PROPOSED BARN CONVERSION

HILL FARM

ELVINGTON LANE

GROMSTON

YORK

YO19 5LD

DRAINAGE REPORT

HM DESIGN
10 The Green York YO26 5LR 07919 031289

1. INTRODUCTION

This report provides the background information for the drainage design for a conversion of a barn at Hill Farm, Grimston.

This report should be read in conjunction with HM Design drainage design drawings YH986/1.

This report and design is also to be used to support a planning application for the barn conversion.

2. LOCATION AND SITE

The site is adjacent to Elvington Lane, Grimston, York. It is the conversion of a barn to a single dwelling. A location plan is shown below, with the site outlined red.

LOCATION PLAN

3. SURFACE WATER ASSESSMENT

The surface water from this development should use Sustainable Drainage Systems (SuDS) to deal with the surface water. This system or systems should discharge surface water through one or more of the following, in this order of priority.

- Discharge to the ground (infiltration).
- Discharge to a surface water body.
- Discharge to a surface water sewer, highway drain or other drain.
- Discharge to a combined sewer.

INFILTRATION

A soakaway test was undertaken and witnessed by City of York Flood Management team. They confirmed that the ground is unsuitable for infiltration as a means of surface water disposal.

SURFACE WATER BODY

A surface water culvert exists within the field immediately adjacent to the development. This is the only viable discharge point for surface water disposal. Due to the invert levels of the surface water culvert and the existing barn floor levels, the surface water will need to be partially pumped.

4. SURFACE WATER DESIGN

The surface water from the proposed impermeable areas of the barn conversion (roof and proposed patio areas) are to discharge to the surface water culvert at a discharge rate of 0.5l/s. This discharge is to be limited by the pumping rate of the pumping station required.

The surface water will require storage on site, which has been designed to the following criteria.

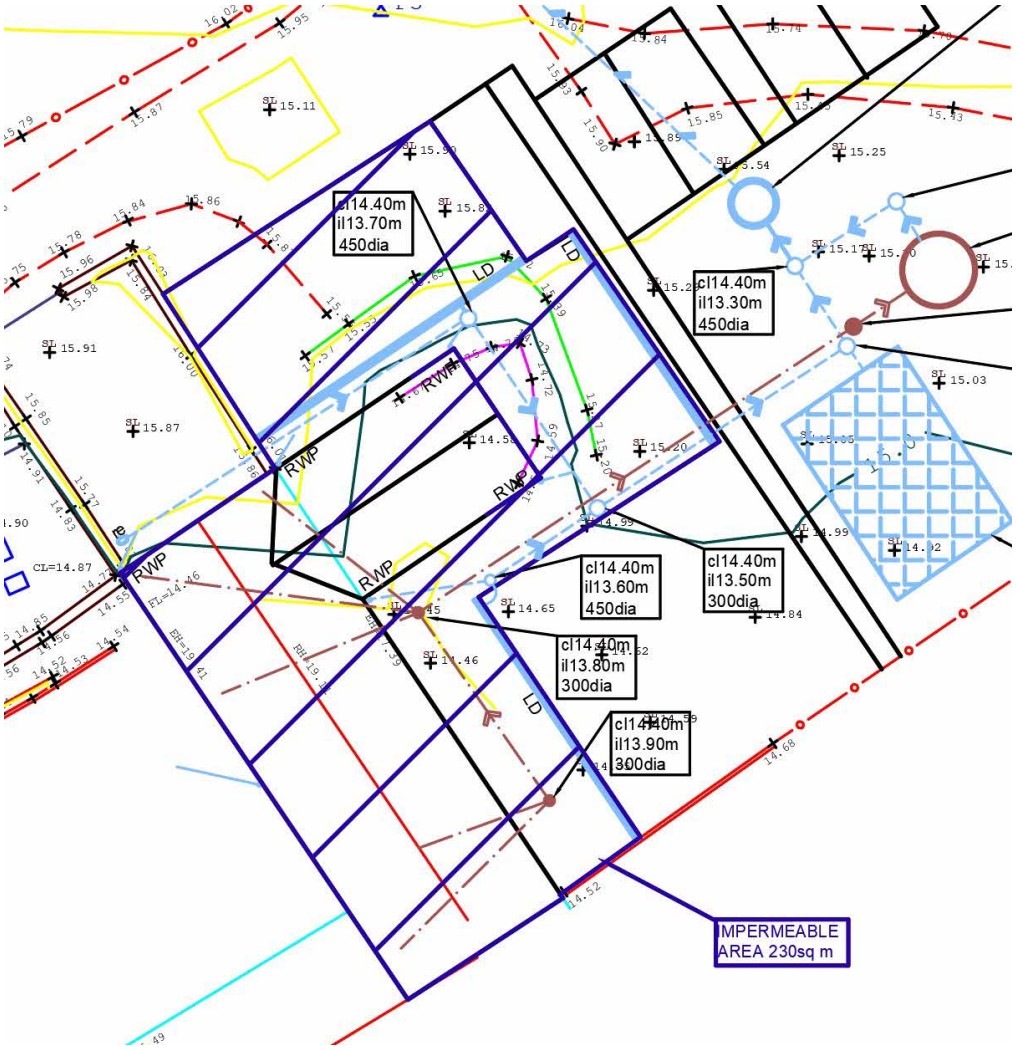
Impermeable area of the barn = 230 sq m (0.023 hectares).
Return Period: 1 in 100 year storm no flooding on or off site.
Climate Change: + 30% added to rainfall.
M5-60 = 19mm
R= 0.400
Maximum discharge rate = 0.5l/s.

