DRAINAGE STRATEGY

for

Mr R ROBINSON

PROPOSED AGRICULTURAL BUILDING

at

STANDRIDGE FARM

SLAIDBURN

AUGUST 2018

REFORD

Consulting Engineers Limited

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Company number: 09620365 VAT Reg. 215 5638 12

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1. INTRODUCTION

1.1 This drainage strategy has been produced on behalf of Mr R Robinson in support of a planning permission for the erection of an agricultural building for free range egg production together with associated feed bins, a hardstanding area and access track at Standridge, Wigglesworth Road, Slaidburn, BB7 4TR.

1.2 The Lead Local Flood Authority has been consulted on the earlier application and required the following:

- *A desk top study of the existing drainage and flood risk of the area.*
- *An indicative site drainage strategy to include drawings, calculations and exceedance routes.*
- *Details of ground conditions.*

1.3 There is no foul water drainage to be discharged from the site.

1.4 There is dirty wash down water from within the building to be collected.

1.5 This drainage strategy will address the issues previously raised by the LLFA.

1.6 The application site comprises an existing agricultural enterprise that operates from Standridge Farm, Tosside Road, Slaidburn that extends to approximately 70 hectares of owner occupied land. The enterprise is situated about 2.5km to the east of the settlement of Slaidburn, on the B6478 road that connects Slaidburn to Tosside further to the east. A site location plan is included within Appendix A.

1.7 The developed site is flat. To the north of the new building the ground falls to the north towards a watercourse, which flows to the north into the Barn Gill and ultimately the River Hodder.

1.8 Another watercourse lies to the west of the site and connects to the one to the north.

1.9 The watercourses take surface water runoff from the existing area.

1.10 The access to the site is from the B6478.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to land to the north of the B6478, approx. 2.5km to the east of the settlement of Slaidburn.

2.2 The existing site comprises grassland.

2.3 The site has a general fall towards the watercourse to the north.

Site geology

2.4 A detailed site investigation has not been carried out.

2.5 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable wet very acid upland soils with a peaty surface with impeded drainage, which are not conducive to infiltration.

2.6 Excavations that have been carried out on the site have confirmed the site geology, which are not conducive to the discharge of surface water by infiltration. Infiltration tests have therefore not been carried out.

Understanding of existing drainage and flood risk local to the site

2.7 The site lies within Flood Zone 1 as identified on the Environment Agency's flood map for planning, the lowest risk.

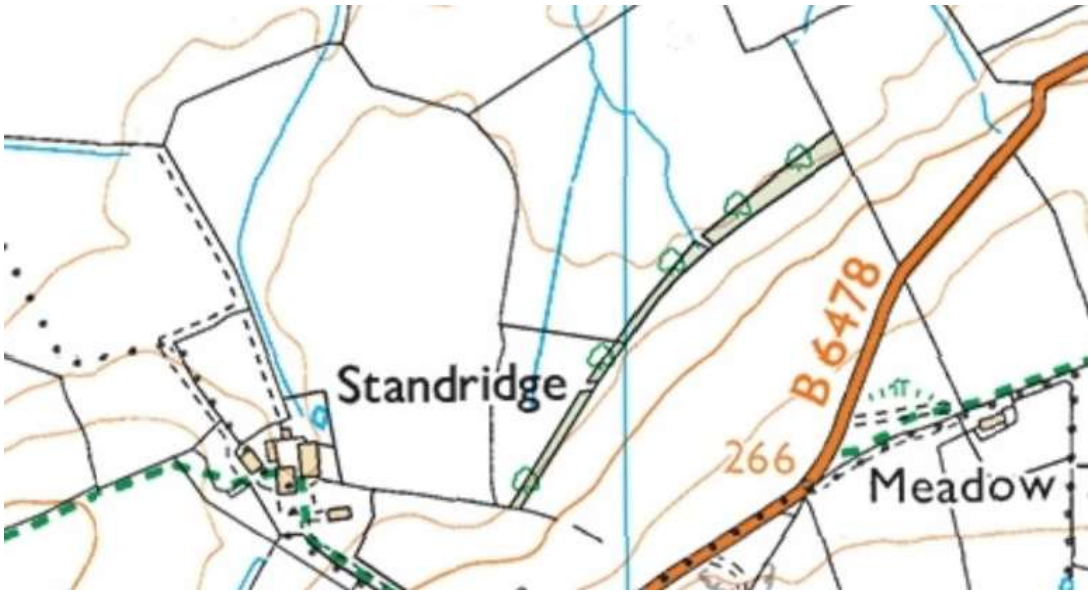
2.8 Watercourses lie to the west and the north of the site. The watercourses take surface water runoff from the local area and flow into the Barn Gill and ultimately the River Hodder.

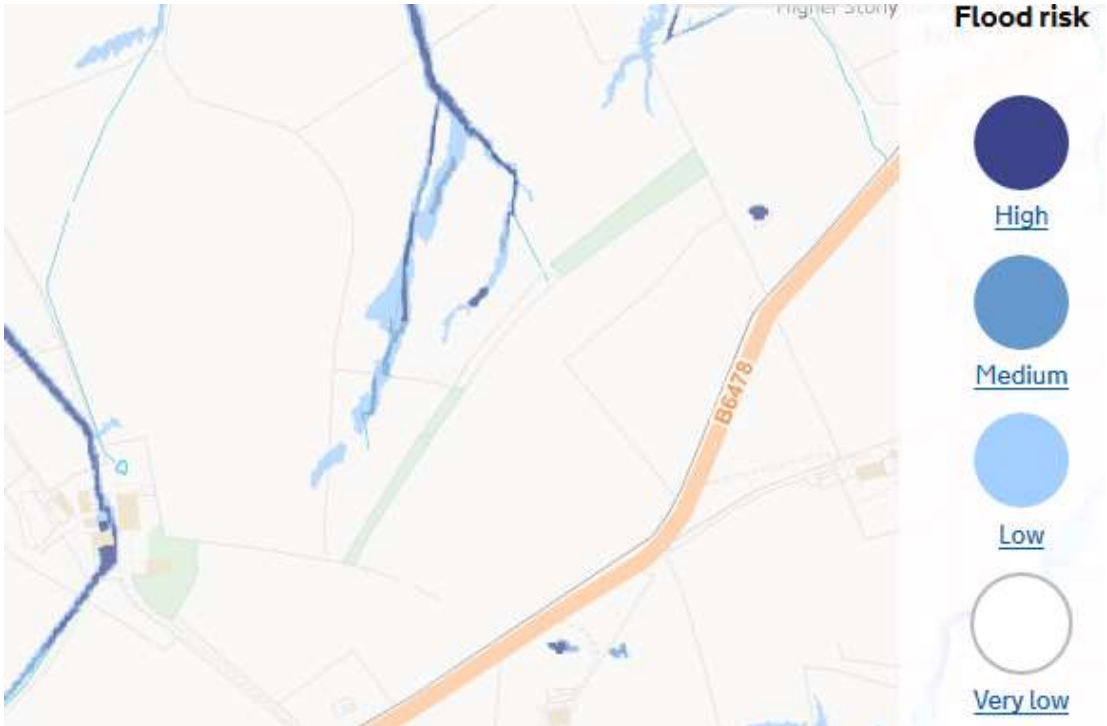
2.9 The extract from Ordnance Survey mapping shows the watercourses locations.

