci	[redacted]
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Project Number:	HYG1131	
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1 Introduction

1.1 Background

This foul effluent drainage scheme has been undertaken by Hydrogeo Ltd (Hydrogeo) on behalf of AGM Planning (the Client) at Tamarra Stud (the Site).

The scheme has been designed to meet Pre-commencement Planning Condition 4

Drainage - Foul (Pre-commencement)

No development shall commence until a detailed scheme for the disposal of foul drainage from the development has been submitted to and approved in writing by the Local Planning Authority. The development shall thereafter be carried out in accordance with the approved details and completed prior to the occupation of the dwelling(s).

The Site is located at Old Wells Road, Egford, Somerset, BA11 3JR. The grid reference to the approximate centre of the Site is ST 75279 48102. All distance measurements are taken from this point unless otherwise stated. The ordnance survey map of the Site location is shown in Figure 1-1 and the Site boundary is shown in Figure 1-2.

The Site lies at an approximate elevation of 87m above ordnance datum (AOD) at the northern boundary and 82mAOD at the southern boundary.

Figure 1-1 – Site location.

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The Site currently comprises several buildings including a stable, garage and several storage containers with a hardstanding track for vehicle access onto the undeveloped fields. The fields to the east and north are within the ownership boundary but remain undeveloped and are currently used for horse grazing. The Site currently operates as an equestrian stud.

Figure 1-2 – Site boundary.

Contains Bing Satellite imagery © Microsoft 2023.

1.2 Proposed Development

The proposed development includes the construction of a new 3 box stable building, lorry parking, muck heap, outdoor arena, and a 2-bed rural workers accommodation with associated car parking and turning area. The relevant proposed Site layout plans provided by the Client team have been attached as Appendix A.

A planning application was submitted to Mendip District Council on the 7th June 2022 under the reference 2022/1168/FUL for the "*Erection of Stables, Menage, and the Siting of a Temporary Mobile Home for Rural Worker"* which was accepted on the 21st December 2022. One of the conditions of the acceptance was for a *"detailed scheme for the disposal of foul drainage"* to be undertaken.

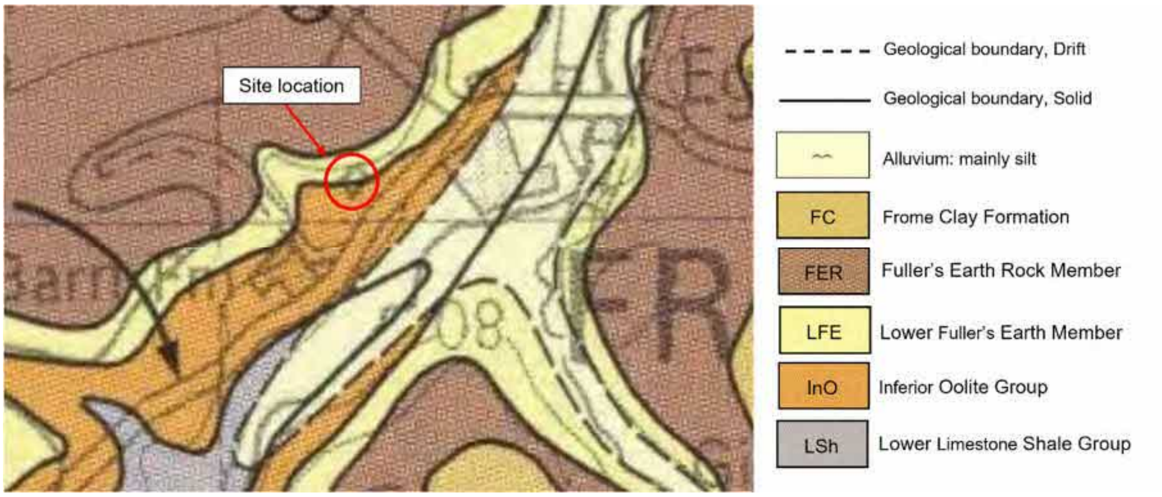
A Foul / Non-Mains Drainage Assessment was undertaken and showed there are currently no sewer networks which underlie the Site and subsequently the proposed development cannot connect to the public mains sewer system. Therefore the temporary mobile home will be served by a package treatment plant and drainage field or mound.

2 Site Setting

2.1 Published Geology

The Site is covered by the BGS 1:50,000 solid and drift sheet map 281 Frome, 2000. An extract from the BGS sheet map is shown in Figure 2-1. This map, as well as online resources, have been used to determine the anticipated underlying geology at the Site.

Figure 2-1 – BGS sheet map extract.



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There is a fault with downthrow to the south of unknown displacement mapped 390m to the north of the Site. There are no artificial or superficial deposits anticipated to be present underlying the Site.

The Site is mapped as being underlain in the north and west by mudstone of the Lower Fuller's Earth Member. This is described by the BGS as *"olive-grey, silty, calcareous mudstones with thin intervals of argillaceous limestone and oyster-rich mudstones"*. The east and south of the Site is mapped as being underlain by ooidal limestone of the Inferior Oolite Group. This is described by the BGS as *"thinly and rubbly bedded with many non-sequences"*.

2.2 BGS Borehole Data

A number of borehole records surrounding the Site area available online. A selection of the closest and most relevant borehole records is outlined in Table 2-1.

Table 2-1 – Borehole details within the Site vicinity.

BH Details	Observed Geology
BGS ID: ST74NE46 Location: 195mE Elevation: 76mAOD Geology: Alluvium, Inferior Oolite	▪ 0 – 4m ALUVIUM ▪ 4 – 10m INFERIOR OOLITE ▪ 10 – 20m UPPER LIAS Drilling water was totally lost in the Inferior Oolite.
BGS ID: ST74NW47 Location: 593m NE Elevation: 74mAOD Geology: Head, Lower Fuller's Earth Member	▪ 0 – 1m HEAD ▪ 1 – 19m FULLER'S EARTH ▪ 19 – 42m INFERIOR OOLITE Drilling water was lost below 14.5mbgl. Rest water level 2mbgl.
BGS ID: ST74NE3 Location: 1.1km SE Elevation: 122mAOD Geology: Forest Marble Formation	▪ 0 – 22.56m FOREST MARBLE ▪ 22.56 – 52.63m FROME CLAY ▪ 52.63 – 53.16m UPPER FULLER'S EARTH ▪ 53.16 – 58.45m FULLER'S EARTH ROCK ▪ 58.45 – 72.14m LOWER FULLER'S EARTH ▪ 72.14 – 73.10m INFERIOR OOLITE
BGS ID: ST74NW14 Location: 2.4km SW Elevation: 123mAOD Geology: Inferior Oolite	▪ 0 – 30.5m INFERIOR OOLITE ▪ 30.5 – 24.7m BLACK ROCK LIMESTONE Water struck at 17mbgl, 34mbgl. Rest water level 15mbgl.

2.3 Local Hydrology

The main river within the Site vicinity is the Egford Brook which is located 133m to the south and has a north-eastward flow direction. Springs of tributaries to this brook are located 973m east and 864m south. Another main river, the Fordbury Water, is located 859m north and also flows in a north-eastward direction. Both of these waters join the River Frome 1km north-east of the Site.

There are also 2 small farm ponds located 750m north of the Site.

2.4 Hydrogeology

The Site is covered by the BGS 1:100,000 hydrogeological map 8 Chalk and associated Minor Aquifers of Wessex, 1979.

The Fuller's Earth Formation, in the north and west of the Site, consists predominantly of clays and has low permeability which confines the groundwater beneath it and restricts recharge.

The Inferior Oolite consists mainly of oolitic and sandy limestones which are permeable and can supply reasonable local yields.

The presence of a fault within the bedrock may interfere with and limit groundwater flow.

2.5 Environmental Designations

The Site is located within a Nitrate Vulnerable Zone (NVZ) and a Source Protection Zone (SPZ) Zone I – Inner Protection Zone. As the Site is located within the SPZ an environmental permit to discharge effluent water will be required.

631m north-east of the Site there is an area which is a Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Groundwater Dependent Terrestrial Ecosystem (GDTE) and designated Ancient Woodland.

2.6 Licensed Abstractions

There are 8no. licensed groundwater abstractions and 10no. licensed surface water abstractions within 5km of the Site. Their details are outlined in Table 2-2 and Table 2-3 below and their locations are shown in Figure 2-2.

