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Appendix 9.C – Hydrology

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 9C: Hydrology

NeuConnect Britain Ltd

September 2019

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Table of Contents

1.	Introduction.....	1-1
2.	Methodology.....	2-2
3.	Input Data.....	3-1
	Area.....	3-1
	Catchment Descriptors.....	3-1
	Climate Change.....	3-1
4.	ReFH2.....	4-2
	Parameters.....	4-2
	Results.....	4-2
	Greenfield Volume.....	4-3
	Post-Development Runoff Rate.....	4-3
	Post-Development Volume.....	4-4
	Annex 9C-1.....	4-1
	Greenfield Runoff Rate Results.....	4-1
	Annex 9C-2.....	4-1
	Greenfield Runoff Volume Results.....	4-1
	Annex 9C-3.....	4-1
	Post-Development Runoff Rate Results.....	4-1
	Annex 9C-4.....	4-1
	Post-Development Runoff Volume Results.....	4-1

Figures

No table of figures entries found.

Tables

Table 3.1	Catchment descriptors.....	3-1
Table 4.1	Parameters calculated in ReFH2.....	4-2
Table 4.2	Greenfield Runoff Rate Results.....	4-2
Table 4.3	Greenfield total flow volume results.....	4-3
Table 4.4	Post-development runoff rate results.....	4-3
Table 4.5	Post-development total flow volume results.....	4-4

1. Introduction

- 1.1 This report is to be read in conjunction with the Environmental Statement Water Resources Chapter and Appendix 9B – Outline Drainage Strategy. This report provides details of the hydrological methods used to support the outline drainage strategy. The ReFH2 Plot Scale Application has been used to calculate greenfield and post-development runoff rates and volumes for the selected Site Area.

2. Methodology

- 1.2 The latest version of the Revitalised Flood Hydrograph Model, (ReFH2), is one of the recommended methods within the current CIRIA SuDS Manual (C753)¹ for undertaking the estimation of greenfield runoff rates using the rural model. In addition, it is also one of the recommended methods for undertaking the estimation of post-development runoff rates and volumes for simple developments using the urban model. For assessing the runoff from development sites it is anticipated that the usual route would be to use a point export from the Flood Estimation Handbook (FEH) Webservice². The software uses plot scale equations at the point of import to calculate Time to Peak and Baseflow Lag.
- 1.3 Guidance on the method used can be found in The Revitalised Flood Hydrograph Model ReFH 2.2: Technical Guidance³.
- 1.4 The runoff rate for both the greenfield and post-development scenarios can be calculated based on the peak flow exported from ReFH2 using the following equation1:

$$Runoff\ Rate = \frac{10 \times Peak\ Flow}{Area}$$

- 1.5 Units for the runoff rate is l/s/ha, the peak flow is m³/s and the catchment area is km².

¹ CIRIA (2015) *The SuDS Manual (C753)*, London.

² Centre for Ecology & Hydrology, *FEH Webservice*, Available at: <https://fehweb.ceh.ac.uk/Account/Login>, Accessed: Jan 2019.

³ Wallingford Hydro Solutions (2016), 'The Revitalised Flood Hydrograph Model ReFH 2.2: Technical Guidance', WHS: Wallingford.

3. Input Data

Area

- 3.1 The area used to inform the drainage calculations has been taken from the GIS land boundary layer and is 0.084km² (8.4ha). This does not include the DC cable route boundary.
- 3.2 The size of the developed impermeable area has been taken as the plan area of the permanent infrastructure following the completion of the development. This considers the converter station platform (approximately 62500m²), the substation platform (approximately 6400m²) and the potential substation expansion site (approximately 6400m²) all with a 2 m offset, in addition to the access road (approximately 5500m²) and the sealing end compound (approximately 1050m²). The total impermeable area is calculated as approximately 8.4ha.

Catchment Descriptors

- 1.6 The catchment descriptors exported from the FEH Webservice² for the development location are listed in Table 3.1.

Table 3.1 Catchment descriptors

Catchment Descriptor	Value	Source
X Coordinate	587559	Point data
Y Coordinate	176472	Point data
BFIHOST	0.479	Point data
PROPWET	0.21	Point data
SAAR	524	Point data
SPRHOST	32.97	Catchment at 587150,176800
URBEXT2000	0.000	Catchment at 587150,176800

- 3.3 The British Geological Survey (BGS) website⁴ defines the underlying geology; with superficial deposits formed from River Terrace Deposits (sand and gravel) overlaying bedrock comprising the London Clay Formation. This correlates with the BFIHOST value of 0.479 that indicates that the site is of moderate permeability. A low PROPWET value of 0.21 indicates that this catchment is wet a low proportion of the year. This value correlates with the low average annual rainfall (SAAR) value of 524.

Climate Change

- 3.4 3.3.1 In accordance with the Environment Agency guidance on climate change allowances⁵, the percentage climate change for the peak rainfall intensity allowance is 20%. This has been taken as the worst case scenario (upper end) incorporating potential change anticipated for the '2050s (2040 to 2069)' as the design life for the development is 40 years to approximately the year 2064 (considering a construction start date in 2021 and construction period of 36 months).

⁴ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

⁵ Environment Agency, 2016, Flood risk assessments: climate change allowances, available at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>, accessed: May 2019

4. ReFH2

Parameters

- 4.1 The following parameters, detailed in Table 4.1, have been calculated within the ReFH2 software. These parameters have not been altered from the default figures in the software. As the catchment is less than 0.5km², the Time to Peak (T_p) and Base Flow Lag (BL) have been taken from the calculations based on an area of 0.5km² as recommended in the ReFH2 technical guidance¹.

Table 4.1 Parameters calculated in ReFH2

ReFH2 Parameter	Calculated Value
Cmax (mm)	428.1
Cini (mm)	126.9
Tp (Hr)	3.741
BL	46.605
BR	0.972

- 4.2 The runoff rate calculations use the critical storm duration of 5.5 hours and a time step of 30 minutes. These are automatically calculated in the ReFH2 software.
- 4.3 Whereas, the runoff volume for a development site is usually defined as the 1:100 year 6 hour duration design event⁶. Therefore, for the volume calculations, a storm duration of 6 hours and a time step of 40 minutes has been used.
- 4.4 For the post-development calculations an urban adjustment has been applied in accordance with the technical guidance¹. The following parameters have been used.
- Impervious Runoff Factor (IRF) = 1.0
 - Imperviousness factor = 1.0

Results

Greenfield Runoff Rate

- 4.5 The peak flow values for the greenfield runoff rate have been taken from the ReFH2 rural model. These in addition to the subsequent runoff rates are displayed in **Error! Reference source not found.** for the required return periods. This is based on the total developed area of 8.4 ha. Greenfield runoff rate results are presented in **Annex 9C-1**.

Table 4.2 Greenfield Runoff Rate Results

Return Period (1inXXyear)	Total peak flow from rural model (m ³ /s)	Greenfield runoff rate (l/s/ha)
2	0.02	2.21
30	0.04	4.83
100	0.06	6.75

⁶ Kellagher, R., 2002 Storage requirements for rainfall runoff from greenfield development sites, Version 2, 909 HR Wallingford Report SR580, HR Wallingford, Wallingford

Return Period (1inXXyear)	Total peak flow from rural model (m ³ /s)	Greenfield runoff rate (l/s/ha)
100+20%	0.07	8.10
100+40%	0.08	9.45
1000	0.11	13.6

Greenfield Volume

- 4.6 The total flow volume calculated in ReFH2 for each of the return periods has again been taken from the rural model for the greenfield scenario. This is based on the total developed area of 8.4 ha. The volumes have then been converted to m³ with the results shown in Table 4.3. Greenfield runoff volume results are presented in **Annex 9C-2**.

Table 4.3 Greenfield total flow volume results

Return Period (1inXXyear)	Total peak flow from urban model (m ³ /s)	Post-Development runoff rate (l/s/ha)
2	0.08	9.86
30	0.18	21.4
100	0.24	29.0
100+20%	0.29	34.9
100+40%	0.34	40.7
1000	0.44	52.9

Post-Development Runoff Rate

- 4.7 For the post-development scenario, an urbanisation adjustment was used as described above. The calculated post-development total peak flow was taken from the urban ReFH2 model with the consequent runoff rate calculated. This is based on the total developed area of 8.4 ha being impermeable. The results of these calculations do not take into account any attenuation or restrictions to flow. These results can be seen in Table 4.4. Post-development runoff rate results are presented in **Annex 9C-3**.

