

Forest House, Leicester Lane, Desford
Drainage Technical Note
May 2025
Our Ref: 27239-FLD-0101

Introduction

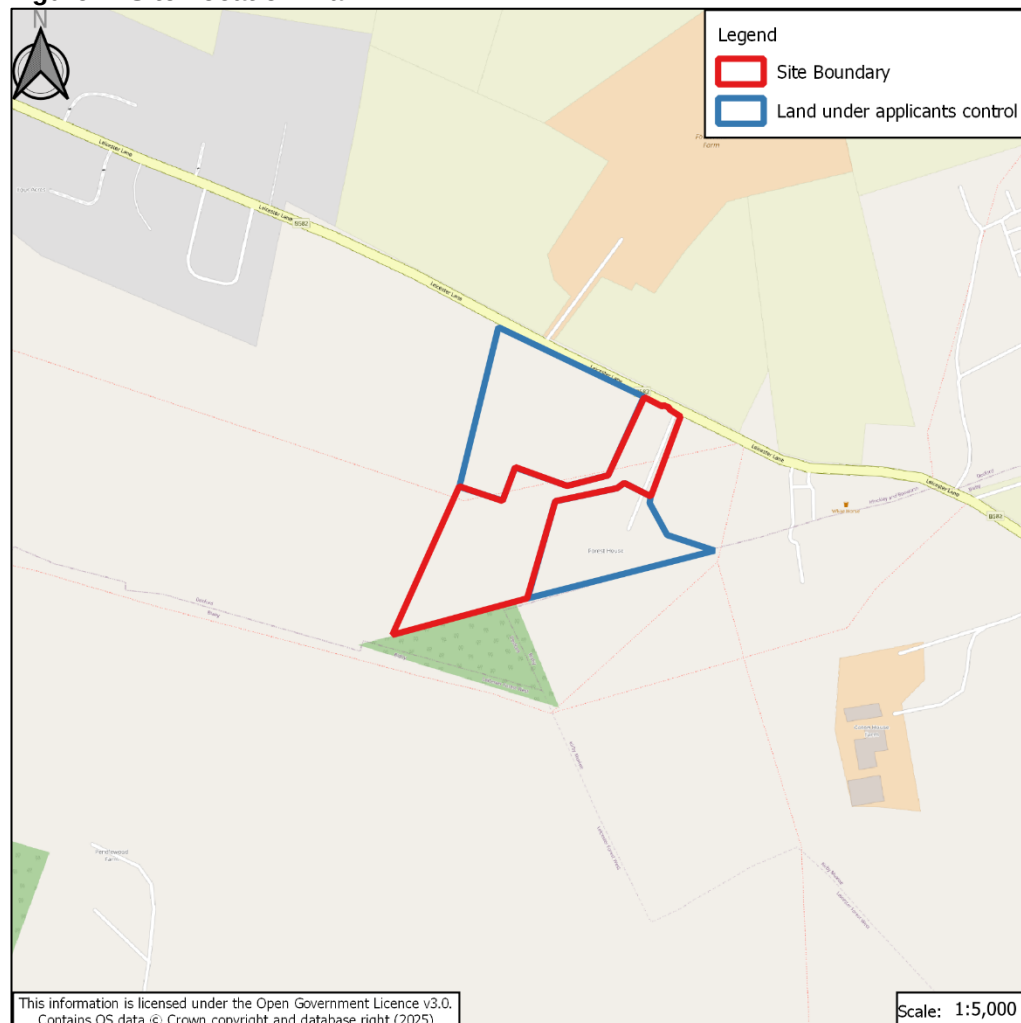
MEC Consulting Group has been commissioned by Savage Marine Ltd (hereafter referred to as 'the Client') to prepare a drainage strategy for a proposed commercial unit at Forest House, Leicester Lane, Desford. (hereafter referred to as 'the Site'). This report aims to discharge conditions 10 and 13 as part of planning application 22/01160/OUT received on 30th August 2024. The conditions are outlined below.

Condition 10 – *No part of the development hereby permitted shall be occupied until site drainage details have been provided to and approved in writing by the Local Planning Authority. Thereafter, surface water shall not drain into the public highway and therefore shall be maintained.*

Condition 13 – *The development shall not commence until drainage plans for the disposal of surface water and foul sewage have been submitted to and approved by the Local Planning Authority. The scheme shall be implemented in accordance with the approved details before the development is first brought into use.*

In total, the site covers approximately 0.91ha, with proposals comprising a commercial unit (self-storage) with associated parking and access. The proposed site location is shown in Figure 1.

Figure 1: Site Location Plan



Flood Risk Information

The site is located within Flood Zone 1 (FZ1). FZ1 is defined as land assessed of having an annual probability of flooding from rivers or seas of less than 0.1%.

The majority of the site is at low risk of surface water flooding. There are areas within the redline boundary at medium – high risk of surface water flooding due to localised low topography; however, these areas have a low probability of flooding to 0.2m deep and are not situated within the development area.

Surface Water Drainage

Surface water arising from the development should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows if the site was undeveloped. When considering surface water discharge the SuDS hierarchy needs to be adhered to and is as follows;

- Water reuse, where a need is identified;
- Into the ground (infiltration), where ground conditions permit;
- To a surface water body
- To a surface water sewer, highway drain, or other drainage systems; or
- To a combined sewer

Discharge at Source

British Geological Survey (BGS) mapping shows the site is underlain by bedrock of the Edwalton Member, consisting of mudstone. Superficial deposits comprise of the Oadby Member, consisting of diamicton.

Soil Infiltration Rate Testing to BRE365 specifications was undertaken by MEC in January 2025. Testing was undertaken within the Oadby Member deposits and results can be found within **Appendix A**. TP01 was advanced to 2.70m bgl to confirm ground conditions and the depth to groundwater. Groundwater seepages were encountered at 0.90m 1.60m and 2.40m bgl, representing locally perched water within the Oadby Member. Groundwater was not encountered to a depth of 2.00m. Insufficient soakage was recorded within SA01 to enhance calculations of a representative infiltration rate in accordance with BRE365. Therefore, an alternative method of discharge should be sought.

Discharge to a Surface Water Body

The closest designated Main River is the Rothley Brook, located 2.38km north of the site. Any route to this watercourse would cross third-party land and, therefore, an alternative option should be sought.

There is an existing ditch network to the south of the site, however after site investigations, this appears to be a field drain with no connectivity.

There is a pond within the applicant's land. Based on the topography, surface water from the existing greenfield land outfalls into the existing pond. Therefore, in accordance with the drainage hierarchy, surface water from the proposed development will discharge into the existing pond onsite.

Discharge to a Sewer

In accordance with the drainage hierarchy, surface water will discharge into the existing pond network within the land under applicant's control.

A review of sewer records, provided by Severn Trent Water, shows there are no public sewers nearby to the site. Although Severn Trent records do not show private sewers, as the existing site is greenfield it is unlikely that there would be any private sewers on site.

Land Use

To calculate the drainage requirements, the existing and proposed land use are required. Table 1 below, summarises the proposed land uses within the site. The site currently consists of open green space and an existing road. The existing road has been included in the proposed site areas, but will not be accommodated within the drainage strategy as it is assumed it has its own drainage features. The current land use has been calculated using the existing site plan and the post-development land has been measured from the proposed layout. Due to the proposed use of the development, it is considered that urban creep will not be required to be added to the calculations due to the low likelihood of expansion in the future without the need for additional planning applications.

