DRAINAGE STRATEGY

INCORPORATING AN ASSESSMENT OF FLOOD RISK

for

Mr & Mrs A & J WRIGHT

CONVERSIONS OF EXISTING BUILDINGS

TO RESIDENTIAL DWELLINGS

at

PARSONAGE FARM

CHURCH STREET, RIBCHESTER, PRESTON PR3 3YE

JUNE 2023

REFORD

Consulting Engineers Limited

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CONTENTS

1. INTRODUCTION

1.1 This surface water and foul water drainage strategy, incorporating an assessment of flood risk, has been produced on behalf of Mr & Mrs A & J Wright in support of a planning application for the conversion of a red brick barn into two dwellings, the conversion of a single storey blockwork building to an annexe, and the erection of two detached garages at Parsonage Farm, Church Street, Ribchester, Preston PR3 3YE. A location plan is included within Appendix A.

1.2 This report describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed strategy for the provision of new drainage to serve the proposed development.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to land at Parsonage Farm, Ribchester, Preston, which lies to the southwest of the village centre. The area of the site, excluding the access track, is approx. 0.37ha.

2.2 The farmstead comprises the farmhouse and a group of farm buildings. To the northeast of the farmstead is another dwelling Parsonage Cottage and a little further to the east is a watercourse.

2.3 The area where the buildings lie is relatively level. The fields to the west, south and east fall quickly away from the buildings.

2.4 Access to the site is access taken along a single track road from Church Street.

Proposed development

2.5 The proposed development is for the conversion of a red brick barn into two dwellings, the conversion of a single storey blockwork building to an annexe, and the erection of two detached garages. Buildings within the site are to be removed, including the steel framed agricultural buildings, single storey lean-to and a small blockwork extension. The proposed site plan is shown on the drawing accompanying the planning application.

Site geology

2.6 The online Soilscapes viewer has identified that the geology encountered will be freely draining floodplain soils.

Understanding of existing drainage within and local to the site

2.7 An unnamed ordinary watercourse lies approx. 90m to the east of the site and approx. 10m below it. The watercourse flows to the south to discharge into the River Ribble that lies approx. 480m from the site.

2.8 A drainage ditch lies approx. 100m to the south / southeast of the site. The ditch flows to the east to discharge into the unnamed ordinary watercourse.

2.9 A culverted drain lies within the adjacent field to the north of the site and discharges into the unnamed ordinary watercourse.

2.10 Within the site is a surface water drainage system that serves the existing buildings. Surface water is discharged into the culverted drain via manhole connections.

2.11 There are no public sewers within the area.

Flood risk

2.12 The flood map for planning identifies the site lying within Flood Zone 1, the lowest risk. Along the access track from Church Street to the site there is a small area of Flood Zone 3 where the track crosses the unnamed ordinary watercourse that lies approx. 90m to the east of the site and approx. 10m below it, and a small area of Flood Zone 2 where the track crosses what appears to be a drainage ditch midway along the track.

2.13 The Long Term Flood Risk map on the GOV.uk website shows the site is at a very low risk of surface water flooding. A very low risk means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%). A risk of surface water flooding is also identified along parts of the access track to the site, in particular the areas that are shown to have a risk of flooding.

2.14 From the lie of the land, the flooding on the access track, should it occur, will not be very deep enabling access by vehicles should it be necessary. In addition there is a public right of way from the site to the B6245 Preston Road that is less than 1km long and lies wholly within Flood Zone 1 should an additional access be required.

2.15 There are no canals or artificial sources local to the development site.

2.16 There are no sewers local to the development site.

2.17 The Environment Agency risk of flooding from reservoirs map identifies the site is not at risk. However the access track to the site is at risk.

2.18 The Environment Agency does not consider groundwater flooding to be a significant flood risk factor in the Ribble Valley area.

2.19 The proposal is for the conversion of existing buildings to residential dwellings and the erection of two detached garages following the removal of buildings within the site. As such there will be no change to the flood risk upstream or downstream of this location.

3. PROPOSED DRAINAGE STRATEGY

3.1 The proposed drainage layout is included within Appendix B.

Surface Water Drainage

3.2 In accordance with the National Standards for Sustainable Drainage, the drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or
(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.3 The rate and volume of discharge should be restricted to the pre-development values as far as practicable.

Surface water drainage discharges from the developed site

3.4 The online Soilscapes viewer has identified that the geology encountered will be freely draining floodplain soils. However there is a steep fall away from the site and infiltration of surface water back into the ground via a soakaway may result in water from it to spring from the slope causing flooding to the adjacent third party land. As such, we believe that a soakaway is not a suitable method for the disposal of surface water from the development site.

3.5 The proposal is for the conversion of existing buildings to residential dwellings and the erection of two detached garages following the removal of buildings within the site. A drainage ditch lies approx. 100m to the south / southeast of the site. The ditch flows to the east to discharge into the unnamed ordinary watercourse.

3.6 It is therefore intended that surface water runoff from the developed site will be collected by a new drainage system and a discharge made into the drainage ditch that

lies approx. 100m to the south / southeast of the site and flows to the east to discharge into the unnamed ordinary watercourse.