Table 4.4 Post-development runoff rate results

Return Period (1inXXyear)	Total peak flow from urban model (m ³ /s)	Post-Development runoff rate (l/s/ha)
2	0.08	9.86
30	0.18	21.4
100	0.24	29.0
100+20%	0.29	34.9
100+40%	0.34	40.7
1000	0.44	52.9

Post-Development Volume

- 4.8 The post-development total flow volume, calculated in ReFH2 for each of the return periods, has been taken from the urban model. This is based on the total developed area of 8.4 ha, being impermeable. The results of these calculations do not take into account any attenuation or restrictions to flow. The volumes have then been converted to m³ with the results shown in Table 4.5. Post-development runoff volume results are presented in **Annex 9C-4**.

Table 4.5 Post-development total flow volume results

Return Period (1inXXyear)	Total Flow Volume (ML)	Total Flow Volume (m ³)
2	1.40	1400
30	2.82	2820
100	3.99	3990
100+20%	4.79	4790
100+40%	5.59	5590
1000	7.17	7170

Annex 9C-1

Greenfield Runoff Rate Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:42:07 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	23.61	Total runoff (ML):	0.39
Total Rainfall (mm):	14.63	Total flow (ML):	0.76
Peak Rainfall (mm):	3.32	Peak flow (m ³ /s):	0.02

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.3211	0.0000	0.0953	0.0000	0.00277	0.00277
00:30:00	0.5380	0.0000	0.1602	0.0000	0.00274	0.00276
01:00:00	0.8967	0.0000	0.2685	0.0001	0.00271	0.00283
01:30:00	1.4827	0.0000	0.4481	0.0003	0.00268	0.00301
02:00:00	2.4129	0.0000	0.7402	0.0007	0.00266	0.0034
02:30:00	3.3239	0.0000	1.0419	0.0015	0.00264	0.00411
03:00:00	2.4129	0.0000	0.7725	0.0027	0.00263	0.00531
03:30:00	1.4827	0.0000	0.4814	0.0044	0.00264	0.00702
04:00:00	0.8967	0.0000	0.2937	0.0064	0.00267	0.00908
04:30:00	0.5380	0.0000	0.1771	0.0086	0.00272	0.0113
05:00:00	0.3211	0.0000	0.1060	0.0107	0.00279	0.0135
05:30:00	0.0000	0.0000	0.0000	0.0127	0.00288	0.0156
06:00:00	0.0000	0.0000	0.0000	0.0143	0.00299	0.0173
06:30:00	0.0000	0.0000	0.0000	0.0153	0.00311	0.0184
07:00:00	0.0000	0.0000	0.0000	0.0154	0.00324	0.0186
07:30:00	0.0000	0.0000	0.0000	0.0149	0.00336	0.0182
08:00:00	0.0000	0.0000	0.0000	0.0139	0.00347	0.0174
08:30:00	0.0000	0.0000	0.0000	0.0128	0.00358	0.0164
09:00:00	0.0000	0.0000	0.0000	0.0115	0.00366	0.0152
09:30:00	0.0000	0.0000	0.0000	0.0102	0.00374	0.0139
10:00:00	0.0000	0.0000	0.0000	0.0090	0.0038	0.0128
10:30:00	0.0000	0.0000	0.0000	0.0079	0.00384	0.0118
11:00:00	0.0000	0.0000	0.0000	0.0070	0.00388	0.0109
11:30:00	0.0000	0.0000	0.0000	0.0062	0.00391	0.0101
12:00:00	0.0000	0.0000	0.0000	0.0055	0.00393	0.00944
12:30:00	0.0000	0.0000	0.0000	0.0048	0.00394	0.00877
13:00:00	0.0000	0.0000	0.0000	0.0042	0.00394	0.00812
13:30:00	0.0000	0.0000	0.0000	0.0035	0.00394	0.00747
14:00:00	0.0000	0.0000	0.0000	0.0029	0.00393	0.00683
14:30:00	0.0000	0.0000	0.0000	0.0023	0.00392	0.00619
15:00:00	0.0000	0.0000	0.0000	0.0017	0.0039	0.00558
15:30:00	0.0000	0.0000	0.0000	0.0012	0.00387	0.00502
16:00:00	0.0000	0.0000	0.0000	0.0007	0.00384	0.00455
16:30:00	0.0000	0.0000	0.0000	0.0004	0.0038	0.00419
17:00:00	0.0000	0.0000	0.0000	0.0002	0.00376	0.00396

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:30:00	0.0000	0.0000	0.0000	0.0001	0.00373	0.00381
18:00:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00372
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00357	0.00357
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00353	0.00353
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00349	0.00349
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00342	0.00342
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00338	0.00338
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00331	0.00331
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00324	0.00324
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00317	0.00317
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311
26:30:00	0.0000	0.0000	0.0000	0.0000	0.00307	0.00307
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
28:30:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00291	0.00291
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00288	0.00288
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:43:50 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	52.11	Total runoff (ML):	0.91
Total Rainfall (mm):	32.28	Total flow (ML):	1.79
Peak Rainfall (mm):	7.34	Peak flow (m ³ /s):	0.04

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.7088	0.0000	0.2106	0.0000	0.00277	0.00277
00:30:00	1.1874	0.0000	0.3555	0.0001	0.00274	0.00279
01:00:00	1.9790	0.0000	0.5999	0.0003	0.00271	0.00298
01:30:00	3.2723	0.0000	1.0120	0.0007	0.00268	0.00342
02:00:00	5.3254	0.0000	1.7003	0.0016	0.00267	0.00431
02:30:00	7.3360	0.0000	2.4508	0.0033	0.00267	0.00595
03:00:00	5.3254	0.0000	1.8578	0.0060	0.00269	0.00873
03:30:00	3.2723	0.0000	1.1744	0.0100	0.00274	0.0127
04:00:00	1.9790	0.0000	0.7224	0.0147	0.00284	0.0176
04:30:00	1.1874	0.0000	0.4378	0.0198	0.00299	0.0228
05:00:00	0.7088	0.0000	0.2629	0.0248	0.00319	0.028
05:30:00	0.0000	0.0000	0.0000	0.0296	0.00344	0.033
06:00:00	0.0000	0.0000	0.0000	0.0334	0.00373	0.0372
06:30:00	0.0000	0.0000	0.0000	0.0358	0.00405	0.0399
07:00:00	0.0000	0.0000	0.0000	0.0363	0.00438	0.0406
07:30:00	0.0000	0.0000	0.0000	0.0351	0.0047	0.0398
08:00:00	0.0000	0.0000	0.0000	0.0330	0.005	0.038
08:30:00	0.0000	0.0000	0.0000	0.0303	0.00528	0.0355
09:00:00	0.0000	0.0000	0.0000	0.0272	0.00552	0.0328
09:30:00	0.0000	0.0000	0.0000	0.0241	0.00573	0.0299
10:00:00	0.0000	0.0000	0.0000	0.0213	0.0059	0.0272
10:30:00	0.0000	0.0000	0.0000	0.0188	0.00605	0.0248
11:00:00	0.0000	0.0000	0.0000	0.0166	0.00617	0.0228
11:30:00	0.0000	0.0000	0.0000	0.0148	0.00626	0.021
12:00:00	0.0000	0.0000	0.0000	0.0131	0.00634	0.0194
12:30:00	0.0000	0.0000	0.0000	0.0115	0.0064	0.0179
13:00:00	0.0000	0.0000	0.0000	0.0099	0.00644	0.0164
13:30:00	0.0000	0.0000	0.0000	0.0084	0.00647	0.0149
14:00:00	0.0000	0.0000	0.0000	0.0069	0.00648	0.0134
14:30:00	0.0000	0.0000	0.0000	0.0055	0.00647	0.0119
15:00:00	0.0000	0.0000	0.0000	0.0041	0.00645	0.0105
15:30:00	0.0000	0.0000	0.0000	0.0028	0.00642	0.00922
16:00:00	0.0000	0.0000	0.0000	0.0017	0.00638	0.0081
16:30:00	0.0000	0.0000	0.0000	0.0010	0.00632	0.00728
17:00:00	0.0000	0.0000	0.0000	0.0005	0.00626	0.00675

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:30:00	0.0000	0.0000	0.0000	0.0002	0.0062	0.00642
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00613	0.00621
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00607	0.00608
19:00:00	0.0000	0.0000	0.0000	0.0000	0.006	0.006
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00594	0.00594
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00588	0.00588
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00581	0.00581
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00575	0.00575
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00569	0.00569
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00563	0.00563
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00557	0.00557
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00551	0.00551
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00545	0.00545
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00534	0.00534
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00528	0.00528
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00522	0.00522
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00517	0.00517
26:30:00	0.0000	0.0000	0.0000	0.0000	0.00511	0.00511
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00506	0.00506
27:30:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00495	0.00495
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0049	0.0049
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00485	0.00485
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00474	0.00474
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00469	0.00469
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00464	0.00464
31:30:00	0.0000	0.0000	0.0000	0.0000	0.00459	0.00459
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
32:30:00	0.0000	0.0000	0.0000	0.0000	0.00449	0.00449
33:00:00	0.0000	0.0000	0.0000	0.0000	0.00445	0.00445
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0044	0.0044
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
34:30:00	0.0000	0.0000	0.0000	0.0000	0.00431	0.00431
35:00:00	0.0000	0.0000	0.0000	0.0000	0.00426	0.00426