Table 1: Land Use Summary

	Existing Site Areas		Proposed Site Areas	
	ha	%	Ha	%
Impermeable Areas	0.05	15	0.22	24
Green Landscape / Permeable Areas	0.86	85	0.69	76
Total	0.91	100	0.91	100

Climate Change Allowances

The influence of climate change on rainfall intensity is likely to increase the frequency of flood events and the overall volume of water that passes the site. When considering surface water runoff from the site, the increases in peak rainfall intensity varies over the lifetime of the development. Where commercial developments with a lifetime beyond the 2070s are proposed, the NPPF states that the Upper End allowances should be used, as highlighted in green in Table 2.

Table 2: Peak Rainfall intensity allowances from Flood Risk Assessments: Climate Change Allowances Guidance

Annual Exceedance Probability	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
	Central	Upper End	Central	Upper End
3.3% AEP	20%	35%	25%	35%
1% AEP	20%	40%	25%	40%

Discharge Rates

Greenfield runoff conditions have been calculated using the FEH module within Causeway Flow. For the proposed impermeable area of 0.17ha, the peak discharge rate has been calculated as 0.5l/s. As this is a low rate that could cause blockages in the system, surface water from the site will discharge at a controlled rate of 5.0l/s, in accordance with Leicestershire County Council guidelines. Calculations for the greenfield runoff rate can be found within **Appendix B**.

In accordance with the National SuDS standards the drainage strategy involves conveying surface water flows to a geo-cellular tank via permeable paving. This geo-cellular tank will then discharge at the controlled discharge rate of 5.0l/s into the existing pond within the applicant's land.

Geo-Cellular Tank

Surface water flows for an impermeable area of 0.17ha will be conveyed to a proposed geo-cellular tank within the parking areas. A storage volume of 85.27m³ is required within the geo-cellular tank to allow sufficient water to discharge into the proposed geo-cellular tank at a rate of 5.0l/s and cater for all events up to and including the 1%AEP40CC event. The geo-cellular tank has been designed to a depth of 0.8m, with an allowance of 0.6m cover. The calculations for the proposed design can be seen in **Appendix B**, and the drainage strategy based on the principles above is shown in drawing ref: 27239_01_230_01 in **Appendix C**.

Additional drainage features such as permeable paving, filter drains and tree pits can be used across the site and will provide additional storage and treatment. Permeable paving will act as a first treatment stage for any runoff and will ensure adequate surface water treatment is provided. These features have been excluded from calculations at this stage.

Applicable SuDS Techniques

The Non-Statutory Technical Standards for Sustainable Drainage Systems that deals with SuDS, covers a whole range of sustainable approaches to surface water drainage management including;

- Source control measures including rainwater recycling and drainage;
- Filter strips and swales, which are vegetated features that hold and drainage water mimicking natural drainage patterns;
- Filter drains and permeable pavements to allow rainwater and runoff to infiltrate into permeable paving below ground and provide storage if needed; and
- Basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding.

Each of the five SuDS components listed above is discussed below in Table 3, with reference to their suitability for the proposed development.

Table 3: Suitability of SuDS Techniques

	COMPONENT	SUITABILITY	REASONS
Source Control	Rainwater Harvesting	Yes	Rainwater harvesting could be used across the site.
	Green Roofs	No	More appropriate SuDS features can be accommodated within the development and are preferred.
	Bio-retention Systems / Rain Gardens	Yes	Open green space can be converted to provide additional water quality improvements.
Proprietary Systems	Proprietary bio-retention systems	No	More appropriate SuDS features can be accommodated within the development and are preferred.
Infiltration Devices	Permeable Paving	Yes	Permeable paving is suitable for the proposed development within parking spaces.
	Infiltration trenches / Soakaways	Yes	Could be considered for the use of filter drains
Filtration	Open swales / Filter Strips / Drains	No	Due to the size and location of the site, open swales are not considered suitable.
Retention / Detention	Detention Basin, Attenuation Pond / Tanks	Yes	The proposed geo-cellular tank will provide surface water storage.

Surface Water Quality

The CIRIA SuDS Manual C753, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant) that equals or exceeds the pollution hazard index. Surface water runoff from commercial roofs and low-traffic roads will have a low pollution hazard level.

The pollution hazard indices, mitigation indices of each SuDS component and the accompanying calculations are provided in Table 4.

Table 4: SuDS Mitigation Indices (from CIRIA SuDS Manual)

SuDS Component	Mitigation Indices		
	<i>Total Suspended Solids</i>	<i>Metals</i>	<i>Hydrocarbons</i>
Commercial Roofs, Commercial Yards and delivery areas	0.7	0.6	0.7
Permeable Paving	0.7	0.6	0.7
SuDS Mitigation Index	0.7	0.6	0.7
Mitigation Requirement Met?	Yes	Yes	Yes

For the medium pollution hazard levels generated at the site, the proposed permeable paving would provide sufficient treatment in accordance with the Simple Index Approach.

Exceedance and Flow Routing

The risk of overland flowing from adjacent land to the building is low. The design of levels and features on the site will follow best practice by ensuring any overland flow is routed safely away from the commercial unit and to areas of lowest risk. Any surcharging and subsequent flooding of sewers on or in the vicinity of the site will also be mitigated by the flood routing described above. As such, the risk of flooding on site from exceedance events and flood flow routes is low.

Maintenance and Management

An integrated approach to the maintenance and management of SuDS is a requirement of the NPPF and the Flood and Water Management Act 2010. A maintenance and management plan aims to ensure that there is a clear understanding of drainage responsibilities and that a maintenance regime is implemented for all new drainage systems, for the lifetime of the development.

All private drainage, including SuDS, will be maintained by the landowners, or by an appointed management company.

A proposed maintenance schedule, which breaks down the maintenance requirements of the proposed SuDS features, is shown in **Appendix D**.

Foul Water Strategy

According to The Buildings Regulations (2010), foul water drainage from new developments should be discharged into the following, in order of priority;

- A public sewer;
- A private sewer communicating with a public sewer;
- A septic tanks, which has an appropriate form of secondary treatment; or
- A cesspool

Severn Trent Water has confirmed in the application comments that there are no public sewers within the vicinity of the site.

The foul water from the existing dwelling currently outfalls into a Klargestor package treatment plant, with treated effluent combining with surface water and discharging into the existing pond within the applicant's land. It is assumed that the remaining effluent is tankered away from the site at regular intervals.

In accordance with The Building Regulations, foul water flows from the proposed development will discharge into a new package treatment plant and outfall into the pond. The Company currently employs 19 staff, and it is envisaged that the workforce would only grow in the immediate future by 2 people. A Klargestor BD BioDisk, or equivalent, will be utilised to accommodate a population equivalent of 25 and a max daily flow of 5.0m³. Foul flows entering this treatment plant are treated in line with national guidance, to a state where flows can be discharged directly into watercourses. The Klargestor Certificate of Performance is included in **Appendix E**.