3.7 The surface water runoff from the developed site is to be restricted to 5 l/s and attenuation provided using underground storage crates.

3.8 A surface water drainage design has been carried out for the 100 year critical rain storm plus 50% on stored volumes. The additional 50% is to allow for climate change and has been included in the surface water volume. The surface water drainage design is included within Appendix C.

3.9 Surface water falling onto the undrained soft landscaped areas will be taken up by plants or evaporated or infiltrate. The surface water within these areas of the site will therefore be dealt with close to where it falls, at source.

Foul Water Drainage

3.10 Foul water discharges from the site will be treated by individual sewage treatment plants, one for each dwelling, and the effluent discharged into the drainage ditch that lies approx. 100m to the south / southeast of the site and the unnamed ordinary watercourse.

3.11 For each dwelling, a typical plant is the Marsh Ensign sewage treatment plant that has been sized for a population of five for a three bed dwelling and for a population of six for a four bed dwelling. The sewage treatment plants are to be located a minimum 7m from the proposed dwellings. Details of the typical sewage treatment plants can be found within Appendix D. The size of the plants are to be confirmed prior to ordering.

4. SUMMARY AND CONCLUSIONS

4.1 This surface water and foul water drainage strategy, incorporating an assessment of flood risk, has been produced on behalf of Mr & Mrs A & J Wright in support of a planning application for the conversion of a red brick barn into two dwellings, the conversion of a single storey blockwork building to an annexe, and the erection of two detached garages at Parsonage Farm, Church Street, Ribchester, Preston PR3 3YE.

4.2 A soakaway is not a suitable method for the disposal of surface water from the development site.

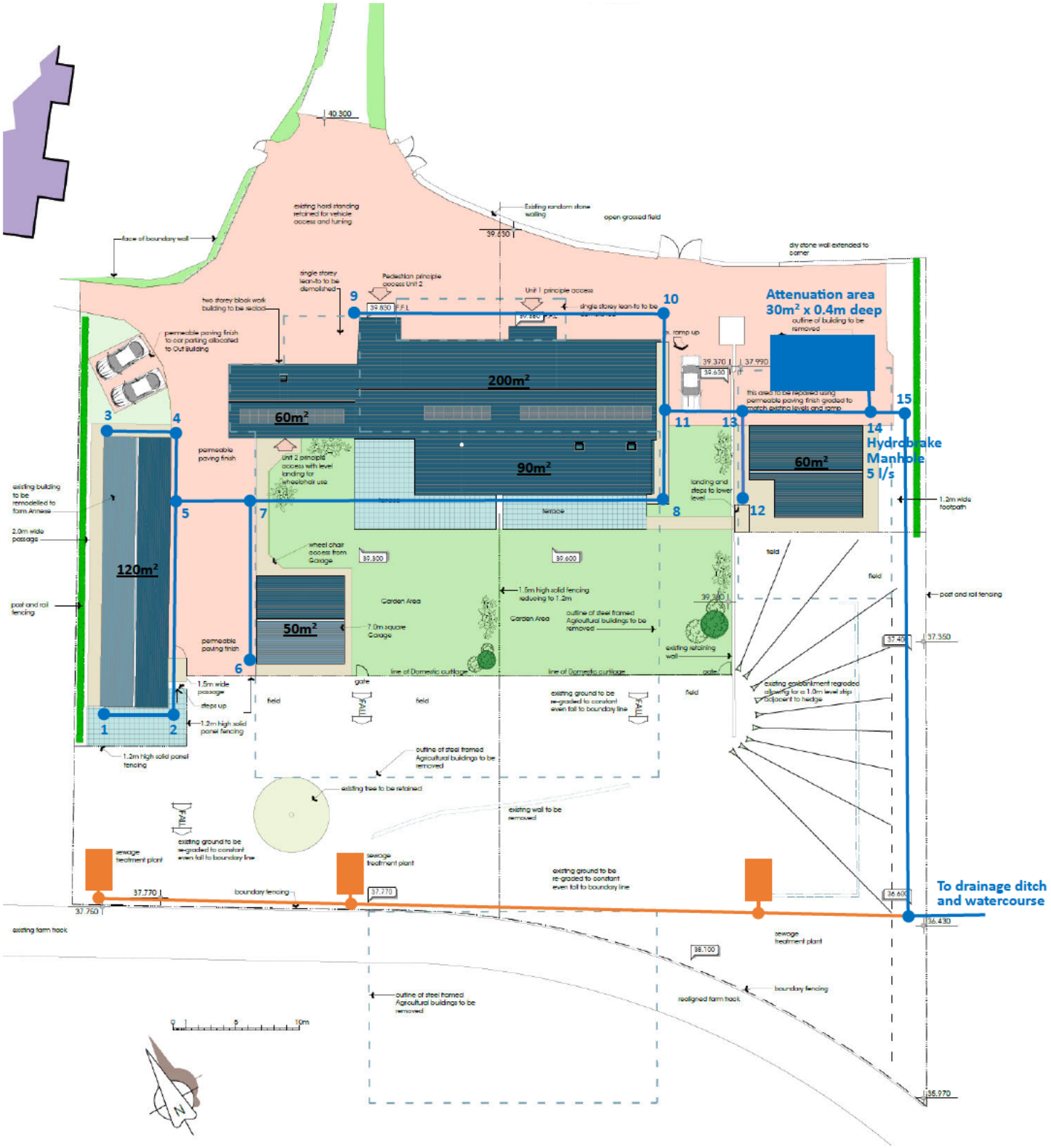
4.3 Surface water runoff from the developed site will be collected by a new drainage system, be restricted to 5 l/s and a discharge made into the drainage ditch lies approx. 100m to the south / southeast of the site and flows to the east to discharge into the unnamed ordinary watercourse. Attenuation will be provided using underground storage crates.