2.10 The Environment Agency's flood Risk of Flooding from Surface Water map shows the site at a very low risk. The watercourses are identified as having a high risk within their channels.

2.11 It should be noted that surface water flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm. In addition, local features can greatly affect the chance and severity of flooding.

2.12 Extracts from the Ordnance Survey and the Environment Agency's Risk from Surface Water map are shown below.





2.13 The watercourse to the west of the site flows away from the proposed building location and will therefore not be a flood risk to the proposed building and its associated works.

2.14 There are no public sewers local to the site.

Proposed development

2.15 The proposed development is for a large single building of approx. size 74m by 37m, along with an associated hardstanding area for the turning of vehicles and car parking and an access track to the site from the B6478.

3. DRAINAGE STRATEGY

Surface water drainage

3.1 Guidance for the disposal of surface water from a development site is for soakaways to be considered as the primary solution. If this is not practical, discharge to a waterbody or watercourse is to be considered as the next available alternative. Only if neither of these options is available, and other sustainable drainage methods not possible, should the use of the public sewerage system be considered.

3.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.

3.3 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable wet very acid upland soils with a peaty surface with impeded drainage, which are not conducive to infiltration. This is supported by excavations that have been carried out on the site. The nature of the geology of the site means that infiltration back into the ground is not feasible.

3.4 Watercourses lie to the west and the north of the site. The watercourses take surface water runoff from the local area and flow into the Barn Gill and ultimately the River Hodder.

3.5 It is therefore intended that new surface water drainage will be constructed, appropriately sized to take all surface water runoff from the new building roof and hardstanding area, to discharge into the watercourse that lies to the north of the site. The total area of the new building roof and hardstanding area is 5,700m^2.

3.6 Surface water runoff from the access track to the site from the B6478 will be collected by a French drain running along its length. The area of the access track is 1,200m^2.

3.7 The flow from the development will be controlled to pre-development runoff rates allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume.

3.8 To determine the restricted surface water discharge rate from the developed site, Greenfield runoff has been calculated using the 'Causeway Flow' programme. The calculations are based upon the developed area of the site, which has been measured as 0.57ha. The pre-development discharge rates have been calculated as follows:

- Qbar 6.3 l/s
- Q1 5.4 l/s
- Q30 10.6 l/s
- Q100 13.0 l/s

3.9 A surface water drainage design has been carried out for rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume. Surface water flows from the developed site are to be attenuated to 5 l/s. Attenuation is provided by a dry pond located within the land between the northern site boundary and the watercourse.

3.10 The surface water drainage design is included within Appendix B.

3.11 Exceedance flows will be away from the development across the adjacent field into the local watercourses.

3.12 The attenuation pond will also act to provide water quality treatment prior to surface water discharging into the watercourse. In addition a fuel interceptor is to be installed on the discharge pipe from the hardstanding area.

Dirty water drainage

3.13 An underground sealed dirty water tank is provided at the northern end of the building to collect and store the wash down water from within the building. The tank will be regularly emptied by pump and taken away.

4. SURFACE WATER MANAGEMENT AND MAINTENANCE PLAN

4.1 The maintenance responsibilities for the surface water drainage features of the scheme lies with Standridge Farm, Slaidburn.

4.2 The table below lists the surface water drainage features utilised within the proposed drainage design along with the maintenance regime that should be followed.

ROOF DRAINAGE	
Regular maintenance	**Frequency**
Visually inspect gutters to ensure they are kept clear of leaves, debris etc. Lift covers of drainage to inspect chambers for debris and build-up of silts.	Annually. No triggers other than maintenance to be taken on regular schedule.
Occasional tasks	**Frequency**
Remove leaves and debris from gutters. Remove debris from inspection chambers to ensure outlets are kept clear of debris to ensure adequate drainage.	As required. Indicator of problem / trigger for maintenance when surcharging or flooding of drains occurs or gutters and chambers full of debris and leaves etc.
Remedial work	**Frequency**
Should drains be heavily blocked or damaged carry out unblocking / repair works.	As required. Indicator of problem / trigger for maintenance when drainage not functioning and unblocking pipes and chambers etc. not effective.
SURFACE WATER DRAINAGE	
Regular maintenance	**Frequency**
Manhole covers are securely in place. Specialist operatives with current confined spaces training to lift covers and visually inspect manholes to ensure they are kept clear of leaves, debris, silt, etc. Check drainage pipes are operating as expected.	Annually or when notified.
Visually inspect outfall structure on watercourse to ensure it is kept reasonably clear of leaves and debris etc. at surface.	Annually. No triggers other than maintenance to be taken on regular schedule.
Occasional tasks	**Frequency**
Specialist operatives with current confined spaces training to remove debris and silt from the manholes to ensure outlets are kept clear of debris to ensure adequate drainage.	As required from regular maintenance inspection to trigger works.
Remedial work	**Frequency**
The specialist operatives are to advise of any repair works necessary to the manholes. Drains heavily blocked or damaged to be jetted / repaired.	As required from regular maintenance inspection to trigger works.
Repair of outfall structure on watercourse.	As required.

HARDSTANDING AREA AND ACCESS ROAD DRAINAGE (GULLIES / CHANNELS AND CONNECTIONS, INTERCEPTOR)	
Regular maintenance	**Frequency**
Brush regularly and remove all sweepings from hard surfaces and inspect gullies for debris and silt. Clean out gullies.	As required. Indicator of problem / trigger for remedial action when road gullies clogged or blocked and remaining full and overflowing.
Occasional tasks	**Frequency**
Check wearing course and access for condition (and any other inspection works).	As required. Indicator of problem / trigger for remedial action when road gullies clogged or blocked and remaining full and overflowing.
Remedial work	**Frequency**
Repair and reinstatement of access and hardstanding construction where required. Kerbing to be replaced where damaged.	As required. Indicator of problem / trigger for remedial action when drainage clogged or blocked and remaining full and overflowing.
OPEN WATERCOURSE	
Regular maintenance	**Frequency**
Visually inspect watercourse to ensure it is kept reasonably clear of leaves and debris etc. at surface.	Annually. No triggers other than maintenance to be taken on regular schedule.
Cutting of vegetation along length of open watercourse sections so that the watercourse doesn't become overgrown.	Frequency varies, vegetation will require cutting more often in summer / spring months than autumn / winter months. To be cut as required. No triggers other than maintenance to be taken on regular schedule.
Remedial work	**Frequency**
Maintenance of watercourse profile should scour or erosion or build-up of silt occur.	As required. Indicator of problem / trigger for maintenance when significant watercourse scour and erosion or build-up of silt has occurred.
DRY POND	
Regular maintenance	**Frequency**
Cut grass, remove leaves and debris. Visually inspect pond area to be clear of debris or contaminants and remove if present.	4 to 6 times annually.
Occasional tasks	**Frequency**
Clear rubbish and deposits from pond area after heavy storms and check for damage.	As required.
Remedial work	**Frequency**
Should the pond have large deposits of silt and dead organic matter, remove only half at any one time. Remove encroaching vegetation.	Autumn.