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00417	0.00417
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00412	0.00412
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00408	0.00408
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00404	0.00404
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
38:30:00	0.0000	0.0000	0.0000	0.0000	0.00395	0.00395
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00391	0.00391
39:30:00	0.0000	0.0000	0.0000	0.0000	0.00387	0.00387
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00383	0.00383
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00379	0.00379
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00375	0.00375
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00371	0.00371
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00367	0.00367
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00363	0.00363
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00359	0.00359
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00355	0.00355
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
45:00:00	0.0000	0.0000	0.0000	0.0000	0.00344	0.00344
45:30:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
46:30:00	0.0000	0.0000	0.0000	0.0000	0.00333	0.00333
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00326	0.00326
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00319	0.00319
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00309	0.00309
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
51:00:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00299	0.00299
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00296	0.00296
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00293	0.00293
53:00:00	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
54:30:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:44:45 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	71.06	Total runoff (ML):	1.29
Total Rainfall (mm):	44.02	Total flow (ML):	2.54
Peak Rainfall (mm):	10.00	Peak flow (m ³ /s):	0.06

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.9666	0.0000	0.2876	0.0000	0.00277	0.00277
00:30:00	1.6194	0.0000	0.4867	0.0001	0.00274	0.00281
01:00:00	2.6989	0.0000	0.8247	0.0004	0.00271	0.00307
01:30:00	4.4626	0.0000	1.4010	0.0010	0.00269	0.0037
02:00:00	7.2625	0.0000	2.3794	0.0023	0.00268	0.00493
02:30:00	10.0045	0.0000	3.4794	0.0045	0.00268	0.00721
03:00:00	7.2625	0.0000	2.6723	0.0084	0.00272	0.0111
03:30:00	4.4626	0.0000	1.7032	0.0139	0.00281	0.0167
04:00:00	2.6989	0.0000	1.0526	0.0206	0.00296	0.0235
04:30:00	1.6194	0.0000	0.6397	0.0278	0.00318	0.0309
05:00:00	0.9666	0.0000	0.3848	0.0350	0.00347	0.0384
05:30:00	0.0000	0.0000	0.0000	0.0417	0.00383	0.0455
06:00:00	0.0000	0.0000	0.0000	0.0473	0.00425	0.0515
06:30:00	0.0000	0.0000	0.0000	0.0508	0.00471	0.0555
07:00:00	0.0000	0.0000	0.0000	0.0515	0.00519	0.0567
07:30:00	0.0000	0.0000	0.0000	0.0500	0.00566	0.0557
08:00:00	0.0000	0.0000	0.0000	0.0470	0.00611	0.0531
08:30:00	0.0000	0.0000	0.0000	0.0432	0.00651	0.0497
09:00:00	0.0000	0.0000	0.0000	0.0389	0.00686	0.0457
09:30:00	0.0000	0.0000	0.0000	0.0345	0.00717	0.0416
10:00:00	0.0000	0.0000	0.0000	0.0304	0.00743	0.0378
10:30:00	0.0000	0.0000	0.0000	0.0268	0.00765	0.0344
11:00:00	0.0000	0.0000	0.0000	0.0237	0.00783	0.0316
11:30:00	0.0000	0.0000	0.0000	0.0211	0.00798	0.0291
12:00:00	0.0000	0.0000	0.0000	0.0187	0.0081	0.0268
12:30:00	0.0000	0.0000	0.0000	0.0164	0.00819	0.0246
13:00:00	0.0000	0.0000	0.0000	0.0142	0.00827	0.0225
13:30:00	0.0000	0.0000	0.0000	0.0120	0.00831	0.0203
14:00:00	0.0000	0.0000	0.0000	0.0099	0.00834	0.0182
14:30:00	0.0000	0.0000	0.0000	0.0078	0.00834	0.0162
15:00:00	0.0000	0.0000	0.0000	0.0058	0.00832	0.0142
15:30:00	0.0000	0.0000	0.0000	0.0040	0.00829	0.0123
16:00:00	0.0000	0.0000	0.0000	0.0025	0.00823	0.0107
16:30:00	0.0000	0.0000	0.0000	0.0014	0.00816	0.00956
17:00:00	0.0000	0.0000	0.0000	0.0007	0.00809	0.0088

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:30:00	0.0000	0.0000	0.0000	0.0003	0.00801	0.00832
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00792	0.00804
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00784	0.00786
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00776	0.00776
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00767	0.00767
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00759	0.00759
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00751	0.00751
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00743	0.00743
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00735	0.00735
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00727	0.00727
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00719	0.00719
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00712	0.00712
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00704	0.00704
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00697	0.00697
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00689	0.00689
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00682	0.00682
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00675	0.00675
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00667	0.00667
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0066	0.0066
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00653	0.00653
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00646	0.00646
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00639	0.00639
28:30:00	0.0000	0.0000	0.0000	0.0000	0.00633	0.00633
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00626	0.00626
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00619	0.00619
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00613	0.00613
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00606	0.00606
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00599	0.00599
31:30:00	0.0000	0.0000	0.0000	0.0000	0.00593	0.00593
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00587	0.00587
32:30:00	0.0000	0.0000	0.0000	0.0000	0.00581	0.00581
33:00:00	0.0000	0.0000	0.0000	0.0000	0.00574	0.00574
33:30:00	0.0000	0.0000	0.0000	0.0000	0.00568	0.00568
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00562	0.00562
34:30:00	0.0000	0.0000	0.0000	0.0000	0.00556	0.00556
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0055	0.0055

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.00544	0.00544
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00533	0.00533
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00527	0.00527
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00521	0.00521
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00516	0.00516
38:30:00	0.0000	0.0000	0.0000	0.0000	0.0051	0.0051
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00505	0.00505
39:30:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00494	0.00494
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00489	0.00489
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00484	0.00484
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00473	0.00473
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00468	0.00468
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00463	0.00463
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00458	0.00458
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00449	0.00449
45:00:00	0.0000	0.0000	0.0000	0.0000	0.00444	0.00444
45:30:00	0.0000	0.0000	0.0000	0.0000	0.00439	0.00439
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
46:30:00	0.0000	0.0000	0.0000	0.0000	0.0043	0.0043
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00425	0.00425
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00416	0.00416
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00412	0.00412
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00407	0.00407
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00403	0.00403
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00395	0.00395
51:00:00	0.0000	0.0000	0.0000	0.0000	0.0039	0.0039
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00386	0.00386
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00382	0.00382
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00378	0.00378
53:00:00	0.0000	0.0000	0.0000	0.0000	0.00374	0.00374

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.0037	0.0037
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00366	0.00366
54:30:00	0.0000	0.0000	0.0000	0.0000	0.00362	0.00362
55:00:00	0.0000	0.0000	0.0000	0.0000	0.00358	0.00358
55:30:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
56:30:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
57:00:00	0.0000	0.0000	0.0000	0.0000	0.00343	0.00343
57:30:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
58:30:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
59:00:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
59:30:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
60:30:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
61:00:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
61:30:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00308	0.00308
62:30:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
63:00:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
63:30:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00295	0.00295
64:30:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
65:00:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
65:30:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
66:30:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:45:28 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	129.69	Total runoff (ML):	2.63
Total Rainfall (mm):	80.34	Total flow (ML):	5.19
Peak Rainfall (mm):	18.26	Peak flow (m ³ /s):	0.11