REGISTRATION OF AMENDMENTS

Date	Rev	Comment	Prepared By	Checked By	Approved By
May 2025	-	First issue	Zoe Jordan BSc (Hons) Flood Risk Engineer	Thomas Sturtridge BSc (Hons) MSc PIEMA Flood Risk Engineer	Tim Rose BA (Hons) MCIHT MTPS Regional Director

Appendices

- A. Soil Infiltration Rate Testing
- B. Surface and Foul Water Indicative Drainage Calculations (27239-CALC-0101)
- C. Surface and Foul Water Indicative Drainage Strategy (27239_01_230_01)
- D. Maintenance and Management Plan
- E. Klargester Certificate of Performance

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APPENDICES



APPENDIX A

Doc. Ref.	27239-CALC-0401
Sheet	1 of 5
Engineer	OC
Date	13.01.25
Revision	-

SOIL INFILTRATION CALCULATIONS FRONT SHEET

SCHEME	Forest House, Leicester Lane, Desford
CLIENT	Savage Marine Ltd
ASPECTS OF SCHEME TO BE DESIGNED	Soil Infiltration Rate Testing
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	Soil Infiltration Rate testing and calculations completed in general accordance with BRE Digest 365 utilising the gravel fill pit method.
NOTES	The soil infiltration rate test result reported below applies to the specific test depth range as stated on the calculation sheet. Testing was undertaken within the Oadby Member. Soil infiltration test pit and trial pit hole positions are shown on the attached exploratory hole location plan. TP01 was advanced to 2.70m bgl to confirm ground conditions and the depth to groundwater. Groundwater seepages were encountered at 0.90m, 1.60m and 2.40m bgl representing locally perched water within the Oadby Member. Groundwater was not encountered within SA01 to a depth of 2m bgl. Insufficient soakage was recorded in SA01 to enable calculation of a representative infiltration rate in accordance with BRE 365. Based on the result, soakaways will not be appropriate at the test location.

INDEX

Sheets	Calculations	Checked by	Approved By	Date
2	Exploratory Hole Location Plan	AL	DT	15.01.25
3	SA01 – Test 1 Result = Insufficient soakage to derive an infiltration rate.			
4-5	Exploratory Hole Logs			



EXPLORATORY HOLE LOCATION PLAN

Project: Forest House, Leicester Lane, Desford
File Ref: 27239
Postcode: LE9 9JJ



 - Exploratory Hole Location



Scheme Forest House, Leicester Lane, Desford
Client Savage Marine Ltd
Job ref. 27239

Sheet No. 3 of 5
Calcs by OC
Checked By DT
Date 10/01/25

Soil Infiltration Test - Gravel Filled Method

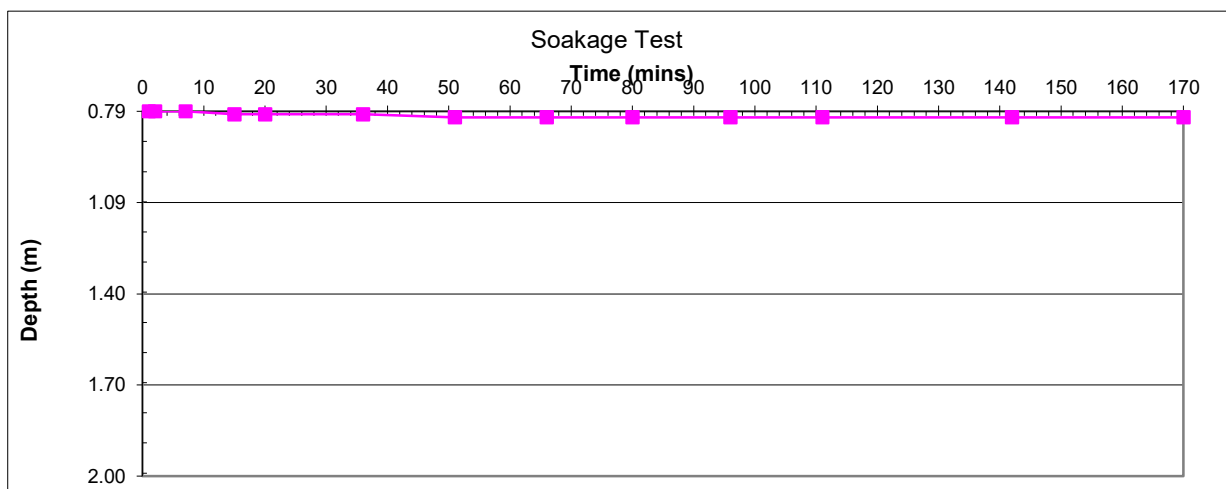
(In general accordance with BRE Digest 365, 2016, Soakaway Design)

Soakaway pit ref.	SA01	Test 1
Length	1.90 m	
Width	0.80 m	
Depth	2.00 m	
Ground water level	Not encountered	
Ground conditions	0.00-0.30m Grass over dark brown, slightly gravelly, sandy, slightly silty clay TOPSOIL with gravel sized fragments of flint and quartzite, and frequent rootlets. 0.30-1.70m Firm reddish brown and grey, gravelly, slightly sandy, slightly silty CLAY. Gravel comprises subangular to subrounded fine to coarse flint and quartzite. Sand is fine to medium. (OADBY MEMBER). 1.70-2.00m Brown, gravelly, slightly silty, slightly clayey SAND. Gravel comprises subangular to subrounded fine to medium flint and quartzite. Sand is fine to coarse.(OADBY MEMBER).	

Time (mins)	Depth to water (m bgl)
1	0.79
2	0.79
7	0.79
15	0.80
20	0.80
36	0.80
51	0.81
66	0.81
80	0.81
96	0.81
111	0.81
142	0.81
170	0.81

Effective storage depth =	1.21 m
75% effective storage depth =	0.91 m
(ie depth below GL) =	1.09 m
25% effective storage depth =	0.30 m
(ie depth below GL) =	1.70 m
effective storage depth 75%-25% =	0.61 m
Time to fall to 75% effective depth =	N/A mins
Time to fall to 25% effective depth =	N/A mins
Void Ratio =	40%
V (75%-25%) =	0.37 m ³
a (50%) =	4.79 m ²
t (75%-25%) =	N/A mins

Insufficient soakage to derive an infiltration rate.





Stability: Stable



Sheet 1 of 1

Plant Used.
JCB 3CX

Elevation (m AOD):	
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Approved By:
DT

B - Bulk Sample
D - Disturbed Sample
ES - Environmental Sample
W - Water Sample
PID - PID Reading
HSV - Hand Shear Vane Reading

Stability: Stable



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APPENDICES



APPENDIX B

Doc. Ref.	27239-CALC-0101
Sheet	1 of 6
Engineer	Z. Jordan
Date	02 May 25
Revision	-

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Forest House, Leicester Lane, Desford
CLIENT	Savage Marine Ltd
ASPECTS OF SCHEME TO BE DESIGNED	Surface WaterSewer Design Surface water attenuation design and simulation results for the 50%AEP, 3.3%AEP35CC and 1%AEP40CC event for the development site.
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	- Design and analysis of urban storm drainage. Wallingford Procedure Vol.1 - Sustainable Drainage Systems- Non-Statutory technical standards for Sustainable drainage systems- 2015 - The SuDS Manual – CIRIA C753
NOTES	Greenfield runoff conditions have been calculated using the FEH module within Causeway Flow. For the proposed impermeable area of 0.17ha, the peak discharge rate has been calculated as 0.5l/s. As this is a low rate that could cause blockages in the system, surface water from the site will discharge at a controlled rate of 5.0l/s, in accordance with Leicestershire guidelines. The strategy involves conveying surface water flows to a geo-cellular tank on site, prior to combining with treated effluent and outfalling into the existing pond network. The calculations for the geo-cellular tank have been carried out using Flow Causeway.