5. SUMMARY AND CONCLUSIONS

5.1 This drainage strategy has been produced on behalf of Mr R Robinson in support of a planning permission for the erection of an agricultural building for free range egg production together with associated feed bins and hardstanding areas and access at Standridge, Wigglesworth Road, Slaidburn, BB7 4TR.

5.2 This drainage strategy has addressed the issues previously raised by the LLFA.

5.3 Infiltration of surface water runoff into the ground is not a viable solution for this site.

5.4 It is intended that new surface water drainage will be constructed, appropriately sized to take all surface water runoff from the new building roof and hardstanding area, be attenuated to 5 l/s prior to discharge into the watercourse that lies to the north of the site. The total area of the new building roof and hardstanding area is 5,700m^2.

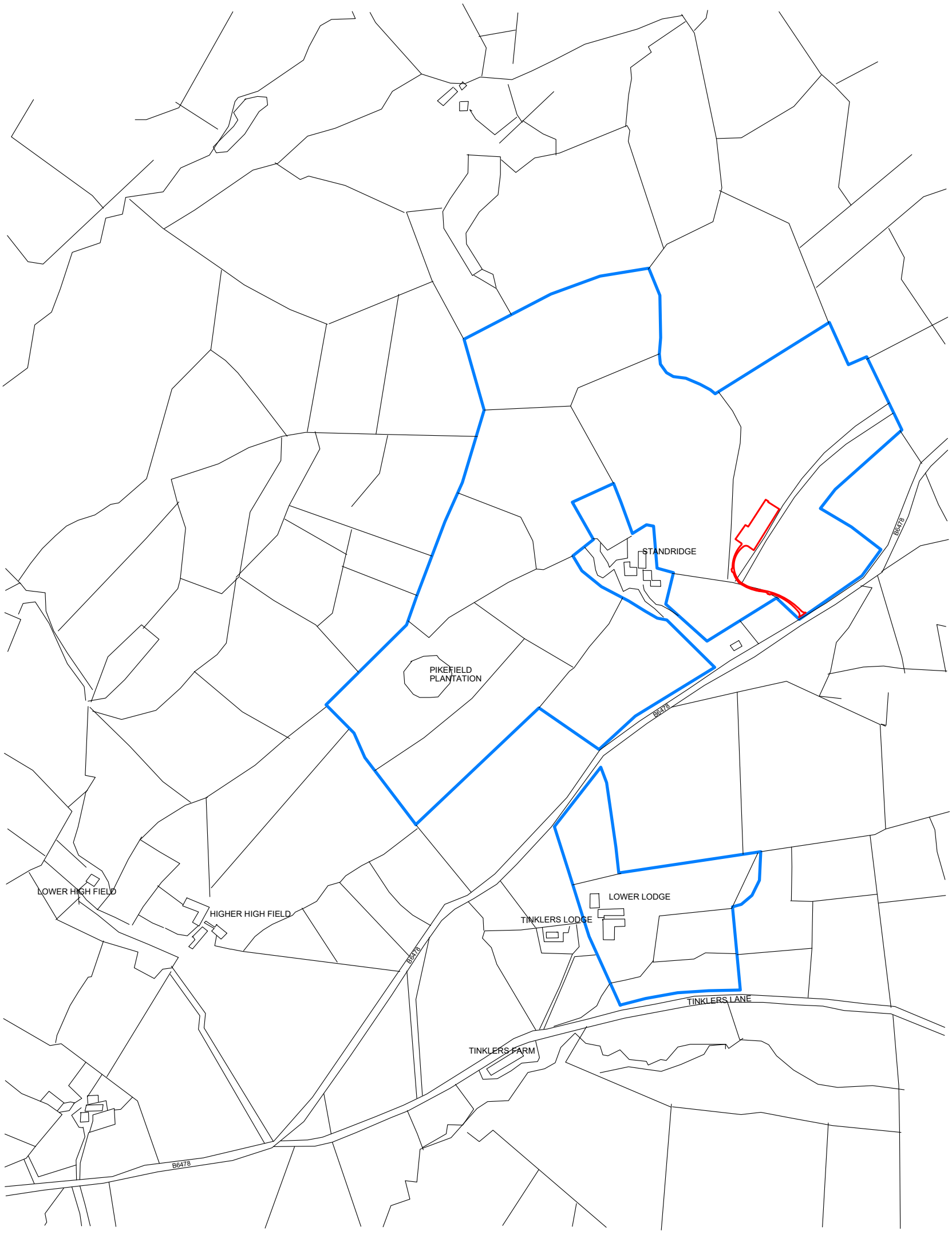
5.5 Surface water runoff from the access track to the site from the B6478 will be collected by a French drain running along its length. The area of access track is 1,200m^2.

5.6 A surface water drainage design has been carried out for rainfall events up to the 100 year critical rain storm plus 30% on stored volumes. The additional 30% is to allow for climate change and has been included in the surface water volume. Attenuation is provided by a dry pond located within the land between the northern site boundary and the watercourse.

5.7 An underground sealed dirty water tank is provided at the northern end of the building to collect and store the wash down water from within the building. The tank will be regularly emptied by pump and taken away.