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	1.7640	0.0000	0.5264	0.0000	0.00277	0.00277
00:30:00	2.9554	0.0000	0.8983	0.0001	0.00274	0.00288
01:00:00	4.9255	0.0000	1.5424	0.0007	0.00271	0.00338
01:30:00	8.1443	0.0000	2.6747	0.0019	0.0027	0.00456
02:00:00	13.2541	0.0000	4.6840	0.0042	0.0027	0.00689
02:30:00	18.2581	0.0000	7.1244	0.0085	0.00274	0.0113
03:00:00	13.2541	0.0000	5.6596	0.0160	0.00283	0.0189
03:30:00	8.1443	0.0000	3.6812	0.0270	0.00303	0.0301
04:00:00	4.9255	0.0000	2.3015	0.0405	0.00335	0.0438
04:30:00	2.9554	0.0000	1.4081	0.0551	0.00381	0.0589
05:00:00	1.7640	0.0000	0.8502	0.0700	0.00441	0.0744
05:30:00	0.0000	0.0000	0.0000	0.0840	0.00517	0.0892
06:00:00	0.0000	0.0000	0.0000	0.0959	0.00604	0.102
06:30:00	0.0000	0.0000	0.0000	0.1037	0.00701	0.111
07:00:00	0.0000	0.0000	0.0000	0.1057	0.00803	0.114
07:30:00	0.0000	0.0000	0.0000	0.1030	0.00902	0.112
08:00:00	0.0000	0.0000	0.0000	0.0971	0.00996	0.107
08:30:00	0.0000	0.0000	0.0000	0.0894	0.0108	0.1
09:00:00	0.0000	0.0000	0.0000	0.0806	0.0116	0.0922
09:30:00	0.0000	0.0000	0.0000	0.0715	0.0123	0.0838
10:00:00	0.0000	0.0000	0.0000	0.0630	0.0128	0.0758
10:30:00	0.0000	0.0000	0.0000	0.0556	0.0133	0.0689
11:00:00	0.0000	0.0000	0.0000	0.0492	0.0137	0.0629
11:30:00	0.0000	0.0000	0.0000	0.0437	0.014	0.0577
12:00:00	0.0000	0.0000	0.0000	0.0387	0.0143	0.053
12:30:00	0.0000	0.0000	0.0000	0.0340	0.0145	0.0486
13:00:00	0.0000	0.0000	0.0000	0.0295	0.0147	0.0443
13:30:00	0.0000	0.0000	0.0000	0.0251	0.0148	0.04
14:00:00	0.0000	0.0000	0.0000	0.0208	0.0149	0.0357
14:30:00	0.0000	0.0000	0.0000	0.0165	0.015	0.0314
15:00:00	0.0000	0.0000	0.0000	0.0124	0.0149	0.0273
15:30:00	0.0000	0.0000	0.0000	0.0086	0.0149	0.0235
16:00:00	0.0000	0.0000	0.0000	0.0054	0.0148	0.0202
16:30:00	0.0000	0.0000	0.0000	0.0030	0.0147	0.0177
17:00:00	0.0000	0.0000	0.0000	0.0016	0.0146	0.0161

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:30:00	0.0000	0.0000	0.0000	0.0007	0.0144	0.0151
18:00:00	0.0000	0.0000	0.0000	0.0002	0.0143	0.0145
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0142
19:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
22:30:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
26:00:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0114	0.0114
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
30:00:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
31:30:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0106	0.0106
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0105	0.0105
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0103	0.0103
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0102	0.0102
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0101	0.0101
34:30:00	0.0000	0.0000	0.0000	0.0000	0.01	0.01
35:00:00	0.0000	0.0000	0.0000	0.0000	0.00991	0.00991

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0098	0.0098
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0097	0.0097
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00959	0.00959
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00949	0.00949
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00939	0.00939
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00929	0.00929
38:30:00	0.0000	0.0000	0.0000	0.0000	0.00919	0.00919
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00909	0.00909
39:30:00	0.0000	0.0000	0.0000	0.0000	0.009	0.009
40:00:00	0.0000	0.0000	0.0000	0.0000	0.0089	0.0089
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00881	0.00881
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00871	0.00871
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00862	0.00862
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00853	0.00853
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00844	0.00844
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00835	0.00835
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00826	0.00826
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00817	0.00817
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00808	0.00808
45:00:00	0.0000	0.0000	0.0000	0.0000	0.008	0.008
45:30:00	0.0000	0.0000	0.0000	0.0000	0.00791	0.00791
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00783	0.00783
46:30:00	0.0000	0.0000	0.0000	0.0000	0.00774	0.00774
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00766	0.00766
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00758	0.00758
48:00:00	0.0000	0.0000	0.0000	0.0000	0.0075	0.0075
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00742	0.00742
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00734	0.00734
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00726	0.00726
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00718	0.00718
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00711	0.00711
51:00:00	0.0000	0.0000	0.0000	0.0000	0.00703	0.00703
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00695	0.00695
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00688	0.00688
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00681	0.00681
53:00:00	0.0000	0.0000	0.0000	0.0000	0.00673	0.00673

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.00666	0.00666
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00659	0.00659
54:30:00	0.0000	0.0000	0.0000	0.0000	0.00652	0.00652
55:00:00	0.0000	0.0000	0.0000	0.0000	0.00645	0.00645
55:30:00	0.0000	0.0000	0.0000	0.0000	0.00638	0.00638
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00631	0.00631
56:30:00	0.0000	0.0000	0.0000	0.0000	0.00625	0.00625
57:00:00	0.0000	0.0000	0.0000	0.0000	0.00618	0.00618
57:30:00	0.0000	0.0000	0.0000	0.0000	0.00611	0.00611
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00605	0.00605
58:30:00	0.0000	0.0000	0.0000	0.0000	0.00598	0.00598
59:00:00	0.0000	0.0000	0.0000	0.0000	0.00592	0.00592
59:30:00	0.0000	0.0000	0.0000	0.0000	0.00586	0.00586
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00579	0.00579
60:30:00	0.0000	0.0000	0.0000	0.0000	0.00573	0.00573
61:00:00	0.0000	0.0000	0.0000	0.0000	0.00567	0.00567
61:30:00	0.0000	0.0000	0.0000	0.0000	0.00561	0.00561
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00555	0.00555
62:30:00	0.0000	0.0000	0.0000	0.0000	0.00549	0.00549
63:00:00	0.0000	0.0000	0.0000	0.0000	0.00543	0.00543
63:30:00	0.0000	0.0000	0.0000	0.0000	0.00538	0.00538
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00532	0.00532
64:30:00	0.0000	0.0000	0.0000	0.0000	0.00526	0.00526
65:00:00	0.0000	0.0000	0.0000	0.0000	0.00521	0.00521
65:30:00	0.0000	0.0000	0.0000	0.0000	0.00515	0.00515
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00509	0.00509
66:30:00	0.0000	0.0000	0.0000	0.0000	0.00504	0.00504
67:00:00	0.0000	0.0000	0.0000	0.0000	0.00499	0.00499
67:30:00	0.0000	0.0000	0.0000	0.0000	0.00493	0.00493
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00488	0.00488
68:30:00	0.0000	0.0000	0.0000	0.0000	0.00483	0.00483
69:00:00	0.0000	0.0000	0.0000	0.0000	0.00478	0.00478
69:30:00	0.0000	0.0000	0.0000	0.0000	0.00473	0.00473
70:00:00	0.0000	0.0000	0.0000	0.0000	0.00468	0.00468
70:30:00	0.0000	0.0000	0.0000	0.0000	0.00463	0.00463
71:00:00	0.0000	0.0000	0.0000	0.0000	0.00458	0.00458

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
71:30:00	0.0000	0.0000	0.0000	0.0000	0.00453	0.00453
72:00:00	0.0000	0.0000	0.0000	0.0000	0.00448	0.00448
72:30:00	0.0000	0.0000	0.0000	0.0000	0.00443	0.00443
73:00:00	0.0000	0.0000	0.0000	0.0000	0.00438	0.00438
73:30:00	0.0000	0.0000	0.0000	0.0000	0.00434	0.00434
74:00:00	0.0000	0.0000	0.0000	0.0000	0.00429	0.00429
74:30:00	0.0000	0.0000	0.0000	0.0000	0.00425	0.00425
75:00:00	0.0000	0.0000	0.0000	0.0000	0.0042	0.0042
75:30:00	0.0000	0.0000	0.0000	0.0000	0.00416	0.00416
76:00:00	0.0000	0.0000	0.0000	0.0000	0.00411	0.00411
76:30:00	0.0000	0.0000	0.0000	0.0000	0.00407	0.00407
77:00:00	0.0000	0.0000	0.0000	0.0000	0.00402	0.00402
77:30:00	0.0000	0.0000	0.0000	0.0000	0.00398	0.00398
78:00:00	0.0000	0.0000	0.0000	0.0000	0.00394	0.00394
78:30:00	0.0000	0.0000	0.0000	0.0000	0.0039	0.0039
79:00:00	0.0000	0.0000	0.0000	0.0000	0.00385	0.00385
79:30:00	0.0000	0.0000	0.0000	0.0000	0.00381	0.00381
80:00:00	0.0000	0.0000	0.0000	0.0000	0.00377	0.00377
80:30:00	0.0000	0.0000	0.0000	0.0000	0.00373	0.00373
81:00:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00369
81:30:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
82:00:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
82:30:00	0.0000	0.0000	0.0000	0.0000	0.00358	0.00358
83:00:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
83:30:00	0.0000	0.0000	0.0000	0.0000	0.0035	0.0035
84:00:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
84:30:00	0.0000	0.0000	0.0000	0.0000	0.00343	0.00343
85:00:00	0.0000	0.0000	0.0000	0.0000	0.00339	0.00339
85:30:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
86:00:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
86:30:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
87:00:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
87:30:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
88:00:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
88:30:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
89:00:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
89:30:00	0.0000	0.0000	0.0000	0.0000	0.00308	0.00308
90:00:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
90:30:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
91:00:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
91:30:00	0.0000	0.0000	0.0000	0.0000	0.00295	0.00295
92:00:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
92:30:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
93:00:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
93:30:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
94:00:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-2