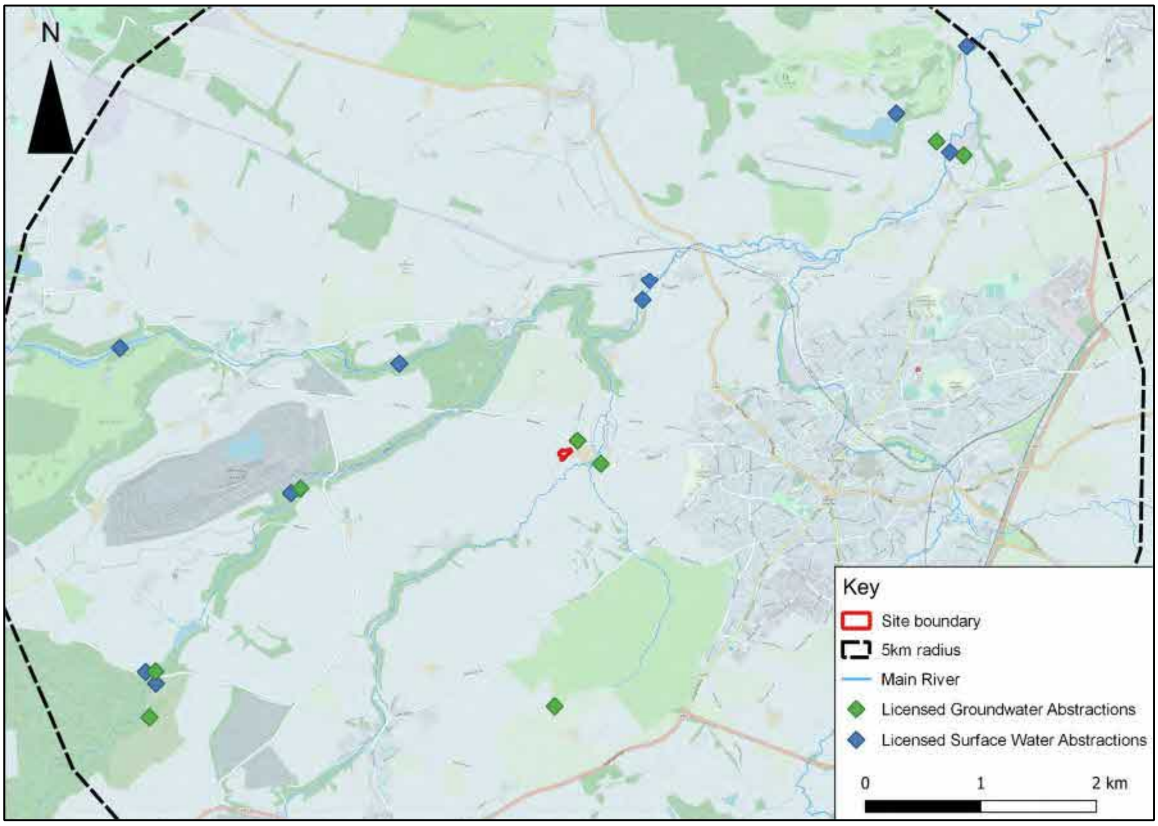
Table 2-2 – Licensed groundwater abstractions within 5km of the Site.

Distance	Purpose	Target Geology	Groundwater Info
160m NE	Agriculture		No BH record
325m E	Public water supply		BH record classified
2.2km S	Agriculture	Inferior Oolite	Water struck at 24mbgl. Rest water level 18mbgl
2.3km W	Industrial		No BH record
4km SW	Industrial		No BH record
4.2km NE	Public Water Supply	Inferior Oolite	Rest water level 3mbgl
4.3km NE	Industrial	Inferior Oolite	Overflowing Artesian
4.3km SW	Industrial dust suppression	Black Rock Limestone	Water struck at 18 and 37mbgl. Rest water level 14mbgl

Table 2-3 – Licensed surface water abstractions within 5km of the Site.

Distance	Purpose	Target System
1.5km NE	Private amenity	Mells River
1.6km NW	Hydroelectric Power	Mells River
1.7km NE	Hydroelectric Power	Mells River
2.4km W	Industrial	Whatley Brook
3.9km NW	Irrigation	Mells Park Lake
4.0km SW	Industrial	Fordbury Water
4.1km SW	Industrial	Shearmoor Stream
4.1km NE	Irrigation	Orchardleigh Lake
4.2km NE	Industrial Cooling	River Frome
4.9km NE	Hydroelectric Power	River Frome

Figure 2-2 – Licensed water abstractions within 5km of the Site.



2.7 Water Quality Exemptions

There are 4no. water quality exemptions within 1km of the Site, their locations are shown in Figure 2-3.

The exemptions are for effluent discharge. 2no. of these are converted from Water Resources Act discharge consent and no volume is listed. The other 2no. exemptions are for discharges to ground of $\leq 2m^3$/day.

There is a discharge which is located 61m east of the Site and is therefore within 200m. Based on the contours of the area, the local groundwater flow direction would be expected to be south-eastwards, and therefore would flow parallel and not interact. In addition, the waste water discharged from the Site will be treated via a package treatment plant and a drainage mound/field.

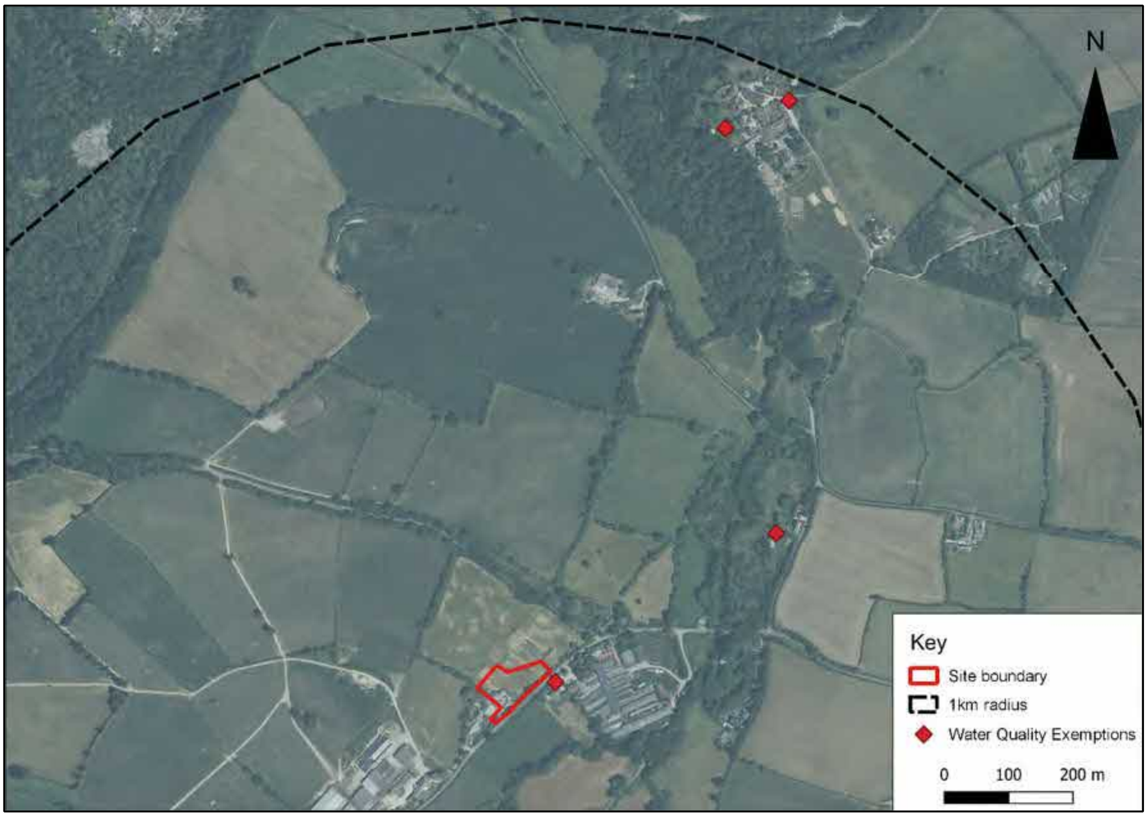


Figure 2-3 – Water quality exemptions within 1km of the Site.

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3 Site Investigation

3.1 Introduction

Hydrogeo attended the Site on the 2nd December 2022 in order to investigate and assess the viability of the ground for a drainage field. Full details of the site investigation can be found in the Percolation Test Report provided by Hydrogeo in December 2022. For the purpose of this drainage scheme, the findings will be summarised below.

3.2 Site Investigation

A total of 3no.trial pits and 8no. percolation pits were advanced across the Site. Their locations are shown in Figure 3-1.

Figure 3-1 – Location of test pits.

Contains Bing satellite imagery © Microsoft 2023.

The trial pits (TP01, TP04 & TP07) were dug to 2mbgl in order to note the presence or absence of groundwater beneath the Site. No groundwater was encountered in any of the pits.

4no. of the percolation pits (TP02-03 & TP05-06) were dug at 0.4mbgl to assess for the viability of a standard drainage field and 4no. of the percolation pits (TP08-11) were dug at ground level to assess for the viability of a raised drainage mound.

Percolation testing was undertaken in accordance with the guidance document BS 6297:2007 + A1:2008 *Code of practice for the installation of drainage fields for use in wastewater treatment* (2008).

3.3 Percolation Test Results

The results of the percolation tests are summarised in Table 3-1.

Table 3-1 – Percolation test results.

Pit ID	Vp (s/mm)			Average Vp (s/mm)
	Test 1	Test 2	Test 3	
TP02	>100	-	-	N/A
TP03	>100	-	-	N/A
TP05	1.2	1.6	3.2	2
TP06	18	-	-	N/A
TP08	112	84	56	84
TP09	36	36	30	34
TP10	96	84	84	88
TP11	96	108	100	101

Notes – Testing in TP02 and TP03 was abandoned due to very low infiltration rate and subsequently tests 2 and 3 were not completed. Tests 2 and 3 were also not completed in TP06 due to no further requirement for testing in this location.

The guidance document indicates that a Vp of between 15 and 100s/mm is required for a drainage field or mound to be viable.

Table 3-1 shows that none of the percolation pits which were dug at 0.4mbgl fall within this range, and therefore a drainage field is not a viable option for the Site.

The percolation pits which were dug at surface level, with the exception of Test 2 in TP11, are within this acceptable range and therefore a drainage mound is a viable option.

4 Foul Effluent Volume, Loading and Treatment

4.1 Foul Effluent Volume

The anticipated foul effluent load that will be produced by the Site after development has been calculated using the British Water Flows and Loads 4 Guidance Document which gives a table of predicted loadings for sewage treatment systems specific to purpose.

The proposed Site layout plans given to Hydrogeo by the Client team show the planned development is for a 2-bed residential dwelling. A standard residential dwelling is indicated to have a flow of 150L per person per day. The guidance states that a 2-bed standard dwelling should be designed for a minimum population (P) of 5. Therefore, the total anticipated flow is 750L/day or 0.75m^3/day.