5.8 There is no foul water drainage associated with the development.

APPENDIX A



LOCATION PLAN

Site: **Standridge Farm**
Slaidburn

Client: Mr R. Robinson

Drawn: BS

Date: 12.02.18

Scale: 1:10,000 @ A3

Project No: ROBINSO/02 Dwg 00

Amendments:

Notes:
All work is to be carried out to the latest current British standards Codes of Practice and recognised working practices. All work and materials should comply with Health and Safety legislation and to be approved by the Local Authority Planning / Building Control Officer.
All dimensions are in millimetres unless where explicitly shown otherwise. The contractor should check and clarify all dimensions as work proceeds and notify the design team of any discrepancies. Do not scale off the drawings, if in doubt ask.
Avalon Chartered Town Planning are not liable for work undertaken prior to Full Planning Consent and/or Building Regulations Approval

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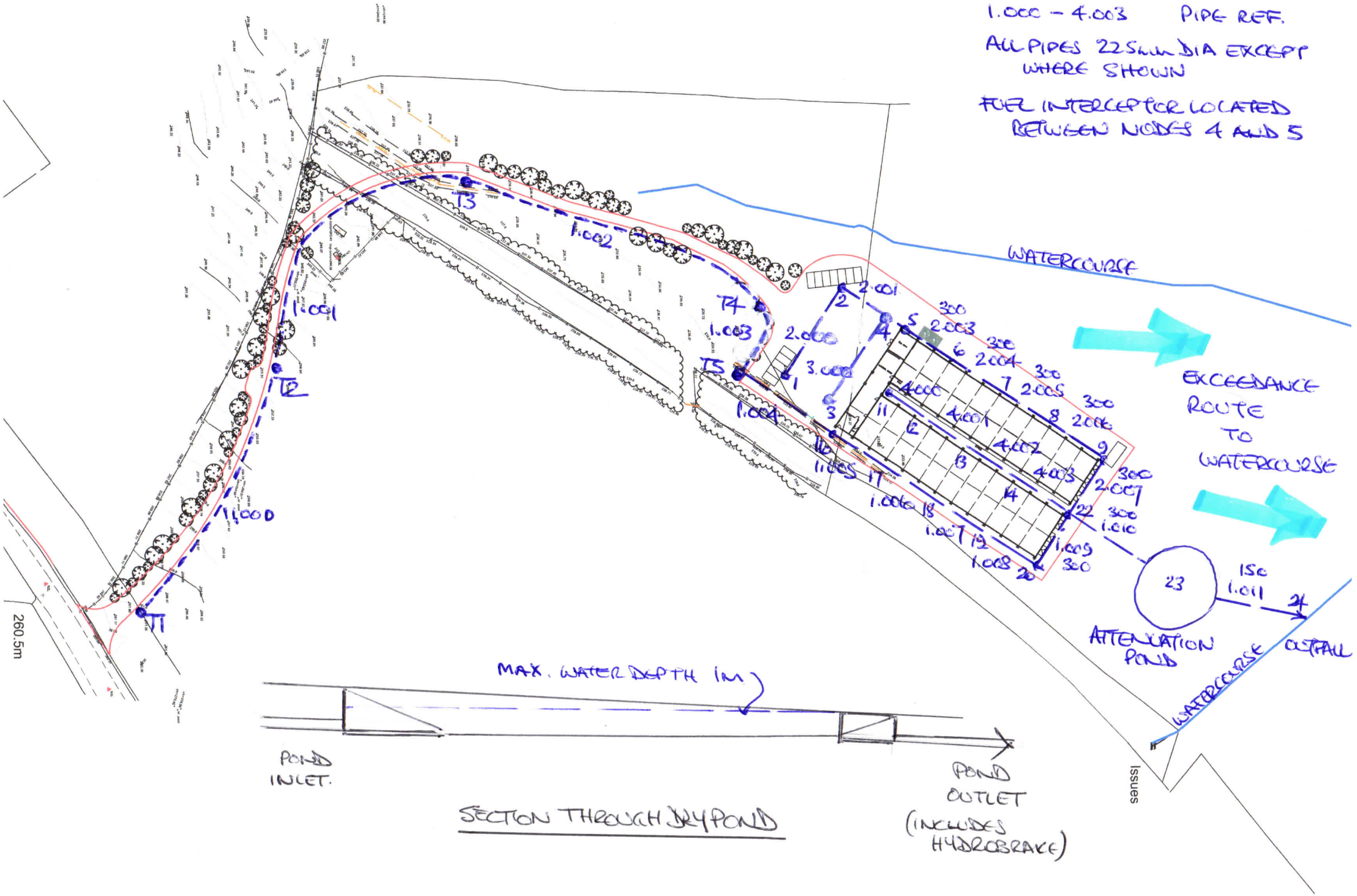
APPENDIX B

SURFACE WATER DRAINAGE LAYOUT

T1 - T5 & 1 - 24 NODE REF.
1.000 - 4.003 PIPE REF.
ALL PIPES 225mm DIA EXCEPT WHERE SHOWN
FUEL INTERCEPTOR LOCATED BETWEEN NODES 4 AND 5



SECTION THROUGH DRY POND

Drainage Design Report

Flow

v7.0

Network	Storm Network
Filename	C:\Users\Bob\Documents\reford\18.479 slaidburn\drainage design\slaidburn a.pfd
Username	Bob Ford (r.e.ford@virginmedia.com)
Last analysed	24/09/2018 19:41:40
Report produced on	24/09/2018 19:46:47

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Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.240
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	75.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	2.000
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Diameter (mm)	Depth (m)
T1	0.040	5.00		261.000	Manhole	1200	1.425
T2	0.040	5.00		251.000	Manhole	1200	1.425
T3	0.040	5.00		236.500	Manhole	1200	1.425
T4				235.000	Manhole	1200	1.425
T5				235.000	Manhole	1200	1.573
1	0.044	5.00		235.000	Manhole	1500	1.425
2	0.044	5.00		235.000	Manhole	1500	1.637
3	0.044	5.00		234.000	Manhole	1500	1.425
4	0.044	5.00		234.000	Manhole	1500	1.637
5	0.024	5.00		233.500	Manhole	1200	1.500
6	0.024	5.00		233.500	Manhole	150	1.574
7	0.024	5.00		233.500	Manhole	150	1.652
8	0.024	5.00		233.500	Manhole	150	1.726
9	0.024	5.00		233.500	Manhole	150	1.804
11	0.027	5.00		233.500	Manhole	1200	1.425
12	0.027	5.00		233.500	Manhole	150	1.496
13	0.027	5.00		233.500	Manhole	150	1.608
14	0.027	5.00		233.500	Manhole	150	1.714
16	0.021	5.00		233.500	Manhole	1200	1.425
17	0.021	5.00		233.500	Manhole	150	1.531
18	0.021	5.00		233.500	Manhole	150	1.643
19	0.021	5.00		233.500	Manhole	150	1.749
20	0.021	5.00		233.500	Manhole	150	1.936
22	0.057	5.00		233.500	Manhole	1200	2.101
23				230.000	Manhole	1200	1.000
24				228.000	Manhole	1200	1.000