4.4 Foul water discharges from the site will be treated by individual sewage treatment plants, one for each dwelling, and the effluent discharged into the drainage ditch that lies approx. 100m to the south / southeast of the site and the unnamed ordinary watercourse.

APPENDIX A

LOCATION PLAN

APPENDIX B



PROPOSED DRAINAGE LAYOUT

APPENDIX C

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.900	Minimum Backdrop Height (m)	2.000
Ratio-R	0.300	Preferred Cover Depth (m)	0.450
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.003	5.00	40.000	600	0.550
2	0.003	5.00	40.000	600	0.651
3	0.003	5.00	39.000	600	0.550
4	0.003	5.00	39.000	600	0.651
5			39.600	600	1.352
6	0.005	5.00	39.600	100	0.550
7	0.013	5.00	39.600	600	1.453
8	0.009	5.00	39.400	600	1.808
9	0.008	5.00	39.800	600	0.550
10	0.005	5.00	39.400	600	0.571
11			39.400	600	1.993
12	0.006	5.00	38.000	100	0.550
13			38.000	600	1.000
14			38.000	1500	1.100
15			38.000	1200	1.130

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	1	2	6.000	0.600	39.450	39.349	0.101	59.4	100	5.10	56.8
1.001	2	5	17.000	0.600	39.349	38.248	1.101	15.4	100	5.24	56.2
2.000	3	4	6.000	0.600	38.450	38.349	0.101	59.4	100	5.10	56.8
2.001	4	5	6.000	0.600	38.349	38.248	0.101	59.4	100	5.20	56.4
1.002	5	7	6.000	0.600	38.248	38.147	0.101	59.4	100	5.34	55.8
3.000	6	7	13.000	0.600	39.050	38.147	0.903	14.4	100	5.11	56.8
1.003	7	8	33.000	0.600	38.147	37.592	0.555	59.5	100	5.89	53.7
1.004	8	11	8.000	0.600	37.592	37.407	0.185	43.2	100	6.01	53.2
4.000	9	10	25.000	0.600	39.250	38.829	0.421	59.4	100	5.42	55.5
4.001	10	11	8.000	0.600	38.829	37.407	1.422	5.6	100	5.46	55.3
1.005	11	13	6.000	0.600	37.407	37.050	0.357	16.8	100	6.06	53.0
5.000	12	13	12.000	0.600	37.450	37.050	0.400	30.0	100	5.14	56.6
1.006	13	14	10.000	0.600	37.000	36.900	0.100	100.0	150	6.23	52.5
1.007	14	15	3.000	0.600	36.900	36.870	0.030	100.0	150	6.27	52.3

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.001	7.9	0.5	0.450	0.551	0.003	0.0	17	0.548
1.001	1.976	15.5	0.9	0.551	1.252	0.006	0.0	17	1.087
2.000	1.001	7.9	0.5	0.450	0.551	0.003	0.0	17	0.548
2.001	1.001	7.9	0.9	0.551	1.252	0.006	0.0	23	0.666
1.002	1.001	7.9	1.8	1.252	1.353	0.012	0.0	32	0.810
3.000	2.046	16.1	0.8	0.450	1.353	0.005	0.0	15	1.059
1.003	1.001	7.9	4.4	1.353	1.708	0.030	0.0	54	1.029
1.004	1.175	9.2	5.6	1.708	1.893	0.039	0.0	57	1.235
4.000	1.001	7.9	1.2	0.450	0.471	0.008	0.0	26	0.718
4.001	3.281	25.8	1.9	0.471	1.893	0.013	0.0	18	1.913
1.005	1.893	14.9	7.5	1.893	0.850	0.052	0.0	50	1.899
5.000	1.414	11.1	0.9	0.450	0.850	0.006	0.0	19	0.843
1.006	1.005	17.8	8.2	0.850	0.950	0.058	0.0	72	0.986
1.007	1.005	17.8	8.2	0.950	0.980	0.058	0.0	72	0.986

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.900	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.300	Skip Steady State	x	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 %)
1	0	0	0	100	0	0	0
30	0	0	0	100	50	0	0

Node 14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	36.900	Product Number	CTL-SHE-0104-5000-1100-5000
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 14 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.900
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	56