The Microdrainage calculations are at the rear of this report and show that:-

A storage system constructed with 6m x 4m x 0.4m deep geo-cellular units to provide a minimum of 8.7 Cu m of storage, will be satisfactory.

5. IMPERMEABLE AREAS

The development roof and patio areas amount to 230 sq m, as shown in the plan below.



IMPERMEABLE AREAS

6. CLIMATE CHANGE

All calculations within this report include a climate change allowance of +30%.

7. FOUL DRAINAGE

This development is remote from the public sewerage system and so foul water needs to be treated at the development through a treatment plant and then connected to the surface water culvert.

To limit flows to a total of 0.5l/s, the foul and surface water system will discharge through the pumping station, so limiting total flow to 0.5l/s.

8. TREATMENT PLANT

The treatment plant size should be based on a 5 bedroom property and a population equivalent of 7.

The treatment plant should be sited downslope of the dwellings and a minimum of 7m away. It should also be located within 30m of vehicle tanker access to provide 6 monthly maintenance and sludge removal, or as advised by the manufacturer.

9. CONCLUSIONS

- This development site can be drained successfully.
- Surface water from the development will be disposed of to the surface water culvert to the north of the site.
- The surface water storage will cater for all storms up to 1 in 100 year plus 30% climate change.
- Foul water will be treated on site and disposed of to the surface water culvert.
- Foul and surface water flows will be limited to a combined flow of 0.5l/s.

Report by

Hugh Morris BSc CEng MICE
09/09/2023

APPENDIX

- MICRODRAINAGE STORAGE CALCULATIONS
  1 in 100 year plus 30% climate change

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 151 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	13.229	0.229	0.0	0.5	0.5	4.8	O K
30 min Summer	13.290	0.290	0.0	0.5	0.5	6.1	O K
60 min Summer	13.337	0.337	0.0	0.5	0.5	7.0	O K
120 min Summer	13.354	0.354	0.0	0.5	0.5	7.4	O K
180 min Summer	13.346	0.346	0.0	0.5	0.5	7.2	O K
240 min Summer	13.334	0.334	0.0	0.5	0.5	7.0	O K
360 min Summer	13.305	0.305	0.0	0.5	0.5	6.4	O K
480 min Summer	13.279	0.279	0.0	0.5	0.5	5.8	O K
600 min Summer	13.256	0.256	0.0	0.5	0.5	5.3	O K
720 min Summer	13.234	0.234	0.0	0.5	0.5	4.9	O K
960 min Summer	13.193	0.193	0.0	0.5	0.5	4.0	O K
1440 min Summer	13.130	0.130	0.0	0.5	0.5	2.7	O K
2160 min Summer	13.081	0.081	0.0	0.5	0.5	1.7	O K
2880 min Summer	13.054	0.054	0.0	0.4	0.4	1.1	O K
4320 min Summer	13.020	0.020	0.0	0.3	0.3	0.4	O K
5760 min Summer	13.003	0.003	0.0	0.3	0.3	0.1	O K
7200 min Summer	13.000	0.000	0.0	0.2	0.2	0.0	O K
8640 min Summer	13.000	0.000	0.0	0.2	0.2	0.0	O K
10080 min Summer	13.000	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	13.259	0.259	0.0	0.5	0.5	5.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.269	0.0	5.2	18
30 min Summer	79.695	0.0	6.9	32
60 min Summer	49.937	0.0	8.6	62
120 min Summer	30.267	0.0	10.4	116
180 min Summer	22.297	0.0	11.5	144
240 min Summer	17.851	0.0	12.3	176
360 min Summer	12.957	0.0	13.4	244
480 min Summer	10.330	0.0	14.2	310
600 min Summer	8.659	0.0	14.9	378
720 min Summer	7.492	0.0	15.5	442
960 min Summer	5.959	0.0	16.4	570
1440 min Summer	4.309	0.0	17.8	808
2160 min Summer	3.110	0.0	19.3	1148
2880 min Summer	2.466	0.0	20.4	1524
4320 min Summer	1.775	0.0	22.0	2244
5760 min Summer	1.405	0.0	23.3	2936
7200 min Summer	1.171	0.0	24.2	0
8640 min Summer	1.008	0.0	25.0	0
10080 min Summer	0.889	0.0	25.8	0
15 min Winter	121.269	0.0	5.8	18