Greenfield Runoff Volume Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:55:56 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	24.15	Total runoff (ML):	0.40
Total Rainfall (mm):	15.29	Total flow (ML):	0.80
Peak Rainfall (mm):	4.16	Peak flow (m ³ /s):	0.02

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.4369	0.0000	0.1297	0.0000	0.00277	0.00277
00:40:00	0.8198	0.0000	0.2446	0.0000	0.00273	0.00277
01:20:00	1.5243	0.0000	0.4590	0.0002	0.00269	0.00292
02:00:00	2.7845	0.0000	0.8524	0.0007	0.00266	0.00332
02:40:00	4.1582	0.0000	1.3066	0.0016	0.00264	0.00421
03:20:00	2.7845	0.0000	0.8976	0.0033	0.00263	0.0059
04:00:00	1.5243	0.0000	0.4990	0.0057	0.00266	0.0084
04:40:00	0.8198	0.0000	0.2706	0.0086	0.00272	0.0113
05:20:00	0.4369	0.0000	0.1449	0.0114	0.00282	0.0143
06:00:00	0.0000	0.0000	0.0000	0.0139	0.00295	0.0169
06:40:00	0.0000	0.0000	0.0000	0.0155	0.00311	0.0187
07:20:00	0.0000	0.0000	0.0000	0.0158	0.00329	0.0191
08:00:00	0.0000	0.0000	0.0000	0.0150	0.00345	0.0184
08:40:00	0.0000	0.0000	0.0000	0.0135	0.0036	0.0171
09:20:00	0.0000	0.0000	0.0000	0.0118	0.00372	0.0156
10:00:00	0.0000	0.0000	0.0000	0.0101	0.00382	0.0139
10:40:00	0.0000	0.0000	0.0000	0.0085	0.0039	0.0124
11:20:00	0.0000	0.0000	0.0000	0.0073	0.00395	0.0112
12:00:00	0.0000	0.0000	0.0000	0.0062	0.00399	0.0102
12:40:00	0.0000	0.0000	0.0000	0.0052	0.00401	0.00921
13:20:00	0.0000	0.0000	0.0000	0.0043	0.00402	0.00829
14:00:00	0.0000	0.0000	0.0000	0.0034	0.00401	0.00739
14:40:00	0.0000	0.0000	0.0000	0.0025	0.004	0.00651
15:20:00	0.0000	0.0000	0.0000	0.0017	0.00397	0.00568
16:00:00	0.0000	0.0000	0.0000	0.0010	0.00393	0.00495
16:40:00	0.0000	0.0000	0.0000	0.0005	0.00389	0.0044
17:20:00	0.0000	0.0000	0.0000	0.0002	0.00384	0.00406
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00378	0.00387
18:40:00	0.0000	0.0000	0.0000	0.0000	0.00373	0.00375
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00368	0.00368
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00363	0.00363
20:40:00	0.0000	0.0000	0.0000	0.0000	0.00357	0.00357
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00352	0.00352
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00342	0.00342

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00337	0.00337
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00333	0.00333
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00323	0.00323
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00319	0.00319
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0031	0.0031
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00297	0.00297
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00293	0.00293
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00288	0.00288
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00284	0.00284
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:56:16 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	53.08	Total runoff (ML):	0.95
Total Rainfall (mm):	33.61	Total flow (ML):	1.87
Peak Rainfall (mm):	9.14	Peak flow (m ³ /s):	0.04

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.9605	0.0000	0.2858	0.0000	0.00277	0.00277
00:40:00	1.8022	0.0000	0.5420	0.0001	0.00273	0.00283
01:20:00	3.3510	0.0000	1.0279	0.0005	0.00269	0.0032
02:00:00	6.1213	0.0000	1.9454	0.0015	0.00267	0.00414
02:40:00	9.1412	0.0000	3.0680	0.0035	0.00266	0.00618
03:20:00	6.1213	0.0000	2.1636	0.0074	0.0027	0.0101
04:00:00	3.3510	0.0000	1.2215	0.0131	0.0028	0.0159
04:40:00	1.8022	0.0000	0.6678	0.0197	0.00299	0.0227
05:20:00	0.9605	0.0000	0.3590	0.0265	0.00327	0.0297
06:00:00	0.0000	0.0000	0.0000	0.0324	0.00363	0.0361
06:40:00	0.0000	0.0000	0.0000	0.0364	0.00405	0.0404
07:20:00	0.0000	0.0000	0.0000	0.0371	0.0045	0.0416
08:00:00	0.0000	0.0000	0.0000	0.0353	0.00494	0.0402
08:40:00	0.0000	0.0000	0.0000	0.0320	0.00533	0.0374
09:20:00	0.0000	0.0000	0.0000	0.0280	0.00567	0.0337
10:00:00	0.0000	0.0000	0.0000	0.0239	0.00595	0.0299
10:40:00	0.0000	0.0000	0.0000	0.0202	0.00617	0.0264
11:20:00	0.0000	0.0000	0.0000	0.0172	0.00634	0.0236
12:00:00	0.0000	0.0000	0.0000	0.0147	0.00647	0.0211
12:40:00	0.0000	0.0000	0.0000	0.0123	0.00657	0.0189
13:20:00	0.0000	0.0000	0.0000	0.0102	0.00663	0.0168
14:00:00	0.0000	0.0000	0.0000	0.0081	0.00666	0.0147
14:40:00	0.0000	0.0000	0.0000	0.0060	0.00666	0.0127
15:20:00	0.0000	0.0000	0.0000	0.0041	0.00664	0.0108
16:00:00	0.0000	0.0000	0.0000	0.0025	0.00659	0.00906
16:40:00	0.0000	0.0000	0.0000	0.0013	0.00652	0.00777
17:20:00	0.0000	0.0000	0.0000	0.0006	0.00644	0.00699
18:00:00	0.0000	0.0000	0.0000	0.0002	0.00635	0.00656
18:40:00	0.0000	0.0000	0.0000	0.0000	0.00627	0.00631
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00618	0.00618
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00609	0.00609
20:40:00	0.0000	0.0000	0.0000	0.0000	0.006	0.006
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00592	0.00592
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00583	0.00583
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00575	0.00575

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00567	0.00567
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00559	0.00559
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00551	0.00551
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00543	0.00543
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00535	0.00535
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00528	0.00528
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0052	0.0052
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00513	0.00513
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00506	0.00506
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00498	0.00498
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00491	0.00491
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00484	0.00484
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00477	0.00477
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00471	0.00471
32:40:00	0.0000	0.0000	0.0000	0.0000	0.00464	0.00464
33:20:00	0.0000	0.0000	0.0000	0.0000	0.00457	0.00457
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00451	0.00451
34:40:00	0.0000	0.0000	0.0000	0.0000	0.00444	0.00444
35:20:00	0.0000	0.0000	0.0000	0.0000	0.00438	0.00438
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00432	0.00432
36:40:00	0.0000	0.0000	0.0000	0.0000	0.00426	0.00426
37:20:00	0.0000	0.0000	0.0000	0.0000	0.0042	0.0042
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00414	0.00414
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00408	0.00408
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00402	0.00402
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00396	0.00396
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00391	0.00391
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00385	0.00385
42:00:00	0.0000	0.0000	0.0000	0.0000	0.0038	0.0038
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00374	0.00374
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00369
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00364	0.00364
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00359	0.00359
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00349	0.00349
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00344	0.00344

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00339	0.00339
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00334	0.00334
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00324	0.00324
50:00:00	0.0000	0.0000	0.0000	0.0000	0.0032	0.0032
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00306	0.00306
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00281	0.00281

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:57:00 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	72.74	Total runoff (ML):	1.35
Total Rainfall (mm):	46.06	Total flow (ML):	2.67
Peak Rainfall (mm):	12.53	Peak flow (m ³ /s):	0.06