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	30.0	0.0	0.400	30.0	0.0	0.401	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	39.465	0.015	0.4	0.0059	0.0000	OK
15 minute winter	2	10	39.364	0.015	0.8	0.0055	0.0000	OK
15 minute winter	3	10	38.465	0.015	0.4	0.0058	0.0000	OK
15 minute winter	4	10	38.369	0.020	0.8	0.0076	0.0000	OK
15 minute winter	5	11	38.277	0.029	1.4	0.0081	0.0000	OK
15 minute winter	6	11	39.063	0.013	0.6	0.0025	0.0000	OK
15 minute winter	7	11	38.194	0.047	3.5	0.0217	0.0000	OK
15 minute winter	8	11	37.645	0.053	4.5	0.0201	0.0000	OK
15 minute winter	9	10	39.275	0.025	1.0	0.0145	0.0000	OK
15 minute winter	10	11	38.846	0.017	1.6	0.0076	0.0000	OK
15 minute winter	11	11	37.455	0.048	6.1	0.0136	0.0000	OK
15 minute winter	12	10	37.467	0.017	0.7	0.0039	0.0000	OK
15 minute winter	13	11	37.070	0.070	6.7	0.0198	0.0000	OK
30 minute winter	14	25	36.980	0.080	5.7	2.4137	0.0000	OK
15 minute summer	15	1	36.870	0.000	1.9	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)
15 minute winter	1	1.000	2	0.4	0.501	0.046	0.0043	
15 minute winter	2	1.001	5	0.7	0.711	0.045	0.0217	
15 minute winter	3	2.000	4	0.4	0.397	0.046	0.0055	
15 minute winter	4	2.001	5	0.7	0.490	0.089	0.0089	
15 minute winter	5	1.002	7	1.4	0.523	0.180	0.0164	
15 minute winter	6	3.000	7	0.6	0.333	0.037	0.0274	
15 minute winter	7	1.003	8	3.5	0.905	0.448	0.1284	
15 minute winter	8	1.004	11	4.5	1.143	0.488	0.0315	
15 minute winter	9	4.000	10	1.0	0.801	0.121	0.0300	
15 minute winter	10	4.001	11	1.6	0.790	0.060	0.0183	
15 minute winter	11	1.005	13	6.0	1.708	0.406	0.0212	
15 minute winter	12	5.000	13	0.7	0.767	0.063	0.0120	
15 minute winter	13	1.006	14	6.8	1.280	0.381	0.0651	
30 minute winter	14	Hydro-Brake®	15	2.7				4.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	39.473	0.023	0.9	0.0091	0.0000	OK
15 minute winter	2	10	39.372	0.023	1.8	0.0085	0.0000	OK
15 minute winter	3	10	38.473	0.023	0.9	0.0088	0.0000	OK
15 minute winter	4	10	38.381	0.032	1.8	0.0121	0.0000	OK
15 minute winter	5	12	38.302	0.054	3.4	0.0152	0.0000	OK
15 minute winter	6	10	39.071	0.021	1.5	0.0039	0.0000	OK
15 minute winter	7	12	38.290	0.143	8.6	0.0660	0.0000	SURCHARGED
30 minute summer	8	19	37.744	0.152	10.1	0.0580	0.0000	SURCHARGED
15 minute winter	9	10	39.290	0.040	2.4	0.0232	0.0000	OK
15 minute winter	10	10	38.855	0.026	3.8	0.0119	0.0000	OK
15 minute winter	11	11	37.497	0.090	13.4	0.0254	0.0000	OK
15 minute winter	12	10	37.477	0.027	1.8	0.0061	0.0000	OK
15 minute winter	13	12	37.117	0.117	15.2	0.0330	0.0000	OK
30 minute winter	14	26	37.097	0.197	13.4	5.9570	0.0000	SURCHARGED
15 minute summer	15	1	36.870	0.000	4.6	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)
15 minute winter	1	1.000	2	0.9	0.644	0.111	0.0081	
15 minute winter	2	1.001	5	1.7	0.736	0.111	0.0466	
15 minute winter	3	2.000	4	0.9	0.502	0.111	0.0105	
15 minute winter	4	2.001	5	1.7	0.611	0.218	0.0186	
15 minute winter	5	1.002	7	3.3	0.601	0.422	0.0364	
15 minute winter	6	3.000	7	1.5	0.380	0.092	0.0582	
15 minute winter	7	1.003	8	7.8	1.035	0.989	0.2582	
30 minute summer	8	1.004	11	9.7	1.304	1.047	0.0594	
15 minute winter	9	4.000	10	2.3	1.026	0.296	0.0571	
15 minute winter	10	4.001	11	3.8	0.927	0.147	0.0360	
15 minute winter	11	1.005	13	13.4	1.961	0.905	0.0411	
15 minute winter	12	5.000	13	1.8	0.711	0.160	0.0428	
15 minute winter	13	1.006	14	15.1	1.406	0.850	0.1539	
30 minute winter	14	Hydro-Brake®	15	4.8				10.7