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
1.000	T1	T2	100.000	259.575	249.575	10.000	10.0	225	Circular	5.40	52.5				
1.001	T2	T3	100.000	249.575	235.075	14.500	6.9	225	Circular	5.73	51.4				
1.002	T3	T4	100.000	235.075	233.575	1.500	66.7	225	Circular	6.77	48.3				
1.003	T4	T5	25.000	233.575	233.427	0.148	168.9	225	Circular	7.19	47.1				
1.004	T5	16	30.000	233.427	232.075	1.352	22.2	225	Circular	7.37	46.7				
2.000	1	2	36.000	233.575	233.363	0.212	169.8	225	Circular	5.60	51.9				
2.001	2	4	12.000	233.363	232.363	1.000	12.0	225	Circular	5.65	51.7				
3.000	3	4	36.000	232.575	232.363	0.212	169.8	225	Circular	5.60	51.9				
2.002	4	5	10.000	232.363	232.075	0.288	34.7	225	Circular	5.73	51.4				
2.003	5	6	18.000	232.000	231.926	0.074	243.2	300	Circular	6.03	50.5				
2.004	6	7	19.000	231.926	231.848	0.078	243.6	300	Circular	6.34	49.5				
2.005	7	8	18.000	231.848	231.774	0.074	243.2	300	Circular	6.64	48.6				
2.006	8	9	19.000	231.774	231.696	0.078	243.6	300	Circular	6.96	47.7				
2.007	9	22	20.000	231.696	231.399	0.297	67.3	300	Circular	7.13	47.3				
4.000	11	12	12.000	232.075	232.004	0.071	169.0	225	Circular	5.20	53.3				
4.001	12	13	19.000	232.004	231.892	0.112	169.6	225	Circular	5.52	52.1				
4.002	13	14	18.000	231.892	231.786	0.106	169.8	225	Circular	5.82	51.1				
4.003	14	22	19.000	231.786	231.474	0.312	60.9	225	Circular	6.00	50.5				
1.005	16	17	18.000	232.075	231.969	0.106	169.8	225	Circular	7.67	45.9				
1.006	17	18	19.000	231.969	231.857	0.112	169.6	225	Circular	7.98	45.1				
1.007	18	19	18.000	231.857	231.751	0.106	169.8	225	Circular	8.28	44.4				
1.008	19	20	19.000	231.751	231.639	0.112	169.6	225	Circular	8.60	43.7				
1.009	20	22	20.000	231.564	231.399	0.165	121.2	300	Circular	8.83	43.2				
1.010	22	23	30.000	231.399	229.000	2.399	12.5	300	Circular	8.95	43.0				
1.011	23	24	30.000	229.000	227.000	2.000	15.0	150	Circular	9.14	42.6				

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	England and Wales		1	0
M5-60 (mm)	20.000		30	0
Ratio-R	0.240		100	0
Summer CV	0.750		100	30
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)	x			
1 year (l/s)	5.4			
30 year (l/s)	10.6			
100 year (l/s)	13.0			
Check Discharge Volume	x			
100 year 360 minute (m³)				

Hydro-Brake®												
Node	Flap Valve	Online / Offline	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Sump Available	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
23	x	Online	x		229.000	1.000	5.0	(HE) Minimise upstream storage		CTL-SHE-0106-5000-1000-5000	0.150	1200

Depth/Area/Inf Area									
Node	**Base Inf Coefficient (m/hr)**	**Side Inf Coefficient (m/hr)**	**Safety Factor**	**Porosity**	**Invert Level (m)**	**Time to half empty (mins)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
23	0.00000	0.00000	2.0	1.00	229.000		0.000	550.0	0.0
Link Surround									
Node	**Base Inf Coefficient (m/hr)**	**Side Inf Coefficient (m/hr)**	**Safety Factor**	**Porosity**	**Invert Level (m)**	**Time to half empty (mins)**	**Link**	**Surround Shape**	**Diameter (mm)**
T2	0.00000	0.00000	2.0	0.30	249.575	0	1.000	(Trench)	600
T3	0.00000	0.00000	2.0	0.30	235.075	0	1.001	(Trench)	600
T4	0.00000	0.00000	2.0	0.30	233.575	0	1.002	(Trench)	600
T5	0.00000	0.00000	2.0	0.30	233.427	0	1.003	(Trench)	600

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.82%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.601	0.026	4.8	0.0440	0.0000	OK	1.000	T2	4.7	1.548	0.028	0.3043	
15 minute winter	T2	11	249.608	0.033	9.5	0.0564	0.0000	OK	1.001	T3	9.2	1.423	0.046	0.6925	
15 minute winter	T3	11	235.144	0.069	13.8	0.1187	0.0000	OK	1.002	T4	13.1	1.094	0.205	1.2759	
15 minute winter	T4	12	233.667	0.092	13.1	0.1414	0.0000	OK	1.003	T5	12.5	1.157	0.313	0.2743	
15 minute winter	T5	13	233.478	0.051	12.5	0.0883	0.0000	OK	1.004	16	12.6	1.104	0.113	0.3471	
15 minute winter	1	10	233.632	0.057	5.2	0.1354	0.0000	OK	2.000	2	5.0	0.816	0.126	0.2245	
15 minute winter	2	10	233.402	0.039	10.2	0.0905	0.0000	OK	2.001	4	10.0	1.225	0.066	0.1019	
15 minute winter	3	10	232.629	0.054	5.2	0.1277	0.0000	OK	3.000	4	5.0	0.519	0.126	0.3524	
15 minute winter	4	11	232.442	0.079	20.2	0.1815	0.0000	OK	2.002	5	20.1	1.720	0.228	0.1172	
15 minute winter	5	11	232.125	0.125	22.8	0.1818	0.0000	OK	2.003	6	23.0	0.790	0.324	0.5239	
15 minute winter	6	11	232.060	0.134	25.7	0.0432	0.0000	OK	2.004	7	25.7	0.816	0.363	0.5984	
15 minute winter	7	11	231.989	0.141	28.4	0.0435	0.0000	OK	2.005	8	28.2	0.869	0.397	0.5836	
15 minute winter	8	11	231.914	0.140	30.9	0.0414	0.0000	OK	2.006	9	30.5	1.142	0.430	0.5112	
15 minute winter	9	11	231.800	0.104	33.2	0.0295	0.0000	OK	2.007	22	33.0	1.344	0.243	0.5102	
15 minute winter	11	10	232.118	0.042	3.2	0.0642	0.0000	OK	4.000	12	3.1	0.466	0.079	0.0816	
15 minute winter	12	10	232.064	0.060	6.3	0.0226	0.0000	OK	4.001	13	6.2	0.614	0.156	0.1923	
15 minute winter	13	11	231.969	0.076	9.4	0.0270	0.0000	OK	4.002	14	9.3	0.848	0.234	0.1978	
15 minute winter	14	11	231.854	0.068	12.3	0.0226	0.0000	OK	4.003	22	12.4	1.264	0.186	0.1868	
15 minute winter	16	13	232.172	0.097	14.2	0.1387	0.0000	OK	1.005	17	14.2	0.830	0.357	0.3075	
15 minute winter	17	13	232.072	0.103	15.7	0.0301	0.0000	OK	1.006	18	15.8	0.853	0.396	0.3513	
15 minute winter	18	13	231.967	0.110	17.2	0.0300	0.0000	OK	1.007	19	17.4	0.879	0.437	0.3557	
15 minute winter	19	13	231.866	0.114	18.8	0.0295	0.0000	OK	1.008	20	18.9	0.966	0.475	0.3718	
15 minute winter	20	13	231.659	0.095	20.3	0.0223	0.0000	OK	1.009	22	20.4	1.046	0.203	0.4570	
15 minute summer	22	10	231.533	0.134	65.2	0.2245	0.0000	OK	1.010	23	67.1	4.941	0.212	0.4705	
960 minute winter	23	660	229.226	0.226	10.6	124.6790	0.0000	SURCHARGED	1.011	24	4.8	1.685	0.104	0.0859	207.8
960 minute winter	24	660	227.033	0.033	4.8	0.0000	0.0000	OK							