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	1.3163	0.0000	0.3921	0.0000	0.00277	0.00277
00:40:00	2.4697	0.0000	0.7467	0.0001	0.00273	0.00287
01:20:00	4.5921	0.0000	1.4262	0.0007	0.00269	0.00339
02:00:00	8.3885	0.0000	2.7325	0.0020	0.00267	0.00471
02:40:00	12.5269	0.0000	4.3865	0.0049	0.00268	0.00756
03:20:00	8.3885	0.0000	3.1423	0.0103	0.00275	0.013
04:00:00	4.5921	0.0000	1.7898	0.0184	0.00291	0.0213
04:40:00	2.4697	0.0000	0.9829	0.0279	0.00319	0.0311
05:20:00	1.3163	0.0000	0.5297	0.0375	0.00359	0.0411
06:00:00	0.0000	0.0000	0.0000	0.0461	0.00412	0.0502
06:40:00	0.0000	0.0000	0.0000	0.0519	0.00474	0.0566
07:20:00	0.0000	0.0000	0.0000	0.0531	0.0054	0.0585
08:00:00	0.0000	0.0000	0.0000	0.0506	0.00604	0.0567
08:40:00	0.0000	0.0000	0.0000	0.0460	0.00662	0.0526
09:20:00	0.0000	0.0000	0.0000	0.0403	0.00712	0.0474
10:00:00	0.0000	0.0000	0.0000	0.0344	0.00753	0.0419
10:40:00	0.0000	0.0000	0.0000	0.0291	0.00786	0.037
11:20:00	0.0000	0.0000	0.0000	0.0248	0.00813	0.0329
12:00:00	0.0000	0.0000	0.0000	0.0211	0.00833	0.0294
12:40:00	0.0000	0.0000	0.0000	0.0177	0.00848	0.0262
13:20:00	0.0000	0.0000	0.0000	0.0146	0.00858	0.0232
14:00:00	0.0000	0.0000	0.0000	0.0116	0.00864	0.0203
14:40:00	0.0000	0.0000	0.0000	0.0087	0.00866	0.0174
15:20:00	0.0000	0.0000	0.0000	0.0060	0.00863	0.0146
16:00:00	0.0000	0.0000	0.0000	0.0036	0.00858	0.0122
16:40:00	0.0000	0.0000	0.0000	0.0018	0.00849	0.0103
17:20:00	0.0000	0.0000	0.0000	0.0008	0.00839	0.00921
18:00:00	0.0000	0.0000	0.0000	0.0003	0.00828	0.00858
18:40:00	0.0000	0.0000	0.0000	0.0001	0.00816	0.00824
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00805	0.00805
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00793	0.00793
20:40:00	0.0000	0.0000	0.0000	0.0000	0.00782	0.00782
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00771	0.00771
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0076	0.0076
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00749	0.00749

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00739	0.00739
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00728	0.00728
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00718	0.00718
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00708	0.00708
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00698	0.00698
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00688	0.00688
27:20:00	0.0000	0.0000	0.0000	0.0000	0.00678	0.00678
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00668	0.00668
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00659	0.00659
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00649	0.00649
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0064	0.0064
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00631	0.00631
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00622	0.00622
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00613	0.00613
32:40:00	0.0000	0.0000	0.0000	0.0000	0.00605	0.00605
33:20:00	0.0000	0.0000	0.0000	0.0000	0.00596	0.00596
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00588	0.00588
34:40:00	0.0000	0.0000	0.0000	0.0000	0.00579	0.00579
35:20:00	0.0000	0.0000	0.0000	0.0000	0.00571	0.00571
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00563	0.00563
36:40:00	0.0000	0.0000	0.0000	0.0000	0.00555	0.00555
37:20:00	0.0000	0.0000	0.0000	0.0000	0.00547	0.00547
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00532	0.00532
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00524	0.00524
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00517	0.00517
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00509	0.00509
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00502	0.00502
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00495	0.00495
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00488	0.00488
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00481	0.00481
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00474	0.00474
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00467	0.00467
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00461	0.00461
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00448	0.00448

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00441	0.00441
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00429	0.00429
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00423	0.00423
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00417	0.00417
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00411	0.00411
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00405	0.00405
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00394	0.00394
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00388	0.00388
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00383	0.00383
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00377	0.00377
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00372	0.00372
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00366	0.00366
56:40:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
57:20:00	0.0000	0.0000	0.0000	0.0000	0.00356	0.00356
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
58:40:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
59:20:00	0.0000	0.0000	0.0000	0.0000	0.00341	0.00341
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
60:40:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
61:20:00	0.0000	0.0000	0.0000	0.0000	0.00327	0.00327
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
62:40:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
63:20:00	0.0000	0.0000	0.0000	0.0000	0.00313	0.00313
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00309	0.00309
64:40:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
65:20:00	0.0000	0.0000	0.0000	0.0000	0.003	0.003
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00296	0.00296
66:40:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
67:20:00	0.0000	0.0000	0.0000	0.0000	0.00287	0.00287
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
68:40:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:57:23 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	132.58	Total runoff (ML):	2.78
Total Rainfall (mm):	83.94	Total flow (ML):	5.49
Peak Rainfall (mm):	22.83	Peak flow (m ³ /s):	0.12

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	2.3990	0.0000	0.7177	0.0000	0.00277	0.00277
00:40:00	4.5010	0.0000	1.3829	0.0003	0.00273	0.00299
01:20:00	8.3690	0.0000	2.6970	0.0013	0.0027	0.00398
02:00:00	15.2880	0.0000	5.3491	0.0038	0.0027	0.00647
02:40:00	22.8301	0.0000	9.0044	0.0092	0.00275	0.0119
03:20:00	15.2880	0.0000	6.7103	0.0198	0.00291	0.0227
04:00:00	8.3690	0.0000	3.9046	0.0359	0.00325	0.0392
04:40:00	4.5010	0.0000	2.1676	0.0553	0.00384	0.0591
05:20:00	2.3990	0.0000	1.1746	0.0752	0.00468	0.0799
06:00:00	0.0000	0.0000	0.0000	0.0933	0.00578	0.0991
06:40:00	0.0000	0.0000	0.0000	0.1060	0.00707	0.113
07:20:00	0.0000	0.0000	0.0000	0.1093	0.00846	0.118
08:00:00	0.0000	0.0000	0.0000	0.1048	0.00982	0.115
08:40:00	0.0000	0.0000	0.0000	0.0955	0.0111	0.107
09:20:00	0.0000	0.0000	0.0000	0.0839	0.0121	0.096
10:00:00	0.0000	0.0000	0.0000	0.0716	0.013	0.0847
10:40:00	0.0000	0.0000	0.0000	0.0606	0.0138	0.0744
11:20:00	0.0000	0.0000	0.0000	0.0516	0.0143	0.0659
12:00:00	0.0000	0.0000	0.0000	0.0439	0.0148	0.0587
12:40:00	0.0000	0.0000	0.0000	0.0370	0.0152	0.0522
13:20:00	0.0000	0.0000	0.0000	0.0306	0.0154	0.046
14:00:00	0.0000	0.0000	0.0000	0.0244	0.0156	0.04
14:40:00	0.0000	0.0000	0.0000	0.0184	0.0156	0.0341
15:20:00	0.0000	0.0000	0.0000	0.0128	0.0156	0.0284
16:00:00	0.0000	0.0000	0.0000	0.0078	0.0156	0.0233
16:40:00	0.0000	0.0000	0.0000	0.0040	0.0154	0.0194
17:20:00	0.0000	0.0000	0.0000	0.0018	0.0152	0.017
18:00:00	0.0000	0.0000	0.0000	0.0007	0.015	0.0157
18:40:00	0.0000	0.0000	0.0000	0.0002	0.0148	0.015
19:20:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
20:40:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
21:20:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
22:40:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
24:40:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
25:20:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
26:40:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
28:40:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
29:20:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
30:40:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
31:20:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
32:40:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
33:20:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107
34:40:00	0.0000	0.0000	0.0000	0.0000	0.0105	0.0105
35:20:00	0.0000	0.0000	0.0000	0.0000	0.0104	0.0104
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0102	0.0102
36:40:00	0.0000	0.0000	0.0000	0.0000	0.0101	0.0101
37:20:00	0.0000	0.0000	0.0000	0.0000	0.00993	0.00993
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00979	0.00979
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00965	0.00965
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00952	0.00952
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00938	0.00938
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00925	0.00925
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00912	0.00912
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00899	0.00899
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00886	0.00886
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00873	0.00873
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00861	0.00861
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00849	0.00849
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00837	0.00837
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00825	0.00825
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00813	0.00813