INDEX

Pages	Calculations	Checked by	Date
2 - 6	Surface Water Sewer design details for the 50%, 3.3%AEP35CC and 1%AEP40CC simulation results	RC	02.05.2025



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Tank	0.170	4.00	121.600	1200	1.400
HydroBrake			121.600	1200	1.500
Outfall			120.750	1200	0.930

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Tank	HydroBrake	5.000	0.600	120.200	120.100	0.100	50.0	300	4.04	100.0
1.001	HydroBrake	Outfall	70.000	0.600	120.100	119.820	0.280	250.0	300	5.22	100.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.228	157.5	61.4	1.100	1.200	0.170	0.0
1.001	0.990	70.0	61.4	1.200	0.630	0.170	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.000	50.0	300	Circular	121.600	120.200	1.100	121.600	120.100	1.200
1.001	70.000	250.0	300	Circular	121.600	120.100	1.200	120.750	119.820	0.630

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Tank	1200	Manhole	Adoptable	HydroBrake	1200	Manhole	Adoptable
1.001	HydroBrake	1200	Manhole	Adoptable	Outfall	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Tank	121.600	1.400	1200				
				0	1.000	120.200	300
HydroBrake	121.600	1.500	1200		1	1.000	120.100
				0	1.001	120.100	300
Outfall	120.750	0.930	1200		1	1.001	119.820
							300

**Simulation Settings**

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.4
Summer CV	1.000	Drain Down Time (mins)	240	30 year (l/s)	0.9
Winter CV	1.000	Additional Storage (m³/ha)	0.0	100 year (l/s)	1.2
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	40	0	0
30	35	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1	QMed	0.4
Greenfield Method	FEH	QBar/QMed conversion factor	1.111	QBar	0.5
Positively Drained Area (ha)	0.170	Growth Factor 2 year	0.90	Q 2 year (l/s)	
SAAR (mm)	651	Growth Factor 30 year	1.95	Q 30 year (l/s)	
Host	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	
BFIHost	0.483	Betterment (%)	0		

Node HydroBrake Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	120.100	Product Number	CTL-SHE-0107-5000-0900-5000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	120.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	158

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	115.0	0.0	0.800	115.0	0.0	0.801	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	Tank	78	120.320	0.120	16.1	13.2016	0.0000	OK
60 minute summer	HydroBrake	41	120.342	0.242	16.1	0.2740	0.0000	OK
15 minute summer	Outfall	1	119.820	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute summer	Tank	1.000	HydroBrake	16.2	0.553	0.103	0.2124	
60 minute summer	HydroBrake	Hydro-Brake®	Outfall	5.0				21.7

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Tank	116	120.750	0.550	31.4	60.7205	0.0000	SURCHARGED
120 minute winter	HydroBrake	116	120.750	0.650	14.5	0.7351	0.0000	SURCHARGED
15 minute summer	Outfall	1	119.820	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	Tank	1.000	HydroBrake	14.5	0.550	0.092	0.3521	
120 minute winter	HydroBrake	Hydro-Brake®	Outfall	5.0				88.6

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Tank	116	120.973	0.773	40.8	85.2710	0.0000	SURCHARGED
120 minute winter	HydroBrake	116	120.972	0.872	15.2	0.9866	0.0000	SURCHARGED
15 minute summer	Outfall	1	119.820	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	Tank	1.000	HydroBrake	15.2	0.566	0.097	0.3521	
120 minute winter	HydroBrake	Hydro-Brake®	Outfall	5.0				97.0

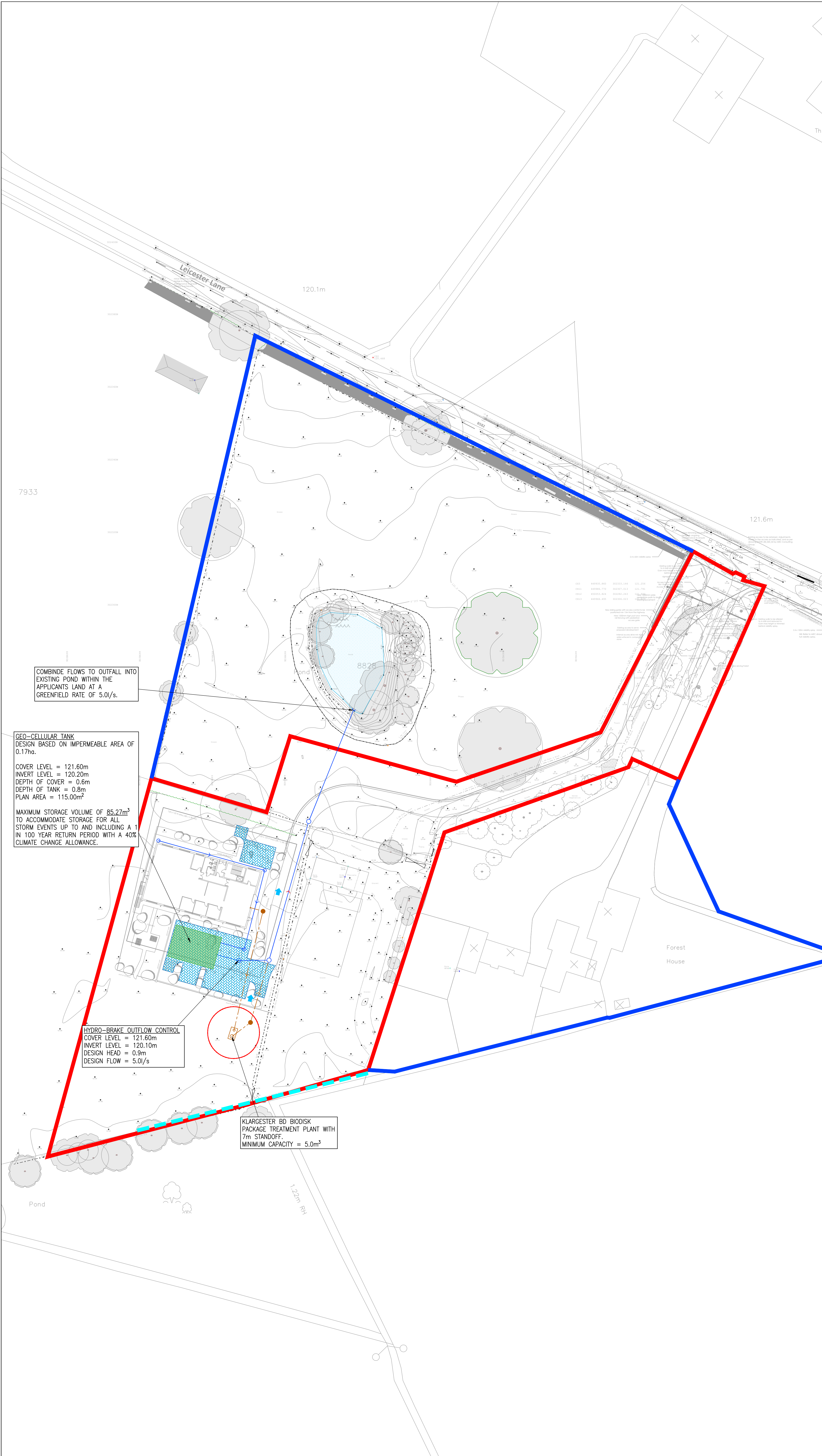


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APPENDICES



APPENDIX C



NOTES:

- DO NOT SCALE THIS DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
- ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
- THIS DRAWING IS FOR STRATEGY PURPOSES ONLY AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
- DESIGN BASED ON EXISTING LEVELS AND SUBJECT TO CHANGE WITH EXTERNAL WORKS DESIGN / CONFIRMATION OF FFLS.
- DRAINAGE STRATEGY IS SUBJECT TO AGREEMENT WITH RELEVANT THIRD PARTIES, INCLUDING ENVIRONMENT AGENCY, LOCAL PLANNING AUTHORITY, LEAD LOCAL FLOOD AUTHORITY AND WATER AUTHORITY.
- CONCRETE PROTECTION TO BE PROVIDED TO ANY PIPES WITH LOW COVER.
- THE DRAINAGE STRATEGY WILL NEED UPDATING IF THE LAYOUT IS REVISED.
- FOUL WATER FLOWS WILL OUTFALL INTO A NEW KLARGESTER BD BIODISK.
- TREATED EFFLUENT WILL COMBINE WITH SURFACE WATER DISCHARGE AND OUTFALL INTO THE EXISTING POND, WHICH IS ASSUMED TO INFILTRATE.
- IT IS RECOMMENDED FURTHER INVESTIGATION OF THE POND NETWORK IS UNDERTAKEN TO DETERMINE ITS EXTENT.

KEY

- SITE BOUNDARY
- LAND UNDER APPLICANTS CONTROL
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER
- EXISTING DITCH NETWORK
- PROPOSED GEO-CELLULAR TANK
- PROPOSED PERMEABLE PAVING
- PROPOSED KLARGESTER BIO DISK WITH 7m STANDOFF
- PROPOSED OVERLAND FLOW ROUTES

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MEC Consulting Group Birmingham Brighton Leicester			Telephone: 01530 264 753 Email: group@m-ec.co.uk Website: www.m-ec.co.uk ORDNANCE SURVEY © CROWN COPYRIGHT 2015. ALL RIGHTS RESERVED. LICENCE NUMBER 100055865.		



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APPENDICES



APPENDIX D

MAINTENANCE AND MANAGEMENT

A proposed maintenance plan is shown in the table below and breaks down the maintenance requirements of the various proposed assets in accordance with the CIRIA C753 SuDS Manual guidance.

Table 1.1: Proposed Maintenance Regime

Drainage Asset	Responsible Organisation	Maintenance Work	Frequency
Pipework / Manholes	Private Ownership / Management Company	Inspect pipework and clear blockages	Annually or after severe storms.
		Inspect manholes and clear blockages	
		Repair any defects in the network	
		Inspect flow control, ensure operating freely and pivoting bypass door and penstock valve operating correctly	
Headwalls	Private Ownership / Management Company	Inspect the structure and remove any debris/litter on the structure.	Annually or after severe storms
		Replace malfunctioning parts or structures	As required
Catchpits	Private Ownership / Management Company	Inspect structure and remove any debris/litter on structure	Annually or after severe storms
		Replace malfunctioning parts or structures	As required
Gullies	Private Ownership / Management Company	Inspect structure and remove any debris/litter on structure	Annually or after severe storms
		Replace malfunctioning parts or structures	As required
Foul Treatment Plant	Private Ownership / Management Company	Inspect wet well, kiosk and valve chamber	Annually or after severe storms
		Inspect structure and remove any debris from the wet well	
		Replace malfunctioning parts or structures	As required
Flow Control Chamber	Private Ownership / Management Company	Inspect structure and remove excessive silt build-up	Monthly during construction and then annually or after severe storms
		Inspect pipework and manholes also clear blockages	Annually or after severe storms
		Inspect manholes and clear blockages	
		Inspect flow control, ensure operating freely and pivoting bypass door and penstock valve operating correctly	
		Replace malfunctioning parts or structures	
		Inspect for evidence of poor operation	6 monthly
		Inspect sediment accumulation rates and establish appropriate removal frequencies	
		Test control structure to ensure operating as per original design	5 yearly
Permeable Pavements	Private Ownership / Management Company	Brushing and vacuuming (standard cosmetic sweep over the whole surface)	Once a year after autumn leaf fall, or reduced frequency as required,



			based on site-specific observations of clogging of manufacturer's recommendations.
		Stabilise and mow contributing and adjacent areas	As required
		Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than sweeping	
		Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50 mm of the level of the paving	
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
		Initial inspection	Monthly for 3 months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	3 monthly, 48 hours after large storms in first 6 months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	
Attenuation Storage Tanks	Private Ownership / Management Company	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months then annually
		Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
		For systems where rainfall infiltrates into the tank from above, check the surface of the filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
		Remove the sediment from pre-treatment structures and/or internal forebays	
		Repair/rehabilitate inlets, outlets, overflows and vents	As required
		Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
		Survey inside of the tank for sediment build-up and remove if necessary	Every 5 years or as required
Ponds and Wetlands	Private Ownership / Management Company	Remove litter and debris	Monthly or as required
		Cut the grass – public areas	
		Cut the meadow grass	



		Inspect marginal and bankside vegetation and remove nuisance plants	
		Inspect inlets, outlets, bankside, structures, pipework etc for evidence of blockages and/or physical damage	
		Inspect water body for a sign of poor water quality	
		Inspect silt accumulation rates in any forebay and the main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half-yearly
		Check any mechanical devices e.g. penstocks	
		Hand-cut submerged and emergent aquatic plants (as a minimum of 0.1 m above pond base)	Annually
		Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	
		Tidy all dead growth before the start of the growing season	
		Remove the sediment from any forebay	Every 1-5 years or as required
		Remove sediment and planting from one quadrant of the main body of ponds within sediment forebays	
		Remove the sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely (every 25-50 years)
		Repair erosion or other damage	As required
		Replant, where necessary	
		Aerate pond when signs of eutrophication are detected	
		Realign rip-rap or repair other damage	
		Repair/rehabilitate inlets, outlets and overflows	