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.82%

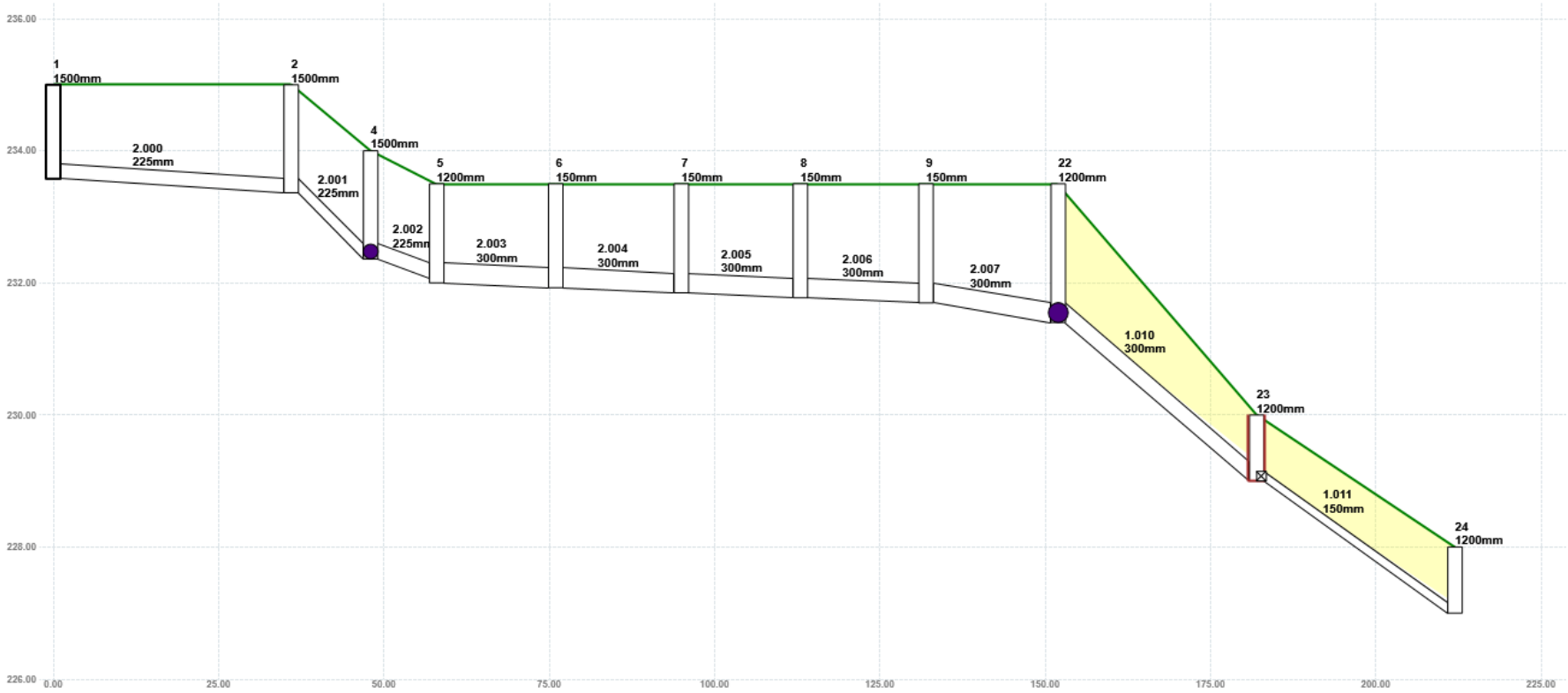
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.615	0.040	11.6	0.0676	0.0000	OK	1.000	T2	11.4	2.005	0.069	0.5714	
15 minute winter	T2	11	249.626	0.051	23.0	0.0878	0.0000	OK	1.001	T3	22.5	1.781	0.113	1.3423	
15 minute winter	T3	11	235.189	0.114	34.0	0.1984	0.0000	OK	1.002	T4	33.0	1.359	0.517	2.4799	
15 minute winter	T4	12	233.734	0.159	33.0	0.2844	0.0000	OK	1.003	T5	32.1	1.479	0.805	0.5398	
15 minute winter	T5	12	233.509	0.082	32.1	0.1686	0.0000	OK	1.004	16	32.0	1.266	0.288	0.7936	
15 minute winter	1	10	233.666	0.091	12.8	0.2178	0.0000	OK	2.000	2	12.5	1.057	0.314	0.4311	
15 minute winter	2	10	233.425	0.062	25.3	0.1425	0.0000	OK	2.001	4	25.1	1.492	0.166	0.2037	
15 minute winter	3	10	232.661	0.086	12.8	0.2048	0.0000	OK	3.000	4	12.5	0.640	0.314	0.7022	
15 minute winter	4	11	232.499	0.136	50.3	0.3142	0.0000	OK	2.002	5	49.7	1.917	0.562	0.2882	
15 minute winter	5	11	232.247	0.247	56.3	0.3577	0.0000	OK	2.003	6	56.3	0.905	0.794	1.1491	
15 minute winter	6	11	232.190	0.264	62.9	0.0854	0.0000	OK	2.004	7	62.5	0.947	0.882	1.2592	
15 minute winter	7	11	232.118	0.270	69.1	0.0832	0.0000	OK	2.005	8	68.7	1.064	0.968	1.1631	
15 minute winter	8	11	232.023	0.249	75.3	0.0736	0.0000	OK	2.006	9	74.7	1.394	1.054	1.0255	
15 minute winter	9	11	231.881	0.185	81.3	0.0525	0.0000	OK	2.007	22	80.9	1.746	0.597	0.9910	
15 minute winter	11	10	232.143	0.068	7.9	0.1020	0.0000	OK	4.000	12	7.8	0.579	0.195	0.1623	
15 minute winter	12	10	232.104	0.100	15.7	0.0379	0.0000	OK	4.001	13	15.4	0.761	0.387	0.3848	
15 minute winter	13	10	232.021	0.129	23.3	0.0454	0.0000	OK	4.002	14	23.0	1.074	0.579	0.3866	
15 minute winter	14	11	231.897	0.111	30.7	0.0371	0.0000	OK	4.003	22	30.7	1.383	0.460	0.4302	
15 minute winter	16	13	232.377	0.302	36.8	0.4307	0.0000	SURCHARGED	1.005	17	34.5	0.923	0.867	0.7159	
15 minute winter	17	13	232.274	0.305	38.5	0.0891	0.0000	SURCHARGED	1.006	18	38.0	0.956	0.955	0.7557	
15 minute winter	18	13	232.144	0.287	41.5	0.0783	0.0000	SURCHARGED	1.007	19	41.6	1.045	1.045	0.7159	
15 minute winter	19	13	231.996	0.245	45.1	0.0632	0.0000	SURCHARGED	1.008	20	45.1	1.165	1.134	0.6973	
15 minute winter	20	12	231.726	0.162	48.9	0.0380	0.0000	OK	1.009	22	49.1	1.504	0.487	0.9089	
15 minute winter	22	10	231.613	0.214	174.4	0.3586	0.0000	OK	1.010	23	176.2	5.603	0.558	0.9646	
600 minute winter	23	570	229.528	0.528	28.2	290.8506	0.0000	SURCHARGED	1.011	24	5.0	1.699	0.108	0.0878	189.3
120 minute summer	24	108	227.033	0.033	5.0	0.0000	0.0000	OK							