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	39.476	0.026	1.1	0.0103	0.0000	OK
15 minute winter	2	11	39.375	0.026	2.2	0.0096	0.0000	OK
15 minute winter	3	13	38.477	0.027	1.1	0.0106	0.0000	OK
15 minute winter	4	13	38.475	0.126	2.2	0.0472	0.0000	SURCHARGED
15 minute winter	5	13	38.470	0.222	4.4	0.0628	0.0000	SURCHARGED
15 minute winter	6	10	39.073	0.023	1.9	0.0044	0.0000	OK
15 minute winter	7	13	38.447	0.300	10.1	0.1388	0.0000	SURCHARGED
15 minute winter	8	12	37.876	0.284	10.7	0.1085	0.0000	SURCHARGED
15 minute winter	9	10	39.297	0.047	3.1	0.0269	0.0000	OK
15 minute winter	10	10	38.859	0.030	4.9	0.0135	0.0000	OK
15 minute winter	11	12	37.591	0.184	14.7	0.0521	0.0000	SURCHARGED
15 minute winter	12	10	37.481	0.031	2.3	0.0070	0.0000	OK
30 minute winter	13	24	37.221	0.221	15.5	0.0625	0.0000	SURCHARGED
60 minute winter	14	45	37.183	0.283	12.1	8.5782	0.0000	SURCHARGED
15 minute summer	15	1	36.870	0.000	4.8	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)
15 minute winter	1	1.000	2	1.1	0.687	0.140	0.0096	
15 minute winter	2	1.001	5	2.2	0.778	0.142	0.0799	
15 minute winter	3	2.000	4	1.1	0.539	0.140	0.0286	
15 minute winter	4	2.001	5	2.2	0.639	0.280	0.0469	
15 minute winter	5	1.002	7	4.6	0.613	0.590	0.0469	
15 minute winter	6	3.000	7	1.9	0.376	0.117	0.0598	
15 minute winter	7	1.003	8	7.7	1.039	0.984	0.2582	
15 minute winter	8	1.004	11	10.2	1.404	1.102	0.0626	
15 minute winter	9	4.000	10	3.0	1.102	0.385	0.0692	
15 minute winter	10	4.001	11	4.9	0.926	0.190	0.0390	
15 minute winter	11	1.005	13	14.4	1.943	0.967	0.0469	
15 minute winter	12	5.000	13	2.3	0.672	0.205	0.0537	
30 minute winter	13	1.006	14	15.3	1.170	0.862	0.1760	
60 minute winter	14	Hydro-Brake®	15	5.0				18.3

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	39.483	0.033	1.7	0.0129	0.0000	OK
15 minute winter	2	10	39.381	0.032	3.4	0.0119	0.0000	OK
15 minute winter	3	14	38.844	0.394	2.3	0.1545	0.0000	FLOOD RISK
15 minute winter	4	14	38.842	0.493	4.0	0.1851	0.0000	FLOOD RISK
15 minute winter	5	14	38.836	0.588	5.0	0.1665	0.0000	SURCHARGED
15 minute winter	6	10	39.079	0.029	2.9	0.0055	0.0000	OK
15 minute winter	7	13	38.811	0.664	10.3	0.3070	0.0000	SURCHARGED
15 minute winter	8	13	38.186	0.594	12.6	0.2268	0.0000	SURCHARGED
15 minute winter	9	10	39.310	0.060	4.6	0.0342	0.0000	OK
15 minute winter	10	10	38.866	0.037	7.4	0.0168	0.0000	OK
60 minute winter	11	51	38.024	0.617	13.9	0.1747	0.0000	SURCHARGED
60 minute winter	12	52	37.973	0.523	3.0	0.1182	0.0000	FLOOD RISK
60 minute winter	13	52	37.972	0.972	15.3	0.2750	0.0000	FLOOD RISK
60 minute winter	14	52	37.962	1.062	14.9	13.2910	0.0000	FLOOD RISK
15 minute summer	15	1	36.870	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)
15 minute winter	1	1.000	2	1.7	0.769	0.213	0.0131	
15 minute winter	2	1.001	5	3.3	0.827	0.215	0.0846	
15 minute winter	3	2.000	4	1.6	0.548	0.209	0.0469	
15 minute winter	4	2.001	5	3.2	0.628	0.412	0.0469	
15 minute winter	5	1.002	7	5.8	0.741	0.737	0.0469	
15 minute winter	6	3.000	7	2.9	0.496	0.179	0.0629	
15 minute winter	7	1.003	8	8.4	1.077	1.072	0.2582	
15 minute winter	8	1.004	11	11.2	1.432	1.214	0.0626	
15 minute winter	9	4.000	10	4.5	1.211	0.573	0.0932	
15 minute winter	10	4.001	11	7.3	1.195	0.285	0.0417	
60 minute winter	11	1.005	13	13.4	1.948	0.901	0.0469	
60 minute winter	12	5.000	13	2.0	0.791	0.180	0.0939	
60 minute winter	13	1.006	14	14.9	1.135	0.838	0.1760	
60 minute winter	14	Hydro-Brake®	15	5.0				28.4

APPENDIX D

Ensign®
Sewage treatment plants
Intensive biological processing for off-mains wastewater

Overview

The Marsh Ensign is widely regarded as one of the most efficient, reliable and economical sewage treatment plants on the market.

The standard Ensign has been adapted to improve reliability and the Ensign:Ultra now brings unique enhancements to further improve noise level, treatment efficiency and final effluent quality.