A PTP that is capable of treating the calculated volume of foul discharge as a minimum will be required for each system. The selected PTP should conform to and meet the standards outlined in BS EN 12566-3.

4.2 Foul Effluent Treatment

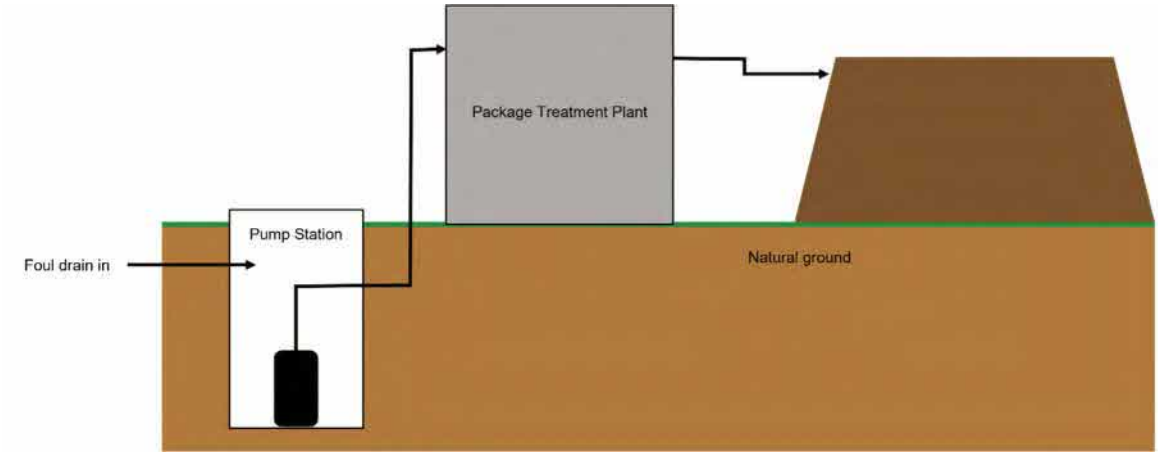
The proposed treated foul drainage system will consist of a PTP and constructed drainage mound. This system provides a primary treatment of settlement of solids prior to discharge into the drainage mound.

The recommended PTP for the Site is a Vortex Eco-Electric Sewage Treatment Plant. The smallest of these, the “Vortex 4”, has a capacity for 1,752 l/day and is therefore considered to be most suitable. Product information for the PTP is attached as Appendix B.

This product is recommended as it can be adjusted post-installation depending on the amount of use that it is getting in order to save energy. In addition, it has up to 98.8% pollutant reduction, including reducing ammonia to 0.3mg/l.

The site layout prevents the effluent draining by gravity into the top of a drainage mound. The foul waste from the building should be piped directly into a below ground pumping station with a high level alarm and a cover which extends partially above the surface to prevent water inflow. The foul waste will then be pumped into the PTP which is located above the ground directly next to the drainage mound. This layout is shown in Figure 4-1.

Figure 4-1 – Foul drainage system layout.



The drainage mound will provide secondary treatment of the effluent before it drains into the topsoil layer. The topsoil provides a tertiary treatment through biodegradation. This will provide significant betterment to any discharge that leaves the Site.

5 Drainage Mound Design

Details, guidelines and parameters from the BRE478 (2008) publication “Mound Filter Systems for the Treatment of Domestic Wastewater” and Part H of the Building Regulations 2010 (Wales) have been used when considering all aspects of designing the mound.

5.1 Drainage Mound Siting

The siting of the drainage mound must meet all of the following criteria:

- ≥15m from any building, and sufficiently distant from any other drainage field or soakaway;
- ≥2m from any site boundary;
- ≥40m from any watercourse or ditch;
- ≥50m from any water abstraction point;
- ≥200m from any other known discharge to ground;
- Downslope of any groundwater sources;
- No water supply pipes or underground services are within the drainage area;
- No access roads, driveways or paved areas are within the drainage area;
- Slope of the original surface does not exceed 12%;
- ≥0.25m naturally occurring soil overlying the bedrock without the presence of groundwater.

Due to the fact that the Site is located within a Source Protection Zone, a permit may be required for the discharge of treated effluent at the Site.

5.2 Drainage Mound Sizing

Based on the calculations in Chapter 4, the Site is expected to produce 0.75m^3/day of foul effluent. Any sewage treatment plant needs to be able to deal with this volume as a minimum.

Minimum Basal Area

The minimum basal area for the drainage mound is calculated using the equation:

$$\mathbf{A_b = P \times Vp \times 0.2}$$

- A_b = area required for the drainage field (m^2)
- P = number of people served by the treatment plant
- Vp = percolation value of the soil (s/mm)
- 0.2 = factor applied for effluents which have received primary treatment, such as in a PTP, and therefore the required area can be reduced by 20%.

The minimum basal area for the proposed drainage mound has been calculated to be:

- P = 5 persons
- Vp = 84s/mm (TP08)
- A_b = 5 x 84 x 0.2 = 84m^2.

Minimum Distribution Layer Area

The minimum distribution layer area for the drainage mound is calculated using the equation:

A_d = P x Vf x 0.2

- A_d = area required for the distribution layer (m^2)
- P = number of people served by the treatment plant
- V_f = percolation value of the filter material (s/mm)
- 0.2 = factor applied for effluents with primary treatment

The minimum distribution layer area for the proposed drainage mound has been calculated to be:

- P = 5 persons
- Vp = 15s/mm (target Vf for filter layer to meet)
- A_d = 5 x 15 x 0.2 = 15m^2.

Feature Surface Dimensions

The calculated surface dimensions of the drainage mound are:

- Minimum distribution layer: 15m^2
- Distance between pipe centres: 1.5m
- Distance from pipe centre to edge of distribution layer: 0.1m
- Number of pipes: 3
- Total width of distribution layer: 3.2m (2x 1.5m + 2x 0.1m)
- Length of pipe: 4.7m (15m^2 area / 3.2m wide)

Feature Depth Dimensions

The drainage mound will consist of:

- Topsoil cover thickness: 300mm (150mm silty/clayey loam + 150mm top soil)
- Permeable geotextile between topsoil and gravel (negligible thickness)
- Gravel distribution layer thickness: 200mm (50mm above pipe centre + 150mm below pipe centre)
- Sand filter material thickness: 700mm
- Permeable geotextile between sand and gravel (negligible thickness)
- Gravel drainage layer: 200mm
- Total thickness: 1.4m

Feature Basal Area Dimensions

The mounds are designed with 1:3 slopes at the sides for stability. As the drainage mound has been calculated to be 1.4m thick, each slope will add 4.2m to the sides of the mound.

The basal area of the drainage mound is calculated to be:

- Width: 11.6m (3.2m + 2x4.2m)
- Length: 13.1m (4.7m + 2x4.2m)
- Area: 151.96m² (11.6m x 13.1m)

Drainage Mound Sizing Summary

A summary of the drainage mound sizing calculations above is given in

Table 5-1 – Summary of drainage mound sizing.

Feature	Size
Daily loading (m^3)	0.75
Distribution area (m^2)	15
Distribution area width (m)	3.2
Distribution area length (m)	4.7
Distribution area depth (m)	1.4
Basal area (m^2)	151.96
Basal area width (m)	11.6
Basal area length (m)	13.1

A section through the proposed drainage mound is shown in Drawing 1.

5.3 Drainage Mound Composition

The BRE 478 guidance recommends a filter layer composed of coarse sand mixed with a minimum amount of fine sand, very fine sand, silt and clay.

Using too coarse a filter will allow wastewater to pass through too quickly and therefore reduce the treatment capabilities of the mound. However, using too fine a filter will result in the residence time of the water being too long, creating a stagnant area that does not allow the proper filtration of the wastewater.

Suitable sands for use within the filter level can be selected using a sieve test to determine grainsize. It is recommended there is no limestone component to the sand.

A target percolation value of the filter layer at 15s/mm has been used to calculate the required areas. Small percolation tests, in accordance with BRE 478 guidance, are recommended before full installation of the filter layer in order to ensure the correct percolation value has been achieved. If a percolation value is achieved that falls within the acceptable range of 15-100s/mm but is not 15s/mm, then the minimum required areas should be recalculated with that value using the equations above.

5.4 Drainage Mound Design

All of the above parameters and guidelines have been taken into account when designing the mound. The proposed location for the drainage mound is limited due to the existing and proposed Site buildings. The proposed drainage mound siting is shown in Figure 5-1.

This position is 3.5m from the Site boundary and 16m from the existing and proposed buildings. The drainage mound is located around the position of TP08 and has therefore been sized according to the testing results.

The proposed location of the drainage mound is not 200m away from other known discharges to ground, however the anticipated flow directions based on the contour lines do not result in the interaction of the treated discharge prior to entering the surface water course, as can be seen in Figure 5-1. In addition, the permeability of the underlying geology means that most of the discharged water will migrate vertically downwards. Therefore, this can be considered to be a sufficient distance from other drainage fields or soakaways.

Figure 5-1 – Drainage mound siting with criteria and anticipated flow directions.

Contains Bing Satellite imagery © Microsoft 2023.

6 Conclusion

6.1 Introduction

This report presents the proposed scheme for foul effluent at the Site undertaken by Hydrogeo. This report has been commissioned in order to support the development of a rural worker's accommodation Tamarra Stud, Egford, BA11 3JR.

6.2 Foul Effluent Drainage

On analysis of the percolation tests previously undertaken by Hydrogeo at the Site, it has been determined that a drainage mound is a viable option for foul effluent drainage at the Site. The Site will be served by a package treatment plant which gives primary treatment of the effluent prior to discharge within an above ground drainage mound feature.