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.82%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.620	0.045	15.0	0.0766	0.0000	OK	1.000	T2	14.7	2.160	0.089	0.6853	
15 minute winter	T2	10	249.633	0.058	29.7	0.1000	0.0000	OK	1.001	T3	29.0	1.888	0.145	1.6264	
15 minute winter	T3	11	235.209	0.133	43.9	0.2335	0.0000	OK	1.002	T4	42.6	1.443	0.669	2.9938	
15 minute winter	T4	12	233.768	0.193	42.6	0.3717	0.0000	OK	1.003	T5	41.3	1.542	1.035	0.6508	
15 minute winter	T5	12	233.522	0.094	41.3	0.2046	0.0000	OK	1.004	16	41.2	1.270	0.371	0.8336	
15 minute winter	1	10	233.680	0.105	16.5	0.2509	0.0000	OK	2.000	2	16.2	1.133	0.406	0.5186	
15 minute winter	2	10	233.434	0.071	32.6	0.1625	0.0000	OK	2.001	4	32.4	1.535	0.214	0.3014	
15 minute winter	3	10	232.674	0.099	16.5	0.2358	0.0000	OK	3.000	4	16.1	0.660	0.406	1.0138	
15 minute winter	4	12	232.634	0.271	65.0	0.6244	0.0000	SURCHARGED	2.002	5	59.0	1.881	0.666	0.3977	
15 minute winter	5	11	232.444	0.444	66.8	0.6442	0.0000	SURCHARGED	2.003	6	67.1	0.953	0.946	1.2675	
15 minute winter	6	11	232.354	0.428	74.1	0.1384	0.0000	SURCHARGED	2.004	7	74.7	1.061	1.054	1.3380	
15 minute winter	7	11	232.238	0.390	81.8	0.1201	0.0000	SURCHARGED	2.005	8	82.2	1.168	1.159	1.2675	
15 minute winter	8	11	232.102	0.328	89.9	0.0970	0.0000	SURCHARGED	2.006	9	89.7	1.427	1.266	1.1833	
15 minute winter	9	11	231.911	0.215	98.1	0.0612	0.0000	OK	2.007	22	98.5	1.885	0.726	1.1610	
15 minute winter	11	10	232.154	0.079	10.1	0.1189	0.0000	OK	4.000	12	10.0	0.601	0.250	0.1993	
15 minute winter	12	10	232.121	0.117	20.1	0.0444	0.0000	OK	4.001	13	19.7	0.798	0.496	0.4684	
15 minute winter	13	10	232.044	0.152	29.8	0.0535	0.0000	OK	4.002	14	29.5	1.124	0.742	0.4725	
15 minute winter	14	11	231.918	0.132	39.3	0.0438	0.0000	OK	4.003	22	39.4	1.413	0.590	0.5466	
15 minute winter	16	13	232.743	0.667	47.4	0.9518	0.0000	SURCHARGED	1.005	17	44.1	1.110	1.110	0.7159	
15 minute winter	17	13	232.574	0.605	48.6	0.1767	0.0000	SURCHARGED	1.006	18	48.6	1.223	1.222	0.7557	
15 minute winter	18	13	232.361	0.504	53.1	0.1376	0.0000	SURCHARGED	1.007	19	53.2	1.339	1.339	0.7159	
15 minute winter	19	13	232.117	0.366	57.7	0.0944	0.0000	SURCHARGED	1.008	20	57.9	1.459	1.455	0.7291	
15 minute winter	20	12	231.756	0.192	62.6	0.0451	0.0000	OK	1.009	22	62.9	1.547	0.624	1.0588	
15 minute winter	22	10	231.651	0.252	214.8	0.4216	0.0000	OK	1.010	23	218.7	5.573	0.692	1.1791	
960 minute winter	23	900	229.731	0.731	25.9	403.1077	0.0000	FLOOD RISK	1.011	24	5.0	1.699	0.108	0.0878	252.2
60 minute summer	24	52	227.033	0.033	5.0	0.0000	0.0000	OK							