Class leading performance
Tested and approved to BSEN12566-3/A1:2009 all Ensign units provide treatment well within national consent requirements. Published test results of 11.5:19.2:8.4mg/ltr (BOD:suspended solids:ammonia), with influent concentrations on test higher than those chosen by most competitor plants, effectively equates to 97% pollutant removal.

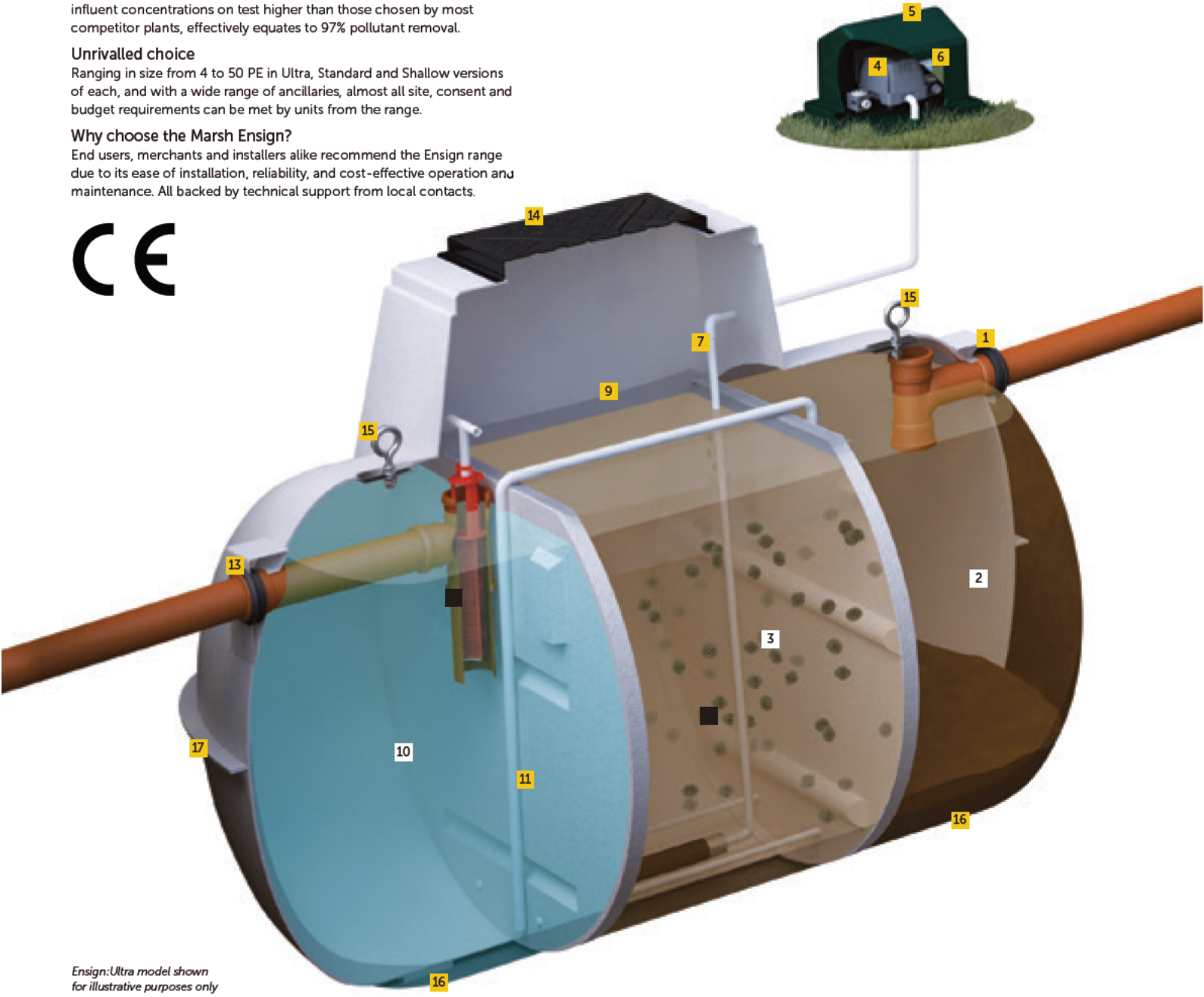
Unrivalled choice
Ranging in size from 4 to 50 PE in Ultra, Standard and Shallow versions of each, and with a wide range of ancillaries, almost all site, consent and budget requirements can be met by units from the range.

Why choose the Marsh Ensign?
End users, merchants and installers alike recommend the Ensign range due to its ease of installation, reliability, and cost-effective operation and maintenance. All backed by technical support from local contacts.

CE

Operating principle

In addition to anaerobic digestion taking place in the primary settlement chamber [2] the Ensign:Ultra unit allows the clarified water to pass into a second 'aeration' chamber [3] where it is treated to remove the dissolved constituents. Here aerobic bacteria, supported by diffused air and mobile media, ensures full treatment is achieved before the treated effluent and 'sloughed off' bacteria flows to a final settlement chamber [10]. The final effluent is then discharged to the drainage field or watercourse via a Polylok filter.



Ensign:Ultra model shown for illustrative purposes only

Benefits

1 Inlet with 'Forsheda seal'
Forsheda seal provides flexibility in the joint for easier installation.
Optional risers to increase invert depth are available.