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APPENDICES



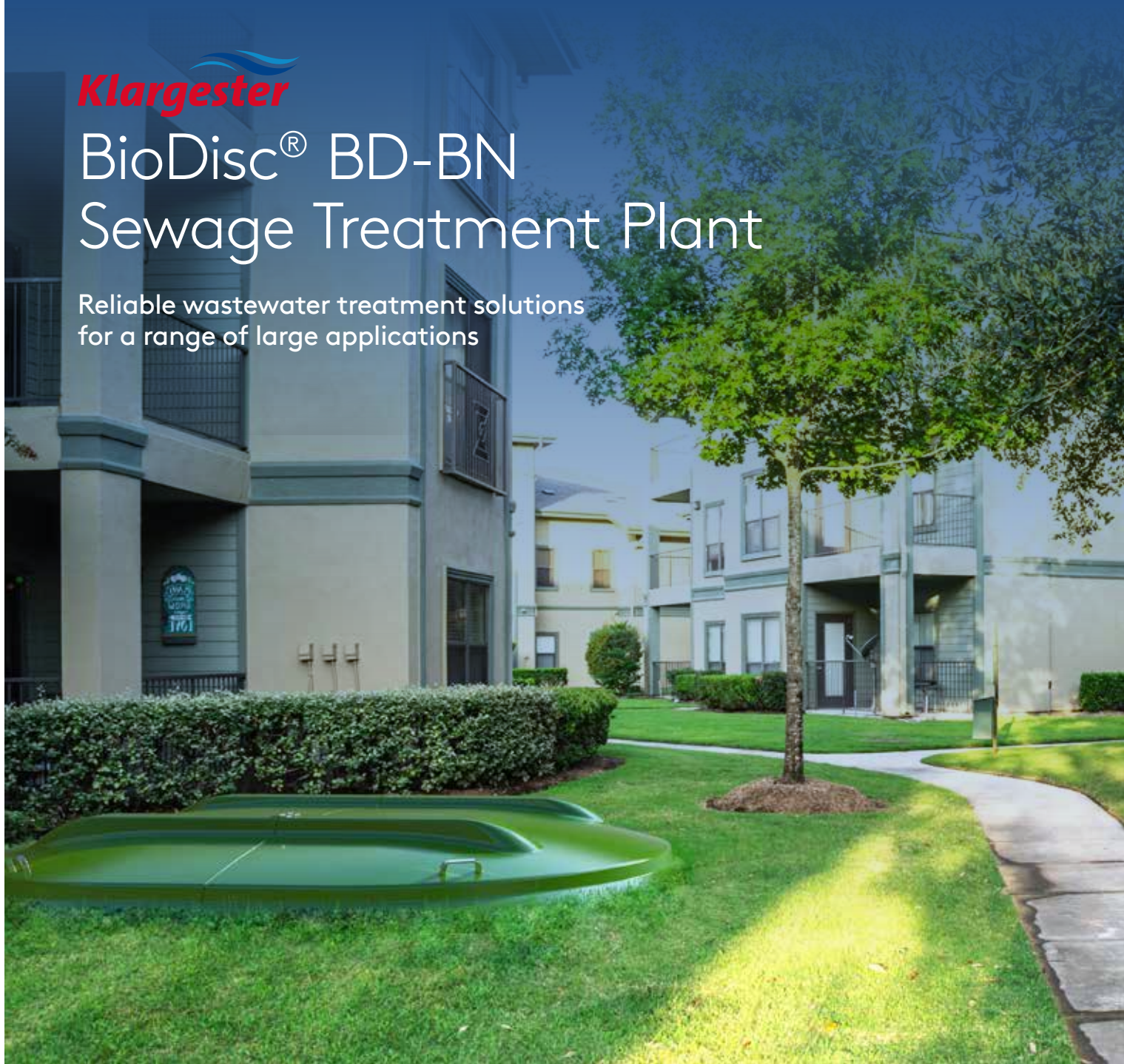
APPENDIX E

Water Management Solutions

Klargester

BioDisc® BD-BN Sewage Treatment Plant

Reliable wastewater treatment solutions
for a range of large applications



klargester.co.uk

Why choose a Large BioDisc®?

With strict Environment Agency standards, it's more important than ever to choose a sewage treatment plant that delivers peace of mind with reliable treatment of wastewater.

Klargester has 70 years' experience in the design and manufacture of water management solutions. The Klargester BioDisc Large treatment plant offers the following benefits:

70 YEARS' EXPERIENCE

Product Benefits

- Low noise
- Odour free
- Affordable lifetime running costs
- A full solution – sizing, commissioning, & maintenance (as optional extras)
- Tried and tested performance

Designed to EN 12255 standards

3 year warranty period*

*Subject to regular maintenance by either Kingspan Service or a Klargester Accredited Installer and Service Partner. Online registration required.

Affordable lifetime running costs

Delivered as a single, packaged system, the Klargester BioDisc RBC range offers affordable running costs due to its unique design and operational efficiencies. A manual air blower system is not required to power the Large BioDisc, as it instead relies on the rotating biological disc which drives the wastewater treatment process in a highly efficient way.

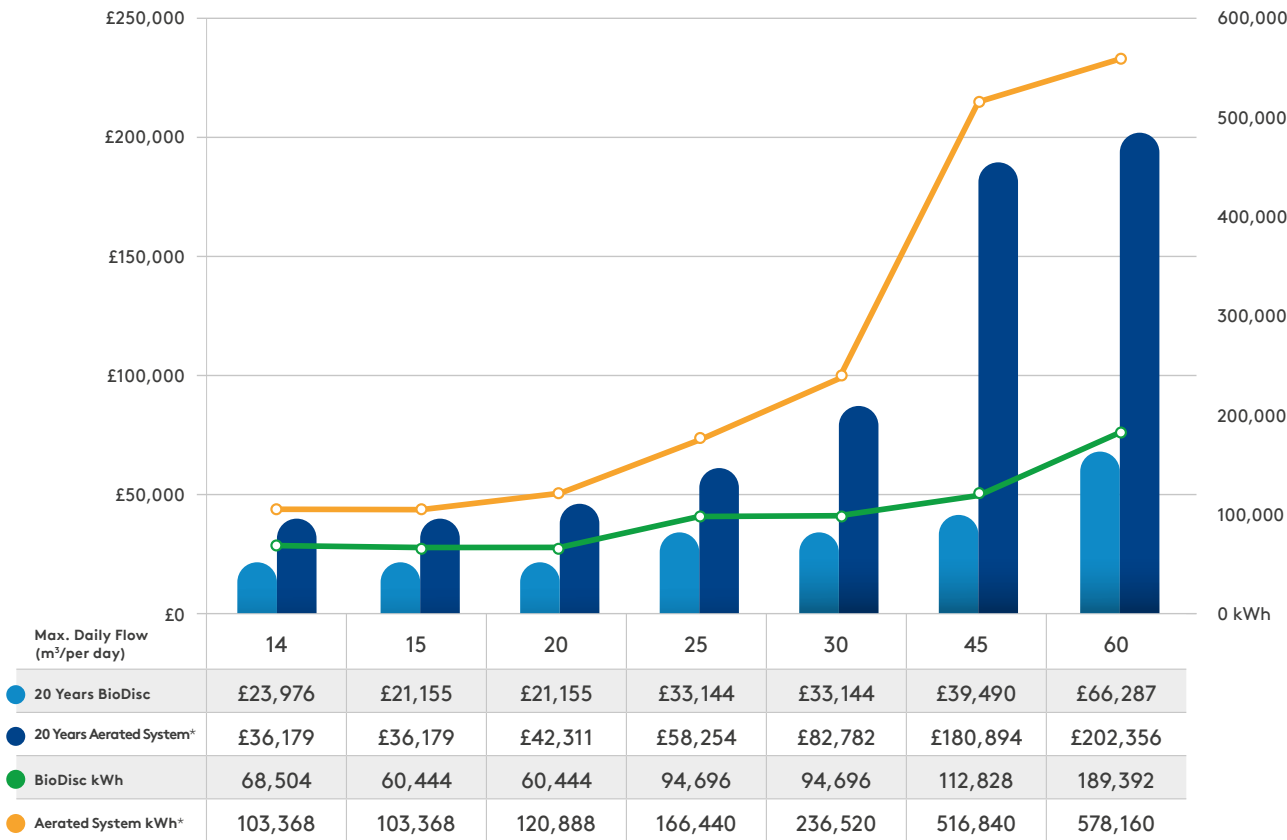
Our range of Large treatment plants is designed to run from either a single phase or three phase power source, and require 60 to 550 watt motors, offering low running costs.