Results for 100 year +30% Critical Storm Duration. Lowest mass balance: 99.82%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	T1	10	259.627	0.052	19.5	0.0873	0.0000	OK	1.000	T2	19.2	2.328	0.116	0.8284	
15 minute winter	T2	10	249.641	0.066	38.7	0.1149	0.0000	OK	1.001	T3	37.8	1.997	0.190	2.0027	
15 minute winter	T3	11	235.236	0.161	57.3	0.2834	0.0000	OK	1.002	T4	55.6	1.522	0.873	3.5080	
15 minute winter	T4	12	233.888	0.313	55.6	0.8172	0.0000	SURCHARGED	1.003	T5	50.3	1.522	1.262	0.8417	
15 minute winter	T5	13	233.574	0.147	50.3	0.3947	0.0000	OK	1.004	16	48.5	1.321	0.437	1.0101	
15 minute winter	1	10	233.698	0.123	21.5	0.2923	0.0000	OK	2.000	2	21.0	1.207	0.529	0.6428	
15 minute winter	2	11	233.450	0.087	42.5	0.2010	0.0000	OK	2.001	4	42.2	1.558	0.279	0.3239	
15 minute winter	3	12	233.146	0.571	21.5	1.3625	0.0000	SURCHARGED	3.000	4	20.7	0.668	0.521	1.4318	
15 minute winter	4	12	233.104	0.741	77.4	1.7088	0.0000	SURCHARGED	2.002	5	68.3	1.902	0.771	0.3977	
15 minute winter	5	12	232.848	0.847	77.4	1.2297	0.0000	SURCHARGED	2.003	6	78.5	1.115	1.107	1.2675	
15 minute winter	6	12	232.724	0.798	86.3	0.2579	0.0000	SURCHARGED	2.004	7	87.9	1.248	1.240	1.3380	
15 minute winter	7	12	232.564	0.716	95.5	0.2206	0.0000	SURCHARGED	2.005	8	97.1	1.378	1.368	1.2675	
15 minute winter	8	12	232.376	0.602	104.8	0.1781	0.0000	SURCHARGED	2.006	9	106.0	1.505	1.495	1.3380	
15 minute winter	9	12	232.139	0.443	114.4	0.1258	0.0000	SURCHARGED	2.007	22	115.1	1.968	0.849	1.4084	
15 minute winter	11	12	232.173	0.098	13.2	0.1485	0.0000	OK	4.000	12	13.0	0.614	0.326	0.2752	
15 minute winter	12	12	232.159	0.155	26.2	0.0588	0.0000	OK	4.001	13	25.7	0.816	0.645	0.6552	
15 minute winter	13	11	232.142	0.250	38.8	0.0881	0.0000	SURCHARGED	4.002	14	37.4	1.115	0.940	0.7159	
15 minute winter	14	11	232.032	0.246	50.6	0.0818	0.0000	SURCHARGED	4.003	22	50.1	1.310	0.751	0.7557	
15 minute winter	16	13	233.255	1.180	54.9	1.6823	0.0000	FLOOD RISK	1.005	17	55.4	1.394	1.394	0.7159	
15 minute winter	17	13	233.018	1.049	59.5	0.3062	0.0000	SURCHARGED	1.006	18	60.7	1.526	1.525	0.7557	
15 minute winter	18	13	232.714	0.857	64.8	0.2340	0.0000	SURCHARGED	1.007	19	65.8	1.655	1.655	0.7159	
15 minute winter	19	12	232.382	0.631	70.0	0.1628	0.0000	SURCHARGED	1.008	20	71.0	1.786	1.785	0.7557	
15 minute winter	20	12	231.974	0.410	76.9	0.0963	0.0000	SURCHARGED	1.009	22	78.4	1.643	0.777	1.4084	
15 minute winter	22	11	231.861	0.462	259.1	0.7729	0.0000	SURCHARGED	1.010	23	266.6	5.018	0.844	1.6106	
960 minute winter	23	915	229.998	0.998	33.4	550.2372	0.0000	FLOOD RISK	1.011	24	5.0	1.699	0.108	0.0878	281.1
30 minute summer	24	31	227.033	0.033	5.0	0.0000	0.0000	OK							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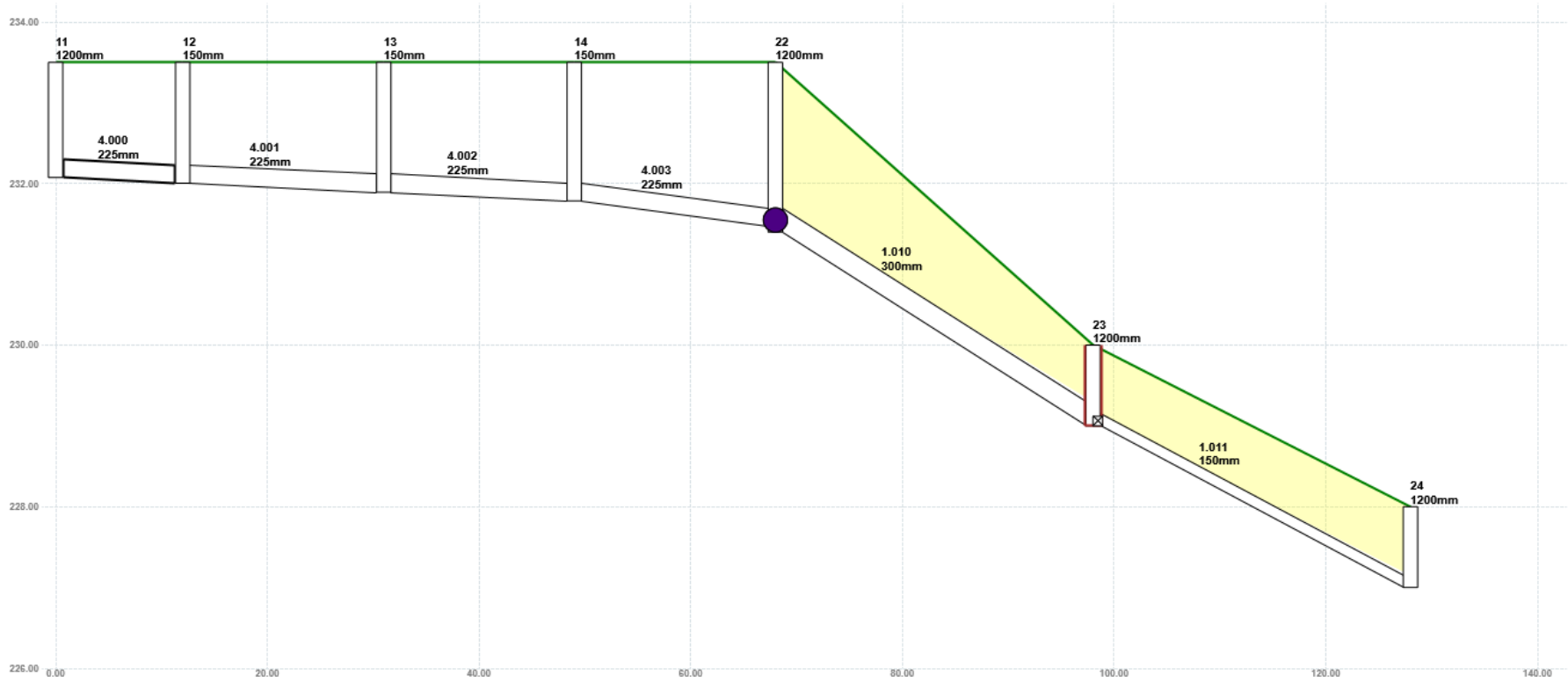
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