2 Primary settlement chamber

3 Aeration chamber

4 Advanced compressor with alarm (Ensign:Ultra units only)
Near silent compressor ensures minimal running, maintenance and servicing costs. Integral alarm detects low pressure in air line. (Regular Low-energy compressor on Ensign:Standard models).

5 Compressor housing - internal or external options available
The compressor can be housed internally or externally with no difference in cost.
External recommended to increase compressor life, and supplied as standard on 4PE, shallow and pumped outlet versions.

6 RCD/Electrical connection (Ensign:Ultra units only)
The RCD box provides easier installation and proveds a higher degree of safety. (Regular plug/socket connection on Ensign:Standard models).

7 PVC pressure pipe/diffuser(s)
Provides a protective conduit for the air diffuser line. Can be easily removed for maintenance and cleaning.

8 Bio-media
High specification bio-media (310m³ per m²) and membrane diffusers ensure even circulation to eliminate 'dead spots'. The bio-media is contained by a stainless steel securing mesh to ensure no migration during handling or potential flooding.

9 Stainless steel mesh
Retains media in aeration chamber during transportation and handling, and in the event of flooding.

10 Final settlement chamber

11 32mm sludge return
Larger diameter sludge return prevents the possibility of blockages and improves system circulation. Provides higher effluent quality whilst balancing flow over a 24 hour period or periods of intermittent use.

12 Unique Polylok tertiary filter (Ensign:Ultra units only)
The Polylok tertiary filter reduces suspended solids and BOD by a further 40% helping to extend drainage field life.

13 Outlet with 'Forsheda seal'
Forsheda seal provides flexibility in the joint for easier installation.
Optional pumped outlets are available.

14 Impermeable lid
Heavy duty lid/frame improves strength and durability whilst blending into the surrounding environment. (Regular lid on Ensign:Standard models).

15 Integral lifting eyes
For safe and secure on-site handling.

16 Stabilising feet
Stabilising feet prevents the tank from rolling and allows safe and steady transportation and installation.

17 Unique 'keying-in' lip
Assists anchoring into granular or concrete surrounds.

Whisspurr
Acoustic Vibration Reduction (AVR) unit
Suitable for all types of diaphragm compressors.
See page 14.

Guidance notes

Package Sewage Treatment Plant's (or PSTP's) are often a suitable option where groundwater in the surrounding environment is vulnerable, drainage field percolation values are restrictive, or direct discharge to a water course or surface water sewer is the prefered discharge method.

- *PSTP's should be sized using the latest version of British Water Flows & Loads which provides detailed information on sewage production figures and sizing calculations*
- *Regulatory authorities for the control of pollution in the UK normally require treatment plants conforming to BSEN12566:3 to be demonstrated as capable of producing a minimum effluent discharge quality of 20:30:20 (Biochemical Oxygen Demand;Suspended Solids: Ammoniacal Nitrogen in mg/ltr), although in certain areas more stringent site-specific qualities may be required*
- *No surface water should enter the system as this can reduce the system's capacity and cause solids to be flushed out which may prematurely block drainage field or cause pollution*
- *As with septic tanks sludge should be removed annually or in line with manufacturers instructions*

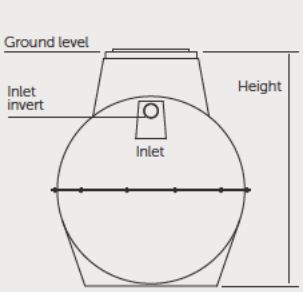
Many domestic sewage treatment plants offered by "internet resellers" claim to hold EN12566-3 compliance. This does not necessarily mean compliance with the UK National Forward, May 2007.

These plants may have been tested in their country of origin but not tested to the same criteria as Marsh Industries, where we strictly adhere to the UK National Forward. Contact contracts@marshindustries.co.uk for more information.

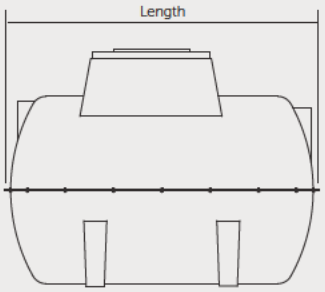
> The Marsh Ensign is widely regarded as one of the most efficient, reliable and economical sewage treatment plants on the market

Specifications

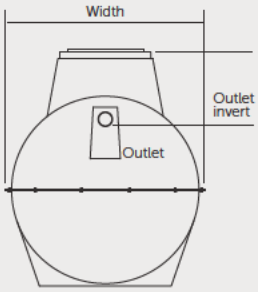
Ensign:Ultra and Ensign:Standard



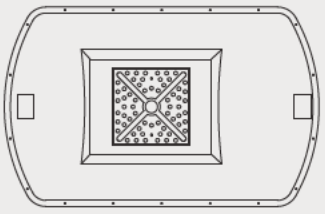
View on inlet end



Typical side elevation



View on outlet end



Typical plan view

Ensign:Ultra and Ensign:Standard

Model	Length	Width	Height	Inlet		Outlet	
(Pop)	+/-50mm	+/-50mm	+/-50mm	Invert	Ø	Invert	Ø
4	1600	1332	1575	540	110	600	110
6	2602	1650	1935	550	110	625	110
8	2602	1650	1935	550	110	625	110
10	2602	1650	1935	550	110	625	110
12	2860	1912	2139	550	110	625	110
16	2860	1912	2284	720	110	800	110
20	3650	1912	2284	720	160	800	160
25	3650	1912	2284	770	160	850	160
30	4200	1912	2284	770	160	850	160
35	4200	1912	2284	770	160	850	160
40	5200	1912	2284	770	160	850	160
45	5200	1912	2284	770	160	850	160
50	5200	1912	2284	770	160	850	160