The drainage mound will have an estimated daily loading of 0.75m^3 which will be distributed over a minimum area of 15m^2. The mound will have a total thickness of 1.4m and will be made of imported soils with a target percolation of 15s/mm. The mound has been designed with slopes of gradient 1:3 for safety and stability, and therefore the minimum basal area of the mound is calculated to be 151.96m^2.

The location of the mound has been designed following official guidelines of minimum distances from Site boundaries, buildings and watercourses. The location is within the guidance distance from other discharge consents, however the anticipated flow direction does not result in any interaction with other known discharges.

The Site is located within a source protection zone and therefore a water quality exemption license will be required for the discharge of treated effluent at the Site.

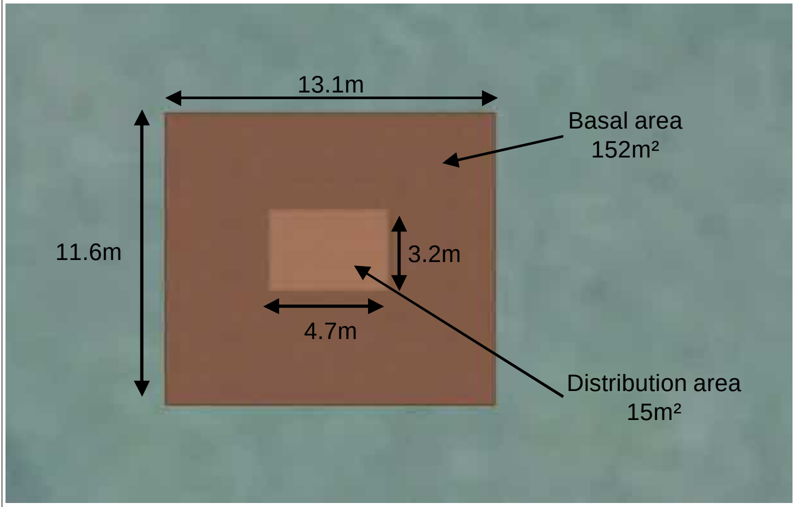
The proposed foul effluent drainage scheme is not expected to have any impacts on the surrounding environment due to the treatment and betterment of the effluent before it reaches the surface water system.

Drawings

Drawing 1

Proposed drainage mound section

Proposed Drainage Mound Sizing



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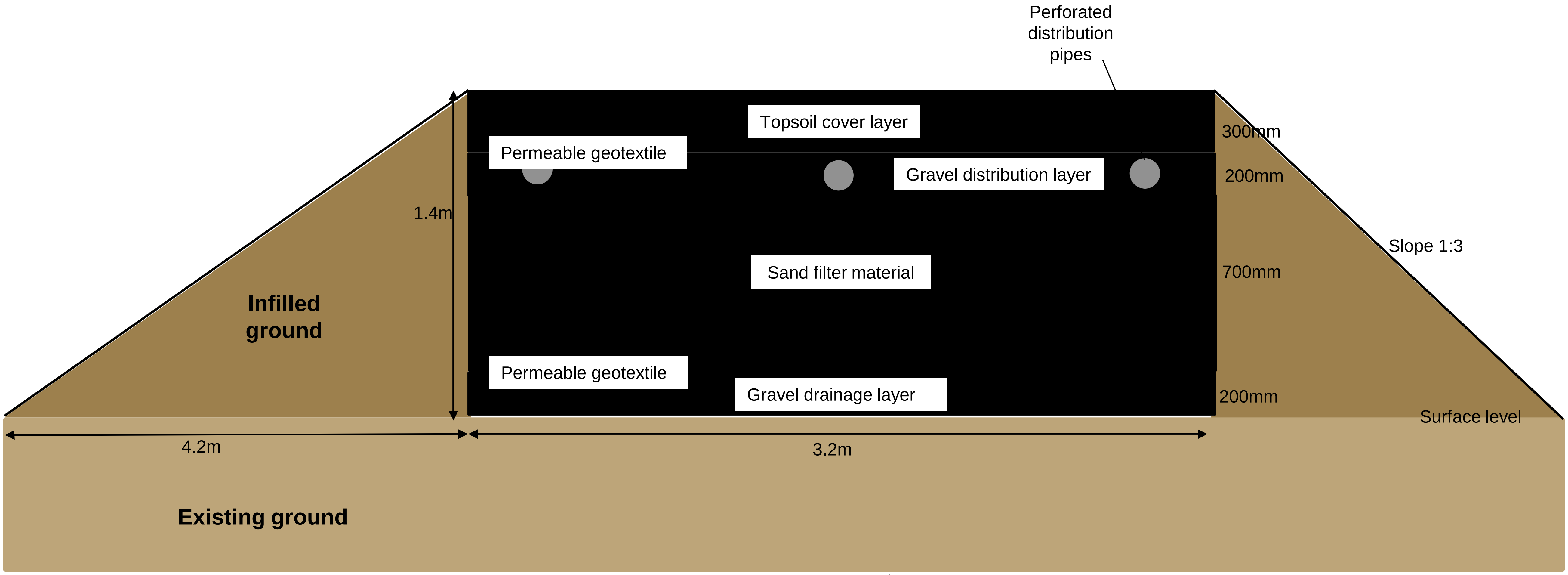

DRAWING 1 – Proposed Drainage Mound Section

Project: HYG1131 Tamarra Stud

HYDROGEO

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Web: www.hydrogeo.co.uk

Client: AMG Planning

Date: 16 11 2023 Drawn by: IZ Paper: A4 Version: 1

Appendices

Appendix A

Proposed Site layout plan

Head Projects Building Consultancy Limited

Coombe Lodge, Blagdon, Bristol, BS40 7RE - T: 01761463860 - E: enquiry@headprojects.com

REV	DATE	DESCRIPTION	INITIAL	CHECKED

Planning Application

Tamarra Stud

CLIENT
L&E Murcott c/o AGM Ltd (2020.088)

TITLE
Proposed Site Block Plan

PROJECT
Tamarra Stud, Old Wells Road, Egford, Frome, BA11 3JR

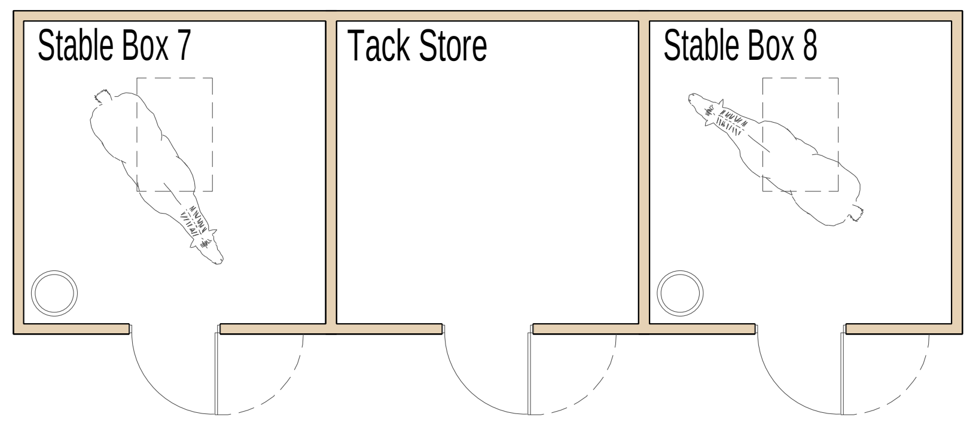
DRAWING REF / REV	DRAWN	SCALE	DATE
7043 PA 003 / *	SJB	1:200 @ A1	05/05/2022

Head Projects Building Consultancy Limited

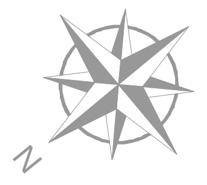
Coombe Lodge, Blagdon, Bristol, BS40 7RE - T: 01761463860 - E: enquiry@headprojects.com

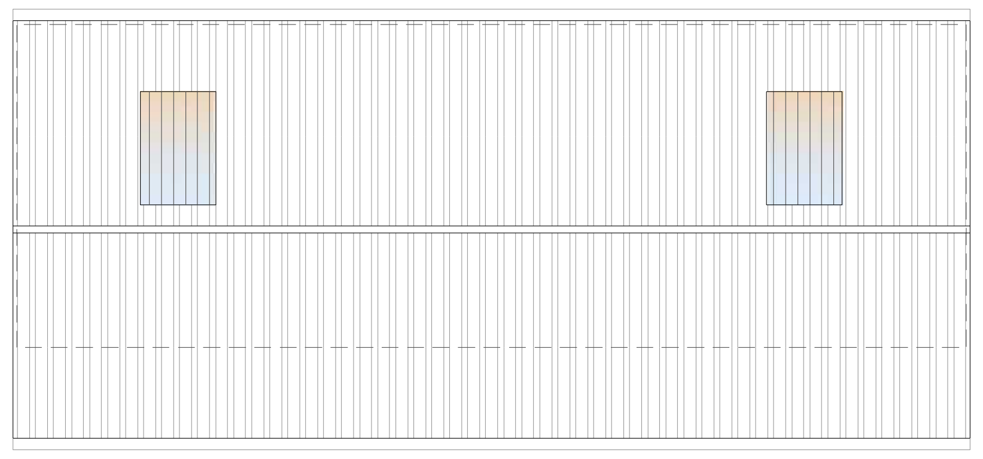
Scale Bar - 1:100 @ A1
0 1 2 3 4 5 10 15
(Metres)