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00802	0.00802
48:00:00	0.0000	0.0000	0.0000	0.0000	0.0079	0.0079
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00779	0.00779
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00768	0.00768
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00757	0.00757
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00746	0.00746
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00736	0.00736
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00725	0.00725
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00715	0.00715
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00705	0.00705
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00695	0.00695
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00685	0.00685
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00675	0.00675
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00666	0.00666
56:40:00	0.0000	0.0000	0.0000	0.0000	0.00656	0.00656
57:20:00	0.0000	0.0000	0.0000	0.0000	0.00647	0.00647
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00638	0.00638
58:40:00	0.0000	0.0000	0.0000	0.0000	0.00629	0.00629
59:20:00	0.0000	0.0000	0.0000	0.0000	0.0062	0.0062
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00611	0.00611
60:40:00	0.0000	0.0000	0.0000	0.0000	0.00602	0.00602
61:20:00	0.0000	0.0000	0.0000	0.0000	0.00594	0.00594
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00585	0.00585
62:40:00	0.0000	0.0000	0.0000	0.0000	0.00577	0.00577
63:20:00	0.0000	0.0000	0.0000	0.0000	0.00569	0.00569
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00561	0.00561
64:40:00	0.0000	0.0000	0.0000	0.0000	0.00553	0.00553
65:20:00	0.0000	0.0000	0.0000	0.0000	0.00545	0.00545
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00537	0.00537
66:40:00	0.0000	0.0000	0.0000	0.0000	0.00529	0.00529
67:20:00	0.0000	0.0000	0.0000	0.0000	0.00522	0.00522
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00514	0.00514
68:40:00	0.0000	0.0000	0.0000	0.0000	0.00507	0.00507
69:20:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
70:00:00	0.0000	0.0000	0.0000	0.0000	0.00493	0.00493
70:40:00	0.0000	0.0000	0.0000	0.0000	0.00486	0.00486

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
71:20:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
72:00:00	0.0000	0.0000	0.0000	0.0000	0.00472	0.00472
72:40:00	0.0000	0.0000	0.0000	0.0000	0.00465	0.00465
73:20:00	0.0000	0.0000	0.0000	0.0000	0.00459	0.00459
74:00:00	0.0000	0.0000	0.0000	0.0000	0.00452	0.00452
74:40:00	0.0000	0.0000	0.0000	0.0000	0.00446	0.00446
75:20:00	0.0000	0.0000	0.0000	0.0000	0.0044	0.0044
76:00:00	0.0000	0.0000	0.0000	0.0000	0.00433	0.00433
76:40:00	0.0000	0.0000	0.0000	0.0000	0.00427	0.00427
77:20:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
78:00:00	0.0000	0.0000	0.0000	0.0000	0.00415	0.00415
78:40:00	0.0000	0.0000	0.0000	0.0000	0.00409	0.00409
79:20:00	0.0000	0.0000	0.0000	0.0000	0.00403	0.00403
80:00:00	0.0000	0.0000	0.0000	0.0000	0.00398	0.00398
80:40:00	0.0000	0.0000	0.0000	0.0000	0.00392	0.00392
81:20:00	0.0000	0.0000	0.0000	0.0000	0.00386	0.00386
82:00:00	0.0000	0.0000	0.0000	0.0000	0.00381	0.00381
82:40:00	0.0000	0.0000	0.0000	0.0000	0.00376	0.00376
83:20:00	0.0000	0.0000	0.0000	0.0000	0.0037	0.0037
84:00:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
84:40:00	0.0000	0.0000	0.0000	0.0000	0.0036	0.0036
85:20:00	0.0000	0.0000	0.0000	0.0000	0.00355	0.00355
86:00:00	0.0000	0.0000	0.0000	0.0000	0.0035	0.0035
86:40:00	0.0000	0.0000	0.0000	0.0000	0.00345	0.00345
87:20:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
88:00:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
88:40:00	0.0000	0.0000	0.0000	0.0000	0.0033	0.0033
89:20:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
90:00:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
90:40:00	0.0000	0.0000	0.0000	0.0000	0.00316	0.00316
91:20:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
92:00:00	0.0000	0.0000	0.0000	0.0000	0.00307	0.00307
92:40:00	0.0000	0.0000	0.0000	0.0000	0.00303	0.00303
93:20:00	0.0000	0.0000	0.0000	0.0000	0.00299	0.00299
94:00:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
94:40:00	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
95:20:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
96:00:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
96:40:00	0.0000	0.0000	0.0000	0.0000	0.00278	0.00278

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-3

Post-Development Runoff Rate Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:06:18 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	23.61	Total runoff (ML):	1.24
Total Rainfall (mm):	14.76	Total flow (ML):	1.35
Peak Rainfall (mm):	3.35	Peak flow (m ³ /s):	0.08

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.3240	0.0000	0.3240	0.0000	0.00277	0.00277
00:30:00	0.5428	0.0000	0.5428	0.0004	0.00274	0.00309
01:00:00	0.9047	0.0000	0.9047	0.0016	0.00271	0.00435
01:30:00	1.4960	0.0000	1.4960	0.0045	0.00268	0.00718
02:00:00	2.4345	0.0000	2.4345	0.0099	0.00265	0.0126
02:30:00	3.3537	0.0000	3.3537	0.0188	0.00262	0.0214
03:00:00	2.4345	0.0000	2.4345	0.0322	0.00259	0.0348
03:30:00	1.4960	0.0000	1.4960	0.0491	0.00257	0.0516
04:00:00	0.9047	0.0000	0.9047	0.0655	0.00254	0.0681
04:30:00	0.5428	0.0000	0.5428	0.0772	0.00251	0.0797
05:00:00	0.3240	0.0000	0.3240	0.0803	0.00248	0.0828
05:30:00	0.0000	0.0000	0.0000	0.0759	0.00246	0.0784
06:00:00	0.0000	0.0000	0.0000	0.0670	0.00243	0.0695
06:30:00	0.0000	0.0000	0.0000	0.0562	0.00241	0.0586
07:00:00	0.0000	0.0000	0.0000	0.0454	0.00238	0.0478
07:30:00	0.0000	0.0000	0.0000	0.0353	0.00235	0.0376
08:00:00	0.0000	0.0000	0.0000	0.0262	0.00233	0.0286
08:30:00	0.0000	0.0000	0.0000	0.0183	0.0023	0.0207
09:00:00	0.0000	0.0000	0.0000	0.0118	0.00228	0.014
09:30:00	0.0000	0.0000	0.0000	0.0068	0.00226	0.00902
10:00:00	0.0000	0.0000	0.0000	0.0036	0.00223	0.0058
10:30:00	0.0000	0.0000	0.0000	0.0017	0.00221	0.00392
11:00:00	0.0000	0.0000	0.0000	0.0007	0.00218	0.00288
11:30:00	0.0000	0.0000	0.0000	0.0002	0.00216	0.00237
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00214	0.00216

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:06:43 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	52.11	Total runoff (ML):	2.74
Total Rainfall (mm):	32.57	Total flow (ML):	2.85
Peak Rainfall (mm):	7.40	Peak flow (m ³ /s):	0.18

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.7151	0.0000	0.7151	0.0000	0.00277	0.00277
00:30:00	1.1981	0.0000	1.1981	0.0008	0.00274	0.00351
01:00:00	1.9968	0.0000	1.9968	0.0036	0.00271	0.00633
01:30:00	3.3017	0.0000	3.3017	0.0099	0.00268	0.0126
02:00:00	5.3731	0.0000	5.3731	0.0219	0.00265	0.0246
02:30:00	7.4018	0.0000	7.4018	0.0414	0.00262	0.0441
03:00:00	5.3731	0.0000	5.3731	0.0711	0.00259	0.0737
03:30:00	3.3017	0.0000	3.3017	0.1083	0.00257	0.111
04:00:00	1.9968	0.0000	1.9968	0.1446	0.00254	0.147
04:30:00	1.1981	0.0000	1.1981	0.1704	0.00251	0.173
05:00:00	0.7151	0.0000	0.7151	0.1773	0.00248	0.18
05:30:00	0.0000	0.0000	0.0000	0.1676	0.00246	0.17
06:00:00	0.0000	0.0000	0.0000	0.1479	0.00243	0.15
06:30:00	0.0000	0.0000	0.0000	0.1241	0.00241	0.126
07:00:00	0.0000	0.0000	0.0000	0.1003	0.00238	0.103
07:30:00	0.0000	0.0000	0.0000	0.0779	0.00235	0.0802
08:00:00	0.0000	0.0000	0.0000	0.0579	0.00233	0.0602
08:30:00	0.0000	0.0000	0.0000	0.0405	0.0023	0.0428
09:00:00	0.0000	0.0000	0.0000	0.0259	0.00228	0.0282
09:30:00	0.0000	0.0000	0.0000	0.0149	0.00226	0.0172
10:00:00	0.0000	0.0000	0.0000	0.0079	0.00223	0.0101
10:30:00	0.0000	0.0000	0.0000	0.0038	0.00221	0.00598
11:00:00	0.0000	0.0000	0.0000	0.0015	0.00218	0.00373
11:30:00	0.0000	0.0000	0.0000	0.0005	0.00216	0.00261
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00214	0.00218