LOW ENERGY

Save up to 67% on energy and cost savings

Large BioDisc (RBC) versus an aerated system

Based on total energy costs over 20 year minimum expected product lifetime.**



*Based on Klargester BioFicient Aerated System

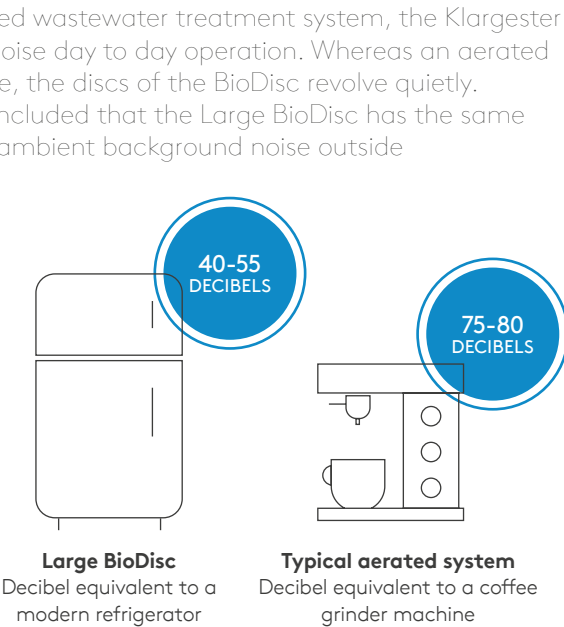
To find out more about the cost benefits of choosing the Klargester BioDisc, contact our in-house technical team who are happy to provide guidance on the size and cost of model for your wastewater project.

Email: klargestester@kingspan.com
Tel: (0) 1296 633 033
Web: klargestester.co.uk

* Based on 20 years running costs of BioDisc BN model versus an aerated treatment plant.
**Cost calculations based on £0.269p per kw/H.

Low Noise

In contrast with a noisy aerated wastewater treatment system, the Klargester Large BioDisc delivers a low noise day to day operation. Whereas an aerated system creates constant noise, the discs of the BioDisc revolve quietly. At a recent site, our team concluded that the Large BioDisc has the same level of noise as the average ambient background noise outside – between 40-55 decibels.



Odourless operation

Klargester's Large BioDisc uses the tried and tested Rotating Biological Contactor technology. This means that it utilises moving discs containing living biomass and a flow management system to treat the wastewater, as opposed to an air pump which is used in a traditional aerated system.

BioDisc is one of the few sewage treatment systems available in the UK that does not make use of an air pump. This means minimal odour being omitted as effluent is not aerated or 'blown around' within a system. This is verified by an independent odour sampling report undertaken at one of our sites in Cumbria, in partnership with H+M Environmental Ltd (April 2017) and in accordance with EN13725 test standards.

The key findings of the report stated:

'No odour was subjectively discernible at the site boundary fence, or within the BioDisc compound'.

- The odour emission rate was calculated by sampling the odour concentration from joins in the unit covers. This was then multiplied by a volumetric air flow.
- Weather conditions were dry and sunny during the sampling.
- Temperatures on the day of sample (18th April) ranged from 8-12°C during the test period.
- The BioDisc operated normally during the sampling with no particular reported operational issues.



Calculated Odour Emissions Rates

Source	Measured Odour Concentration	Measured Air Flow	Calculated Odour Emission
	ou _e /m ³	m ³ /s	ou _e /s
Air vented from BioDisc 9am	330	0.008	2.7
Air vented from BioDisc 11am	339	0.008	2.7

(Above: extract showing actual calculated Odour Emission Rates from sample report –April 2017. Full report available on request from Kingspan Klargester).

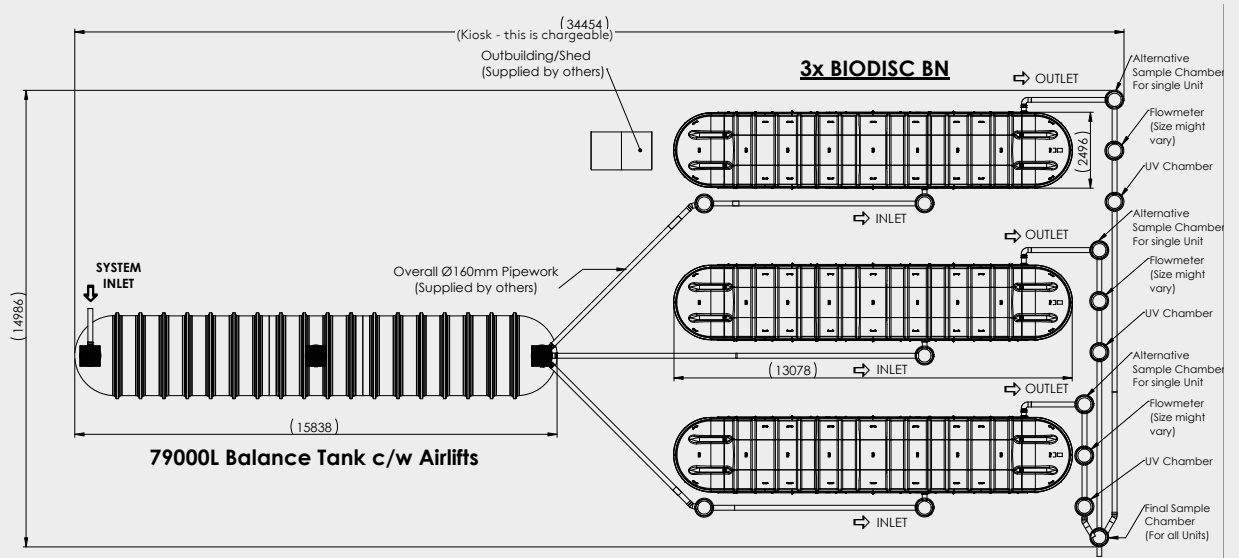
A professional partnership

Klargester provides relevant advice and support throughout the wastewater treatment purchasing process based on our in-depth local knowledge and expertise. How? By offering comprehensive free site visits, professional installation options and aftersales care through our in-house Service team and our national network of Klargester accredited installers and service partners.

Our team provides:

- Free on-site consultations, including sizing advice and full engineering expertise
- A smart commissioning solution which includes our SmartServ Pro remote monitoring software, for total peace of mind (optional extra)
- Professional installation
- Preventative maintenance plans to ensure optimal ongoing performance
- Day to day technical support
- Consultancy and advice, direct from the manufacturer
- A 3 year warranty period (when you register your warranty online). Terms and conditions apply - view online at <https://www.kingspan.com/gb/en-gb/products/wastewater-management/warranty-terms>

As part of our free site visit service, we can offer advice on larger bespoke schemes.