REV	DATE	DESCRIPTION	INITIAL	CHECKED

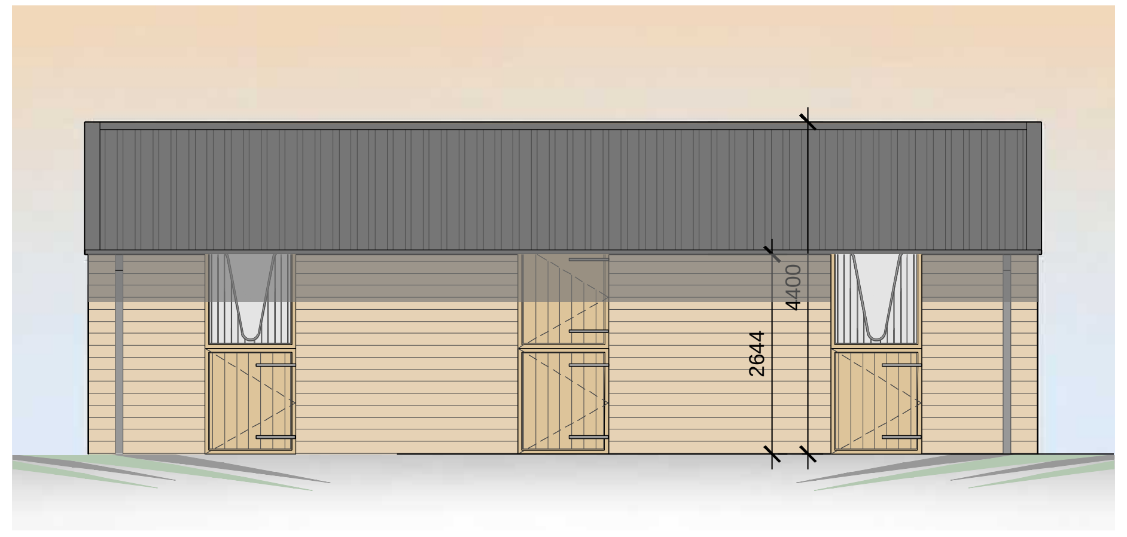


Proposed Stable Floor Plan

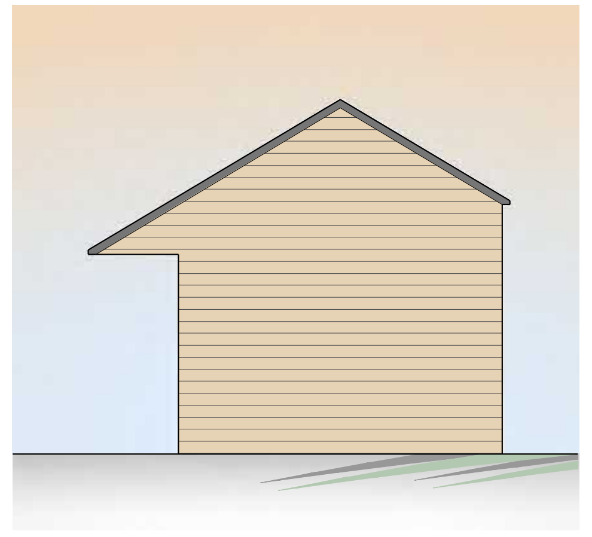




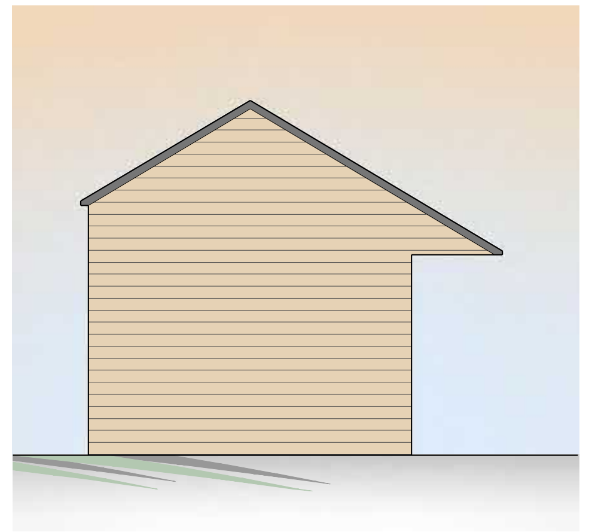
Proposed Stable Roof Plan



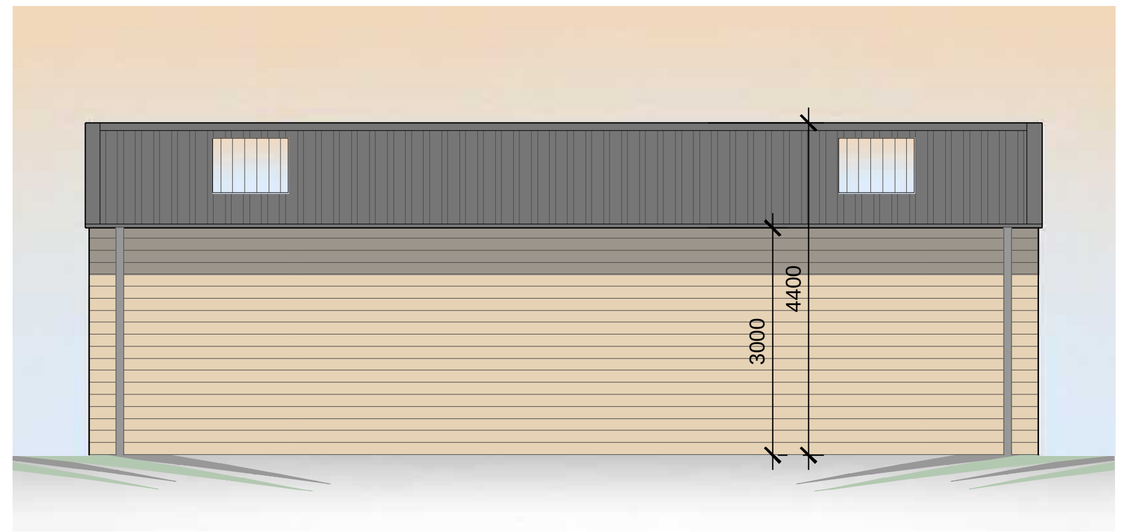
Proposed North West Facing Elevation



Proposed South West Facing Elevation



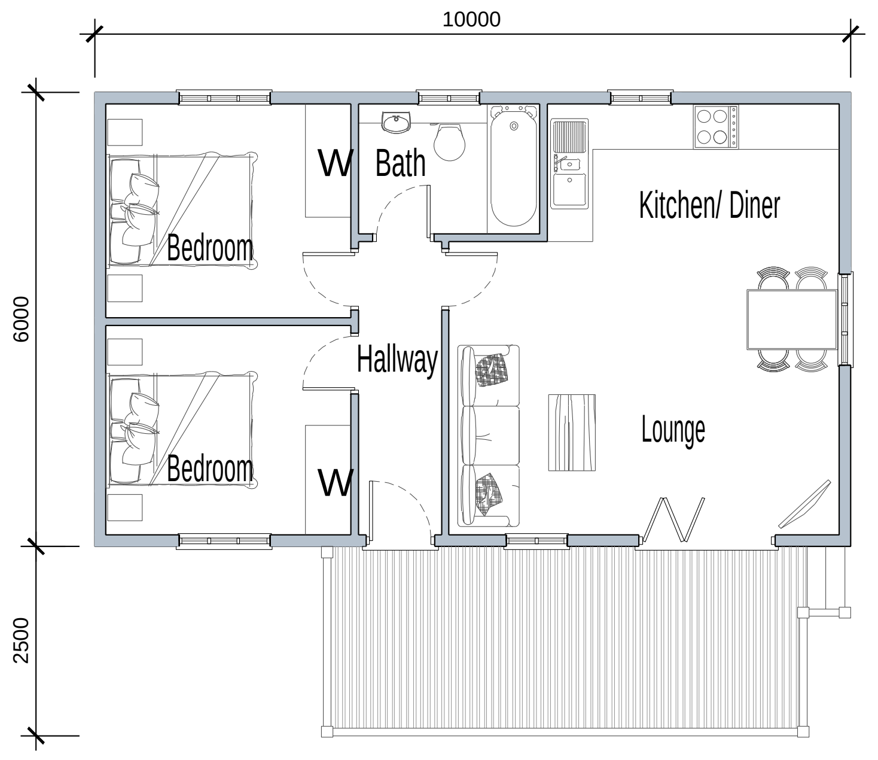
Proposed North East Facing Elevation



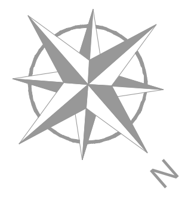
Proposed South East Facing Elevation

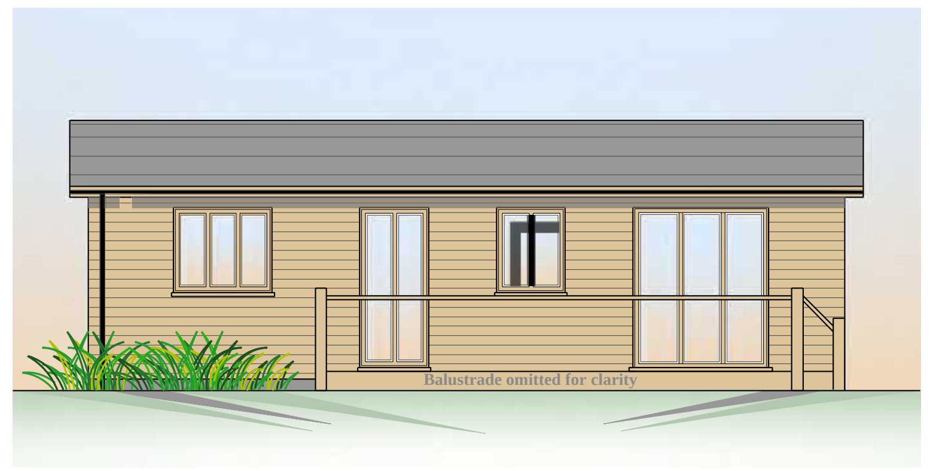
▨ Horizontal Boarding ● Grey Profiled Metal Sheet Roof ▨ Polycarbonate Sheeting Black PVCu Circular Profile Deep Flow Rainwater Goods