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	13.329	0.329	0.0	0.5	0.5	6.9	O K
60 min Winter	13.387	0.387	0.0	0.5	0.5	8.1	O K
120 min Winter	13.694	0.694	0.0	0.5	0.5	8.7	O K
180 min Winter	13.513	0.513	0.0	0.5	0.5	8.5	O K
240 min Winter	13.390	0.390	0.0	0.5	0.5	8.1	O K
360 min Winter	13.351	0.351	0.0	0.5	0.5	7.3	O K
480 min Winter	13.312	0.312	0.0	0.5	0.5	6.5	O K
600 min Winter	13.276	0.276	0.0	0.5	0.5	5.8	O K
720 min Winter	13.242	0.242	0.0	0.5	0.5	5.1	O K
960 min Winter	13.181	0.181	0.0	0.5	0.5	3.8	O K
1440 min Winter	13.099	0.099	0.0	0.5	0.5	2.1	O K
2160 min Winter	13.054	0.054	0.0	0.4	0.4	1.1	O K
2880 min Winter	13.026	0.026	0.0	0.3	0.3	0.6	O K
4320 min Winter	13.000	0.000	0.0	0.2	0.2	0.0	O K
5760 min Winter	13.000	0.000	0.0	0.2	0.2	0.0	O K
7200 min Winter	13.000	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	13.000	0.000	0.0	0.1	0.1	0.0	O K
10080 min Winter	13.000	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	79.695	0.0	7.7	32
60 min Winter	49.937	0.0	9.6	60
120 min Winter	30.267	0.0	11.7	116
180 min Winter	22.297	0.0	12.9	168
240 min Winter	17.851	0.0	13.8	190
360 min Winter	12.957	0.0	15.0	266
480 min Winter	10.330	0.0	15.9	338
600 min Winter	8.659	0.0	16.7	410
720 min Winter	7.492	0.0	17.4	478
960 min Winter	5.959	0.0	18.4	606
1440 min Winter	4.309	0.0	20.0	820
2160 min Winter	3.110	0.0	21.6	1188
2880 min Winter	2.466	0.0	22.9	1552
4320 min Winter	1.775	0.0	24.7	0
5760 min Winter	1.405	0.0	26.1	0
7200 min Winter	1.171	0.0	27.1	0
8640 min Winter	1.008	0.0	28.1	0
10080 min Winter	0.889	0.0	28.8	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.023

Time (mins) From:	To:	Area (ha)
0	4	0.023

Model Details

Storage is Online Cover Level (m) 14.400

Cellular Storage Structure

Invert Level (m) 13.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	22.0	22.0	0.401	0.0	29.5
0.400	22.0	29.5			

Pump Outflow Control

Invert Level (m) 12.900

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.5000	1.800	0.5000	3.400	0.5000	5.000	0.5000
0.400	0.5000	2.000	0.5000	3.600	0.5000	5.200	0.5000
0.600	0.5000	2.200	0.5000	3.800	0.5000	5.400	0.5000
0.800	0.5000	2.400	0.5000	4.000	0.5000	5.600	0.5000
1.000	0.5000	2.600	0.5000	4.200	0.5000	5.800	0.5000
1.200	0.5000	2.800	0.5000	4.400	0.5000	6.000	0.5000
1.400	0.5000	3.000	0.5000	4.600	0.5000		
1.600	0.5000	3.200	0.5000	4.800	0.5000		