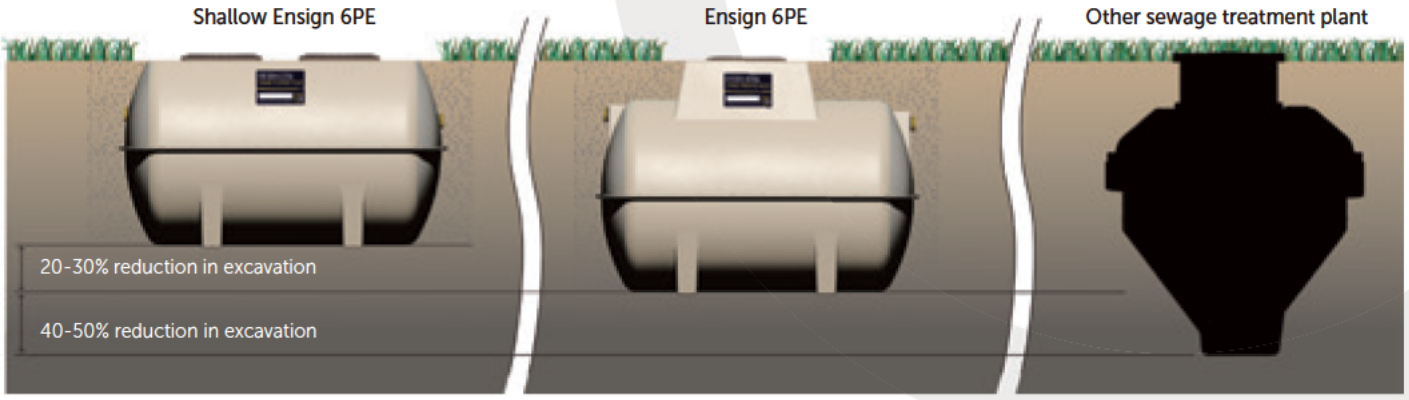
Notes:

- *Larger population sewage treatment plants may be supplied as multiple tank configurations.*
- *For precise tank sizes and configurations, please contact Marsh Industries*
- *All dimensions in mm*

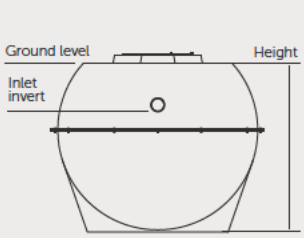
Shallow units

Common sewage treatment plants on the market often exceed 2.3m high. Marsh Industries offer a range of shallow plants from 4-35PE that are only 1.6m in height, meaning installation is not only possible*, but easier and safer too.

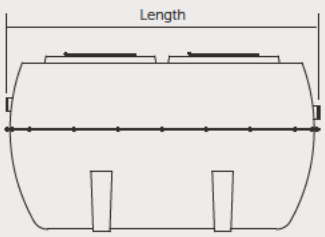
**Shallow Ensign's are often favoured when hard rock site conditions mean deeper alternatives, involving costly and time-consuming excavation.*



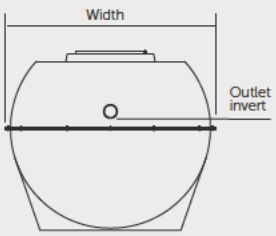
Shallow Ensign:Ultra and Shallow Ensign:Standard



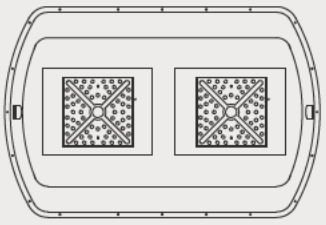
View on inlet end



Typical side elevation



View on outlet end


Typical plan view

Shallow Ensign:Ultra and Shallow Ensign:Standard

Model	Length	Width	Height	Inlet		Outlet	
(Pop)	+/-50mm	+/-50mm	+/-50mm	Invert	Ø	Invert	Ø
6	2860	1912	1600	500	110	575	110
8	2860	1912	1600	500	110	575	110
10	2860	1912	1600	500	110	575	110
12	2860	1912	1600	500	110	575	110
16	3400	1912	1600	500	110	575	110
20	4200	1912	1600	500	160	575	160
25	4200	1912	1600	500	160	575	160
30	5200	1912	1600	500	160	575	160
35	5200	1912	1600	500	160	575	160

Notes:
> *Larger population sewage treatment plants may be supplied as multiple tank configurations.*
> *For precise tank sizes and configurations, please contact Marsh Industries*
> *All dimensions in mm*