Proposed Stables

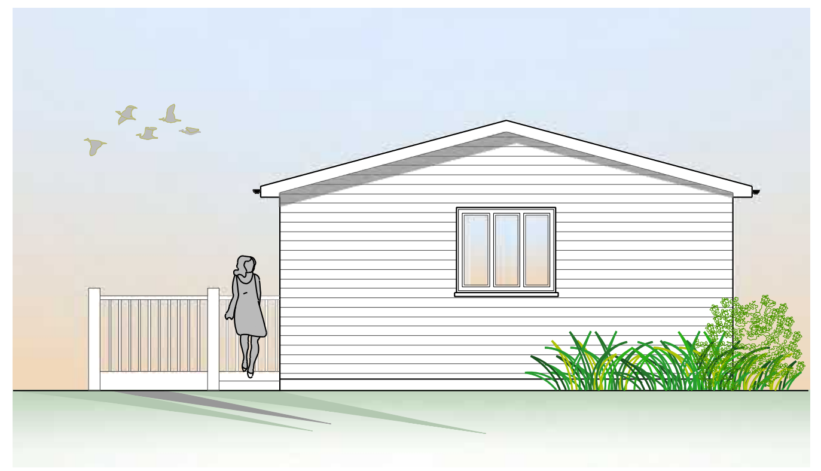


Proposed Ground Floor Plan

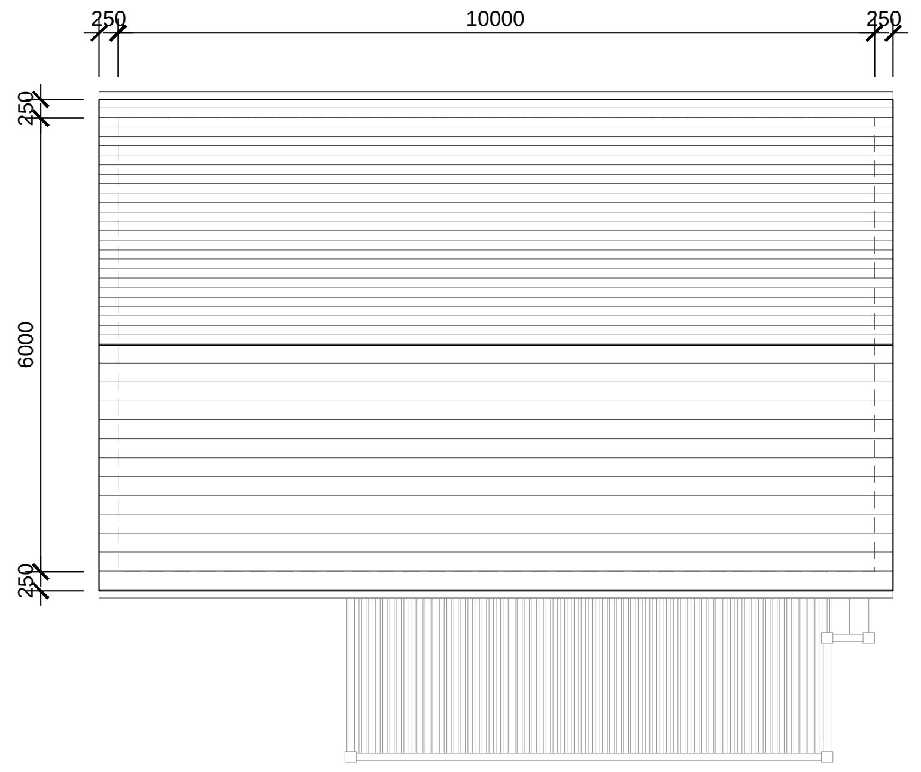




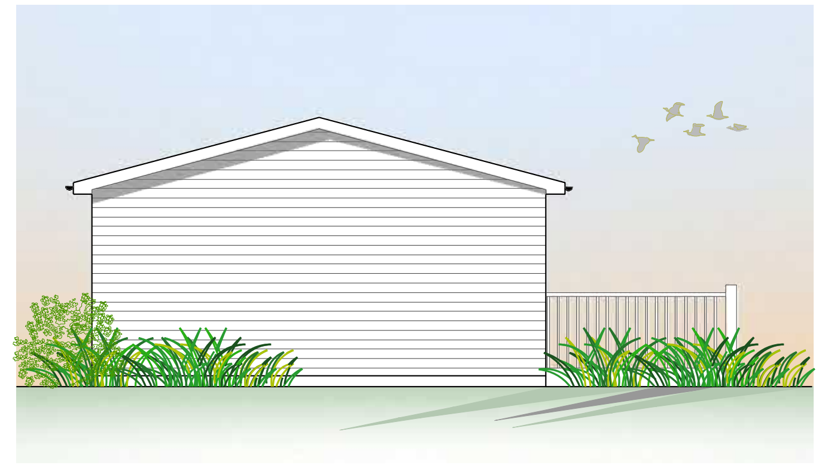
Proposed North East Facing Elevation



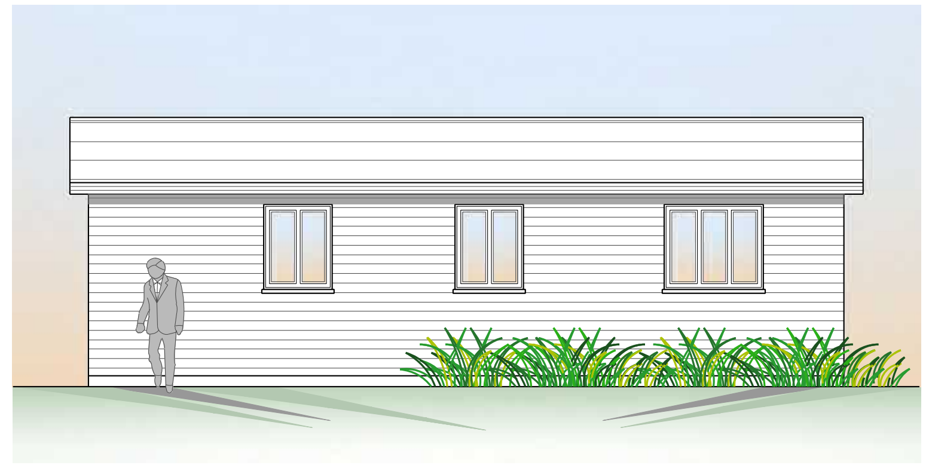
Proposed North West Facing Elevation



Proposed Roof Plan



Proposed South East Facing Elevation



Proposed South West Facing Elevation

Materials:
Roof: Artificial Slate
Walls: Horizontal Timber Boarding - Cedar or Equiv.
Windows: Premium Timber Double Glazed
Rainwater Goods: Black PCA

Proposed Rural Workers Accommodation

Planning Application

Tamarra Stud

CLIENT
L&E Murcott c/o AGM Ltd (2020.088)

TITLE
Proposed Stables & Rural Workers Accommodation

PROJECT
Tamarra Stud, Old Wells Road, Egford, Frome, BA11 3JR

DRAWING REF / REV	DRAWN	SCALE	DATE
7043 PA 005 / *	SJB	1:100 @ A1	05/05/2022

Appendix B

Vortex Eco-Electric Sewage Treatment Plant product information

+44 (0) 1759 369 915 ’ sales@wte-ltd.co.uk
A Unit 2, Bolton Lane, York, YO41 5QX, UK
www.wte-ltd.co.uk

Vortex is an advanced Activated Sludge Process (ASP) sewage treatment plant.

Vortex is designed to receive wastewater (sewage) and process it so that only a clear effluent is discharged into the environment.

Vortex is our best “all rounder”, offering excellent performance in a low cost tank.

It has been fully tested and certified to EN 12566-3.

ADVANTAGES

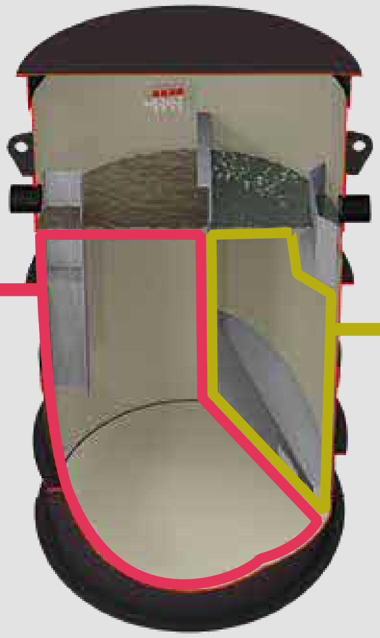
- Simple and reliable operation
- Ultra compact tank –smallest on UK market
- Easy and low cost installation
- Excellent build quality
- No odour
- Low noise
- Low electricity demand
- Adjustable treatment process
- Excellent effluent quality
- CE marked
- EN 12566-3 certified
- Excellent value for money

V1/10 -18

Treatment Process Overview

The Vortex treatment process has been refined over several years to create a simple and reliable system that has no internal moving parts.