Talk to us about larger bespoke schemes, at klargestar@kingspan.com

Technical specifications

How it works

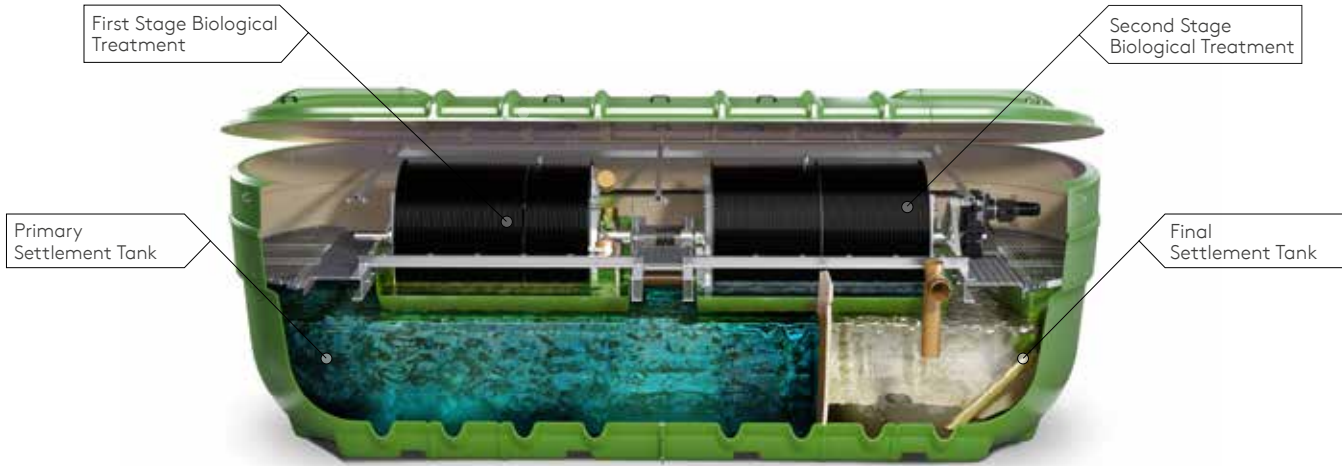
Our flow management systems ensure optimum treatment performance in the treatment zones. BioDisc features two chambers to ensure a totally efficient operation with a unique flow balancing facility.

This managed flow system ensures peak performance by smoothing variable loads. Wastewater is moved at a controlled rate through the sections with the entire media area available, ensuring maximum treatment efficiency.

Performance & Compliance

- Odour free - independently tested in accordance with EN13725.
- Designed for applications selected in compliance with British Water Code of Practice Flows and Loads.

The Large BioDisc Wastewater Management Process



01
Primary Settlement Tank
This is the initial stage of treatment and simply involves the retention of coarse solids present in raw sewage and wastewater for subsequent gradual breakdown.



02
First Stage Biological Treatment
The liquor and fine solids then flow into the first stage of Biological Treatment. A unique managed flow system ensures peak performance by smoothing variable loads.



03
Second Stage Biological Treatment
The liquor is then fed forward at a controlled rate into Biological Treatment stage 2 for further treatment. This process ensures the whole media area available is utilised ensuring maximum efficiency.



04
Final Settlement Tank
The surplus micro-organisms continuously slough off the discs and are carried forward to the final settlement where they settle out as a humus sludge, leaving a clear treated effluent to be discharged to ground or water course.

Technical Specifications

Model Reference	BD	BE	BF	BG	BJ	BK	BL	BM	BN
PE	25	35	50						
Maximum Daily BOD (kg)				4.2	6	7.5	9	13.5	18
Maximum Daily Flow (m3)				14	20	25	30	45	60
Ø/Width (mm)	2450	2450	2450	2450	2450	2450	2450	2450	2450
Length (mm)	3340	3340	4345	5235	7755	7755	7755	10420	13100
Inlet Invert depth (mm)	600/1100	600/1100	600/1100	600/1100	600/1000	600/1000	600/1000	600/1000	600/1000
Depth Below Inlet Invert (mm)	1820	1820	1820	1820	1790	1790	1790	1790	1790
Outlet Invert Depth (mm)	1735	1735	1720	700/1200	750/1150	750/1150	750/1150	750/1150	750/1150
Overall Height (mm)	2825/3325	2825/3325	2825/3325	2825/3325	2830/3230	2830/3230	2830/3230	2830/3230	2830/3230
Height to Rim of Cover (mm)	2485/2985	2485/2985	2485/2985	2485/2985	2490/2890	2490/2890	2490/2890	2490/2890	2490/2890
Empty Weight (kg)	1100/1200	1200/1300	1315/1465	1660/1810	3100/3120	3200/3220	3300/3320	4200/4250	5500/5650
Standard Power Supply	1 Phase	1 Phase	1 Phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase
Motor Rating – 1 Phase (Watts)	253	253	299	180	250	370	370	550	2 x 370
Full Load Current 1 Phase (amps)	1.1	1.1	1.3	1.6	1.5	2.35	2.35	2.8	2 x 2.35
Optional Power Supply	3 Phase	3 Phase	3 Phase	3 phase	3 phase	3 phase	3 phase	3 phase	3 phase
Motor Rating – 3 Phase (Watts)	90	90	250	180	250	370	370	550	2 x 370
Full Load Current 3 Phase (amps)	0.38	0.38	0.42	0.63	0.88	1.35	1.35	2.8	2 x 1.35
Sludge Return Pump Rating (Watts)	250	250	250	250	250	250	250	250	250

Protect your investment with our Smart Commissioning Package

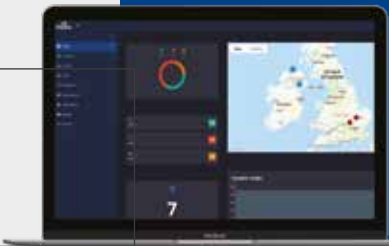
This comprehensive package* includes commissioning, to ensure your Large BioDisc runs optimally right from the start, as well as our remote monitoring solution – SmartServ Pro. Together, both provide total peace of mind when it comes to the ongoing performance of your wastewater treatment solution. Remember that installation of a suitable alarm system is required under EN 12566-3 (BioDisc BE-BF units only).

For information on our Smart Commissioning Package or wider service solutions, contact our team on helpingyou@kingspan.com or visit our website at kingspanservice.com

Register your warranty online by scanning the QR code below to enjoy an extended 3 year warranty period**



**Terms and conditions apply. Visit: <https://www.kingspan.com/gb/en-gb/products/wastewater-management/warranty-terms>



* Available as an optional extra.

Contact Details

UK

Kingspan Water & Energy Ltd.

College Road North
Aston Clinton | Aylesbury
Buckinghamshire | HP22 5EW

T: +44 (0) 1296 633 033

F: +44 (0) 1296 633 001

E: klargest@kingspan.com

W: kingspan.co.uk/klargest

Kingspan Water & Energy Ltd.

Service Office Details:

180 Gilford Road
Portadown
BT63 5LF

T: NI: 028 3836 4600 | ROI: 0818 543 500

E: helpingyou@kingspan.com

W: kingspanservice.com

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PERFORMANCE RESULTS

Kingspan Environmental Ltd.
College Road North, HP22 5EW, Aylesbury
United Kingdom

EN 12566-3

"Small wastewater treatment system for up to 50 PT"

Small wastewater treatment system BioDisc®
Rotating biological contractor

Nominal organic daily load	0.29	kg BOD ₅ /d	
Nominal hydraulic daily load	1.2	m ³ /d	
Material	glass reinforced plastic (GRP)		
Watertightness (water test)	pass		
Crushing resistance (vertical load test)	pass (also wet conditions)		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	89.4 %	59 mg/l
	BOD ₅	95.7 %	10 mg/l
	NH ₄ -N	88.6 %	3.8 mg/l
	SS	94.8 %	15 mg/l
Electrical consumption	1.3	kWh/d	

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
D-52074 Aachen

Certified according to
ISO 9001:2008
Notified Body number: 1739



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Prüfinstitut für Abwassertechnik GmbH
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Elmar Lancé

May 2013



CIVIL ENGINEERING



TRANSPORT



FLOOD RISK & DRAINAGE



STRUCTURES



GEO-ENVIRONMENTAL



ACOUSTIC AIR



UTILITIES



GEOMATICS



LIGHTING



EXPERT WITNESS



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