There are two principal stages to the treatments process:



AERATION

Aeration takes place in the **Vibro Screen** and **Biozone**. Aeration is provided by a simple air blower which is located adjacent to the tank in an unobtrusive housing.

SETTLEMENT

Settlement takes place in the **Final Settlement Tank**.

Performance

Vortex has been designed to meet the UK Royal Commission Standard for effluent. Due to its unique design, it far exceeded this standard during EN testing.

Pollutant	Design Effluent Quality (95%Ile Basis)	Average Effluent Quality – During EN 12566-3 Testing –100% Loading	Average Effluent Quality 10% Loading
COD	N/A	55 mg/L	N/A
BOD$_5$	20 mg/L	9 mg/L	4 mg/L
Suspended Solids	30 mg/L	17 mg/L	14.4 mg/L
Ammonia (NH$_4$-N)	20 mg/L	1.8 mg/L	0.3 mg/L

Treatment Process Detail

Unlike most sewage treatment plants, Vortex is designed to treat both the liquid and solid components of wastewater. It does this by using a combination of coarse and fine air bubbles.

STAGE 1

Wastewater from the building enters to **Vibro Screen**.

Course air bubbles are used to physically break down solid matter and form “soup” or mixed liquor with the water.

The Vibro Screen also provides a buffer for any non degradable material that may enter the system and prevents it from entering the Biozone.

STAGE 3

The mixed liquor then flows into the **Final Settlement Tank**.

Here the mixed liquor separates into clear, treated effluent and sludge.

The clear effluent is able to flow past the scum baffle and out of the tank.

STAGE 2

The mixed liquor flows into the **Biozone**.

The Biozone is where the majority of the treatment process occurs.

A bacterial culture is present in the Biozone which digests the pollutants in the wastewater.

Fine bubble diffusers in the base of the Biozone provide a constant oxygen supply for the bacteria and create turbulence ensuring constant circulation and treatment of the mixed liquor.

Vibro Screen

The Vibro Screen prevents any fibrous material in the wastewater from entering the main part of the system. This greatly reduces the risk of damage to the internal pipework. No other activated sludge or extended aeration sewage treatment plant provides this protection.

Coarse and fine air bubbles

Vortex uses a combination of bubbles sizes to optimise performance and reduce power consumption. Aeration in an ASP sewage treatment plants must achieve two things:

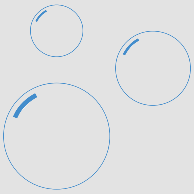
ONE

Break up solids to create a mixed liquor

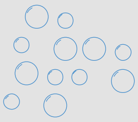
TWO

Supply oxygen to the bacteria

Vortex uses specific air bubbles to achieve these aims:



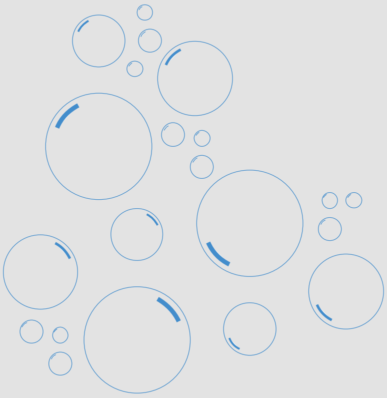
A large and powerful course bubble to physically smash up the solids



A very small fine bubble to oxygenate the water

Fine air bubbles are much more efficient at oxygenating water as the distance the oxygen molecule has to travel to escape from the bubble is reduced. If the efficiency of oxygen transfer can be increased, a smaller air blower is required and this reduces the power demand of the system.

Conventionally, ASP systems rely on a single bubble size to do both functions however. This is inefficient at both tasks and increases the size of the air blower required as a result.



The Sludge Management System

All Activated Sludge Process (ASP) sewage treatment plant produce sludge as part of the treatment process. The sludge is composed of partially digested solid matter.

Two types of sludge are produced: **Settlement Sludge and Floating Sludge**

Vortex’s ability to automatically recycle this sludge via its Sludge Management System is one of the elements that make it an advanced ASP.

Settled Sludge Return (SSR)

Settled sludge is recycled from the bottom of the Final Settlement Tank back to the Vibro Screen using a simple, non-mechanical, air lift.

The return of settled sludge back to the Vibro Screen gives the bacteria a food supply even when there is little or no wastewater coming from the building. This makes the Vortex better able to handle low occupation stress than other ASP sewage treatment plants.

Floating Sludge Return (FSR)

On other ASP systems the floating sludge must be manually recycled back to the Biozone or removed from the tank.

Vortex’s automatic FSR enables it to recycle and manage the floating sludge on an hourly basis without the use of electrical or mechanical components inside the tank.

No other ASP sewage treatment plant has this ability to manage its own floating sludge.

Adjustable Treatment Process

One of the major advantages of the Vortex design is that the aeration inside the tank can be manipulated post installation. This enables the tank to function differently depending on the amount of use it is getting.

As a rough rule, sewage treatment plants require at least 50% of their design load in order to function. It is common however for many sewage treatment plants to be underloaded and fail to produce satisfactory effluent as a result.

Vortex is adjustable so the treatment process can be altered to optimise performance for populations less than 50% of the design load.

10 %

Upon completion of EN 12566-3 testing, Vortex was emptied and restarted and received only 10% of the design load.

THE SYSTEM FUNCTIONED EXCEPTIONALLY WELL WITH NO MAINTENANCE ISSUES.

EXAMPLE

A four bedroom house requires a 6PE (6 person) sewage treatment plant.

A 6PE sewage treatment plant should have at least three residents using it.

The house is only occupied by two residents and the sewage treatment plant doesn’t function correctly as a result.

Odourless Operation

VORTEX IS
100%
AEROBIC

Unlike many sewage treatment plants, Vortex does not have a Primary Tank (similar to a septic tank) where solids in the incoming wastewater accumulate.

Primary Tanks are anaerobic and as the solids break down it creates odour. This is why septic tanks smell. Any sewage treatment plant that has a Primary Settlement Tank (anaerobic first stage) will produce odour from time to time.

Vortex is 100% aerobic. As soon as wastewater enters the tank it is oxygenated and this prevents the formation of foul odour.

Total Wastewater Treatment

Many sewage treatment plants only treat the liquid component of wastewater and not the solids. The solids are stored in a Primary Tank (septic tank) prior to the treatment stage and simply accumulate prior to periodic removal by a suction tanker.

Vortex treats both the liquid and solid constituents in wastewater.

Because solids are actively treated and digested by the bacteria in the Vortex's Biozone, the overall size of the tank is significantly reduced.

Ultra Compact Design

Vortex is the most compact sewage treatment plant on the market and and is approximately one third the size of some of its competitors.

Its compact design significantly reduces the size of the excavation and the quantity of backfill required.

Its small size make handling easy and minimises transportation costs.

Robust Construction

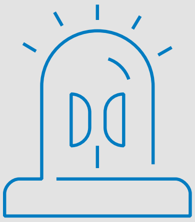
Vortex tanks are fabricated from high density polyethylene (HDPE) sheet.

All sheets are welded, not mechanically joined, to create a one piece tank with all seams covered by the factory warranty.

Fabrication from HDPE sheet gives the tanks inherent strength as bending the sheet to create the cylindrical tank body creates internal tension within the polymer to resist external force. This is a significant advantage over a moulded method of construction.

Additional strength is given to the tanks via the external ribs. The ribs also help the tank to lock into the backfill and anchor it into the ground.

Failure Alarm



To comply with EN 12566-3, a sewage treatment plant must have an alarm to alert the user in the event of failure.

All Vortex tanks come with an audio and visual alarm as standard.

Remote and telemetry alarms are available on request.

Installation

The compact design and robust construction make installation as simple, quick and low cost as possible.

It is suitable for high groundwater sites and when installed on dry sites, there is no requirement for a concrete backfill.

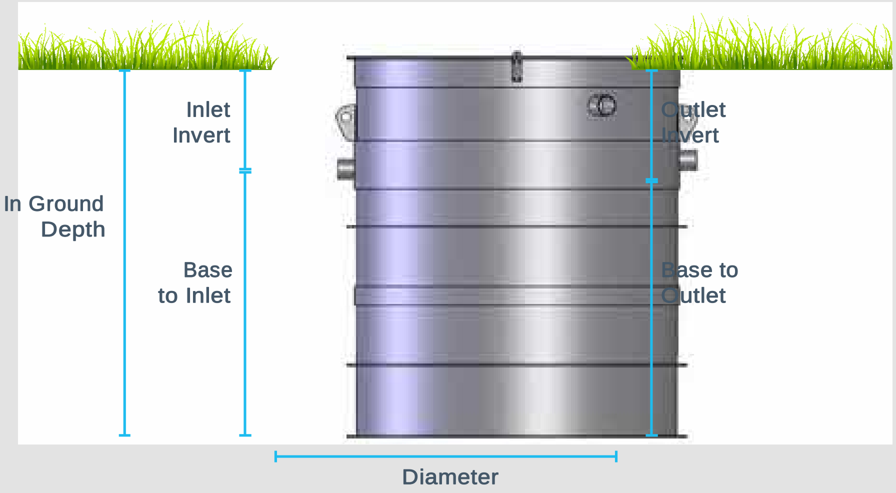
Vortex is capable of being installed above ground if required.

Shallow and deep inlet inverts are available for most tanks in the range to cater for a range of foul drain depths.

Please contact our office if you would like the details of your nearest approved installer.

Technical Details

Model	PE	Diameter (mm)	In Ground Depth (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Inlet Invert* (mm)	Outlet Invert* (mm)	Power (w)
Vortex 4	4	1,121	2,000	1,450	1,400	550	600	40
Vortex 6	6	1,341	2,000	1,450	1,400	550	600	40
Vortex 9	9	1,616	2,000	1,450	1,400	550	600	75
Vortex 12	12	1,850	2,000	1,450	1,400	550	600	95
Vortex 16	16	1,870	2,650	1,900	1,850	750	800	115
Vortex 21	21	1,870	2,650	1,900	1,850	750	800	180
Vortex 30	30	2,195	2,650	1,900	1,850	750	800	230



*Alternative inverts available. Please contact for details.

Vortex Sewage Treatment Plant

The VORTEX® Eco Electric sewage treatment plant is the only ADJUSTABLE sewage treatment system in the UK.

It can be set to work with varying populations simply by turning it either up or down on a hand-turn valve and has much LOWER OPERATING COSTS than all Non-Electric Plants

Approved by the Environment Agency and on the British Water Certified List.

Unique Features of the VORTEX® Sewage Treatment System

- Extremely clean effluent - up to **98.9% pollutant reduction.**Also OK for Northern Ireland with **98.2% BOD reduction.**
- **Fully adjustable** to suit the number of people using it.
- **The lowest electricity consumption of any electric plant** - from only **£25/year.**
- **Much lower maintenance costs than Non-Electric Treatment systems.**
- **Odourless** - complete aerobic digestion throughout the sewage treatment plant.
- **One piece tank construction** - not sectional - no leaking seals.
- **Very small size** enables economic installation in tight spaces.
- The VORTEX has a **unique debris screen** - The Vibro-Screen™ keeps tampons, wipes, etc. out of the plant but lets organic solids through.
- The VORTEX **recycles its own waste products** resulting in less sludge to remove.
- No Primary Settlement Tank - No Primary Tank Odour.
- **No need to buy a separate sampling chamber -** there is a unique sampling point within the tank**. This saves you another £300**.
- Simple and cheap maintenance - one piece construction ensures no structural weakness..
- Top Quality linear motor compressor - these compressors are much more expensive than cheaper diaphragm compressors used by other manufacturers, but they are **almost silent, use very little electricity** and CAN be repaired**.**
- **Cheap, easy installation**. **No Concrete needed** for dry sites
- **10 year tank warranty**- no metalwork to corrode inside or outside the tank.
- Can accept sewage pumped into it if required.
- **Versatile inlet depths** - Vortex sewage treatment plants can be supplied for 160mm, 650mm or 900mm inlet invert levels.
- Can be manufactured with the **inlet and outlet on the same side**at no extra cost for difficult sites.
- **EN 12566-3 2005** Test Report available on request.
- **Unbeatable ammonia reduction** - incredibly **down to 0.4mg/L**. Very important for sensitive watercourses.
- Accepted by the Environment Agency for discharge to watercourses and ditches, **without the need for a permit, if the installation complies with the General and Binding Environment Agency Rules**. If you have a ditch locally, Click here to find out if you own the ditch at the other side of your boundary. You may be surprised.
- The Vortex sewage treatment plant range is 4, 6, 8, 10, 15, 20 and 30 person sizes.
- Vortex plants are exported worldwide, from Iceland to Mongolia.

How the VORTEX® Wastewater Treatment Plant Works

Most sewage treatment plants struggle to work when they are under-loaded. A good rule of thumb is that if a plant is working below 50% of its design capacity, there is not enough 'food' from the toilet solids to either grow, or maintain, a working bacterial population. The Vortex has solved this problem by having a simple hand-turned valve that can turn the amount of air required either up, or down, depending on the number of people using it. Such a SIMPLE solution to a complex problem.

Click on this link for a video of a severely underloaded Vortex 8 person plant which has been used by only 2 people for over 3 years. The final effluent in the Central Discharge Trough is crystal clear and the plant has NEVER been emptied.

The Vortex™ has advanced activated sludge features not found in any other sewage treatment plant in the UK.

The ONLY electrical component is a small, external linear motor compressor which operates ALL the process stages. There are no pumps, motors or any moving parts within the plant. Click for **How the VORTEX™ sewage plant is so energy efficient**

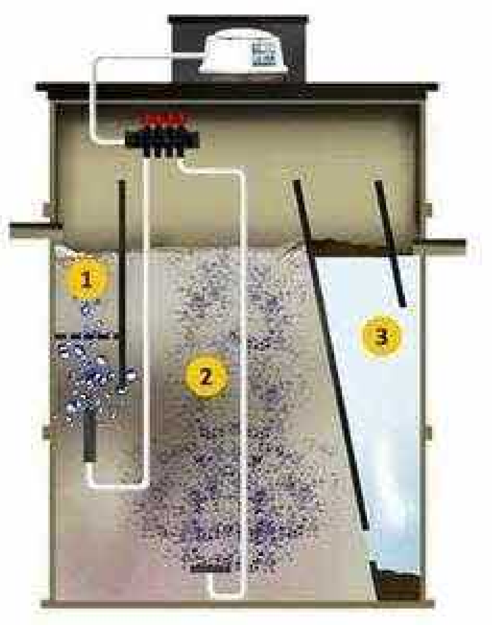
The Vortex Treatment Process (Schematic diagram only)

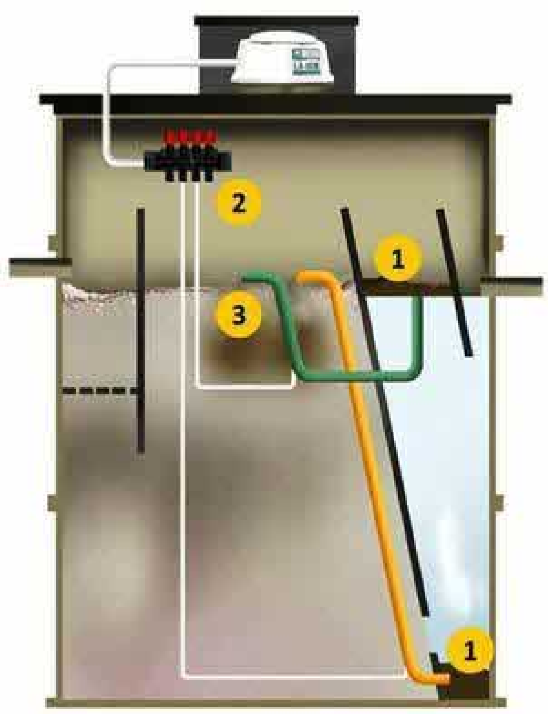
Wastewater from the building enters to Vibro-Screen (1). Here coarse air bubbles are used to physically break down solid matter and form a mixed liquor with the water.

The mixed liquor flows into the Aeration Chamber (2). A bacterial culture is present in the Aeration Chamber which digests the pollutants in the wastewater. The bacterial culture must have a constant oxygen supply and this is provided by a fine bubble diffuser at the base of the tank.

UNIQUE FEATURE - The last red air valve on the control module allows the air to be regulated, more or less, to the diffuser. This enables the plant to be adjusted to work at maximum efficiency if it is underloaded. This is a very valuable feature, e.g. for a 5 bedroom house (which needs a minimum 7 person plant) with only 2 people resident. This feature is not available on any other plant.

The mixed liquor then flows into the Clarification Chamber (3) where it is able to separate into clear, treated effluent and sludge. The clear effluent is able to flow past the scum baffle and out of the tank.





The Sludge Management System (SMS)

In the Clarification Chamber sludge accumulates at the bottom (settled sludge) (1) and top (floating sludge) (1) of the tank.

Air from the blower spurs from the regulator (2) to two sludge return pipes (3).

This creates a continuous vacuum that sucks the sludge from the bottom of the Clarification Chamber back to the Aeration Chamber.

The floating sludge is sucked off for 5 minutes every hour, automatically, and returned to the Digestion Chamber.

Unique Automatic Floating Sludge Return (FSR), included with all models

In all Activated Sludge Process (ASP) sewage treatment plants, floating sludge accumulates at the top of the Clarification Chamber. This sludge must be periodically returned,to the Aeration Chamber. With all other ASP plants, this has to be done by hand by the owner and it is not a pleasant task. All Vortex plants come with the Automatic FSR fitted as standard.

The Automatic FSR enables the Vortex to automatically recycle the floating sludge in the Clarification Chamber back to the Aeration Chamber without the need for the owner to do anything.

No other ASP sewage treatment plant has this ability to manage its own sludge.

The FSR kit can also be fitted retrospectively to existing, older Vortex plants very easily.

Principles of the treatment process

Incoming sewage is screened to prevent accidental non-degradable products entering the digestion chamber. The Vibro-Screen™ allows organic sewage solids to enter the tank without problems.

The screened sewage is aerated and a microbial 'soup' develops that digests the pollutants and organic matter in the sewage. These beneficial microbes are constantly topped up with the microbes that settle out at the bottom of the final settlement tank, ensuring a constant supply of bacteria for the digestion process. There is **no need to add extra bacteria at all**, as is the case with some other plants.

The treated sewage then enters the final settlement chamber where activated sludge bacteria settle out at the bottom. These beneficial microbes are constantly returned to the digestion chamber to boost the treatment system performance.

The bacterial scum or crust that forms on the top of the effluent in the clarification chamber is returned through a pipe to the digestion chamber via the FSR pipe. **This is an innovation unique to the Vortex™.** Other activated sludge plants need this crust removing, by hand, at regular intervals.

It saves a lot of unpleasant work for both the owner and the service engineer, resulting in lower cost servicing bills.

Model	Tank Diameter (m)	Height (m)	[illegible] (m)	[illegible] (m)	[illegible] (m)	[illegible] (m)	[illegible] (m)	Weight (kg)	Working Volume (m³)	Power (W)
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