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:07:04 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	71.06	Total runoff (ML):	3.73
Total Rainfall (mm):	44.42	Total flow (ML):	3.84
Peak Rainfall (mm):	10.09	Peak flow (m ³ /s):	0.24

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.9752	0.0000	0.9752	0.0000	0.00277	0.00277
00:30:00	1.6339	0.0000	1.6339	0.0011	0.00274	0.00379
01:00:00	2.7231	0.0000	2.7231	0.0049	0.00271	0.00765
01:30:00	4.5026	0.0000	4.5026	0.0135	0.00268	0.0162
02:00:00	7.3276	0.0000	7.3276	0.0299	0.00265	0.0325
02:30:00	10.0941	0.0000	10.0941	0.0565	0.00262	0.0591
03:00:00	7.3276	0.0000	7.3276	0.0969	0.00259	0.0995
03:30:00	4.5026	0.0000	4.5026	0.1477	0.00257	0.15
04:00:00	2.7231	0.0000	2.7231	0.1972	0.00254	0.2
04:30:00	1.6339	0.0000	1.6339	0.2324	0.00251	0.235
05:00:00	0.9752	0.0000	0.9752	0.2418	0.00248	0.244
05:30:00	0.0000	0.0000	0.0000	0.2285	0.00246	0.231
06:00:00	0.0000	0.0000	0.0000	0.2017	0.00243	0.204
06:30:00	0.0000	0.0000	0.0000	0.1692	0.00241	0.172
07:00:00	0.0000	0.0000	0.0000	0.1368	0.00238	0.139
07:30:00	0.0000	0.0000	0.0000	0.1062	0.00235	0.109
08:00:00	0.0000	0.0000	0.0000	0.0789	0.00233	0.0813
08:30:00	0.0000	0.0000	0.0000	0.0552	0.0023	0.0575
09:00:00	0.0000	0.0000	0.0000	0.0354	0.00228	0.0376
09:30:00	0.0000	0.0000	0.0000	0.0204	0.00226	0.0226
10:00:00	0.0000	0.0000	0.0000	0.0107	0.00223	0.013
10:30:00	0.0000	0.0000	0.0000	0.0051	0.00221	0.00735
11:00:00	0.0000	0.0000	0.0000	0.0021	0.00218	0.00429
11:30:00	0.0000	0.0000	0.0000	0.0006	0.00216	0.00278
12:00:00	0.0000	0.0000	0.0000	0.0001	0.00214	0.00219

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:07:20 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	129.69	Total runoff (ML):	6.81
Total Rainfall (mm):	81.07	Total flow (ML):	6.92
Peak Rainfall (mm):	18.42	Peak flow (m ³ /s):	0.44

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	1.7798	0.0000	1.7798	0.0000	0.00277	0.00277
00:30:00	2.9818	0.0000	2.9818	0.0019	0.00274	0.00466
01:00:00	4.9697	0.0000	4.9697	0.0090	0.00271	0.0117
01:30:00	8.2173	0.0000	8.2173	0.0247	0.00268	0.0274
02:00:00	13.3729	0.0000	13.3729	0.0545	0.00265	0.0572
02:30:00	18.4218	0.0000	18.4218	0.1031	0.00262	0.106
03:00:00	13.3729	0.0000	13.3729	0.1769	0.00259	0.179
03:30:00	8.2173	0.0000	8.2173	0.2695	0.00257	0.272
04:00:00	4.9697	0.0000	4.9697	0.3599	0.00254	0.362
04:30:00	2.9818	0.0000	2.9818	0.4242	0.00251	0.427
05:00:00	1.7798	0.0000	1.7798	0.4413	0.00248	0.444
05:30:00	0.0000	0.0000	0.0000	0.4171	0.00246	0.42
06:00:00	0.0000	0.0000	0.0000	0.3681	0.00243	0.371
06:30:00	0.0000	0.0000	0.0000	0.3088	0.00241	0.311
07:00:00	0.0000	0.0000	0.0000	0.2496	0.00238	0.252
07:30:00	0.0000	0.0000	0.0000	0.1938	0.00235	0.196
08:00:00	0.0000	0.0000	0.0000	0.1440	0.00233	0.146
08:30:00	0.0000	0.0000	0.0000	0.1008	0.0023	0.103
09:00:00	0.0000	0.0000	0.0000	0.0645	0.00228	0.0668
09:30:00	0.0000	0.0000	0.0000	0.0372	0.00226	0.0394
10:00:00	0.0000	0.0000	0.0000	0.0196	0.00223	0.0218
10:30:00	0.0000	0.0000	0.0000	0.0094	0.00221	0.0116
11:00:00	0.0000	0.0000	0.0000	0.0038	0.00218	0.00603
11:30:00	0.0000	0.0000	0.0000	0.0011	0.00216	0.00329
12:00:00	0.0000	0.0000	0.0000	0.0001	0.00214	0.00224

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-4

Post-Development Runoff Volume Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:11:38 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	24.15	Total runoff (ML):	1.28
Total Rainfall (mm):	15.29	Total flow (ML):	1.40
Peak Rainfall (mm):	4.16	Peak flow (m ³ /s):	0.08

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.4369	0.0000	0.4369	0.0000	0.00277	0.00277
00:40:00	0.8198	0.0000	0.8198	0.0006	0.00273	0.00336
01:20:00	1.5243	0.0000	1.5243	0.0031	0.00269	0.00577
02:00:00	2.7845	0.0000	2.7845	0.0089	0.00265	0.0115
02:40:00	4.1582	0.0000	4.1582	0.0195	0.00261	0.0221
03:20:00	2.7845	0.0000	2.7845	0.0369	0.00257	0.0395
04:00:00	1.5243	0.0000	1.5243	0.0584	0.00254	0.0609
04:40:00	0.8198	0.0000	0.8198	0.0754	0.0025	0.0779
05:20:00	0.4369	0.0000	0.4369	0.0797	0.00247	0.0822
06:00:00	0.0000	0.0000	0.0000	0.0725	0.00243	0.0749
06:40:00	0.0000	0.0000	0.0000	0.0596	0.0024	0.062
07:20:00	0.0000	0.0000	0.0000	0.0457	0.00236	0.0481
08:00:00	0.0000	0.0000	0.0000	0.0324	0.00233	0.0348
08:40:00	0.0000	0.0000	0.0000	0.0210	0.0023	0.0233
09:20:00	0.0000	0.0000	0.0000	0.0119	0.00226	0.0142
10:00:00	0.0000	0.0000	0.0000	0.0058	0.00223	0.00807
10:40:00	0.0000	0.0000	0.0000	0.0025	0.0022	0.00471
11:20:00	0.0000	0.0000	0.0000	0.0009	0.00217	0.00306
12:00:00	0.0000	0.0000	0.0000	0.0002	0.00214	0.00233
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:11:56 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	53.08	Total runoff (ML):	2.82
Total Rainfall (mm):	33.61	Total flow (ML):	2.94
Peak Rainfall (mm):	9.14	Peak flow (m ³ /s):	0.18

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	0.9605	0.0000	0.9605	0.0000	0.00277	0.00277
00:40:00	1.8022	0.0000	1.8022	0.0014	0.00273	0.00411
01:20:00	3.3510	0.0000	3.3510	0.0068	0.00269	0.00946
02:00:00	6.1213	0.0000	6.1213	0.0195	0.00265	0.0222
02:40:00	9.1412	0.0000	9.1412	0.0429	0.00261	0.0455
03:20:00	6.1213	0.0000	6.1213	0.0812	0.00257	0.0838
04:00:00	3.3510	0.0000	3.3510	0.1283	0.00254	0.131
04:40:00	1.8022	0.0000	1.8022	0.1658	0.0025	0.168
05:20:00	0.9605	0.0000	0.9605	0.1752	0.00247	0.178
06:00:00	0.0000	0.0000	0.0000	0.1594	0.00243	0.162
06:40:00	0.0000	0.0000	0.0000	0.1311	0.0024	0.133
07:20:00	0.0000	0.0000	0.0000	0.1005	0.00236	0.103
08:00:00	0.0000	0.0000	0.0000	0.0713	0.00233	0.0737
08:40:00	0.0000	0.0000	0.0000	0.0461	0.0023	0.0484
09:20:00	0.0000	0.0000	0.0000	0.0262	0.00226	0.0285
10:00:00	0.0000	0.0000	0.0000	0.0128	0.00223	0.0151
10:40:00	0.0000	0.0000	0.0000	0.0055	0.0022	0.00772
11:20:00	0.0000	0.0000	0.0000	0.0020	0.00217	0.00412
12:00:00	0.0000	0.0000	0.0000	0.0004	0.00214	0.00257
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:12:11 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	72.74	Total runoff (ML):	3.87
Total Rainfall (mm):	46.06	Total flow (ML):	3.99
Peak Rainfall (mm):	12.53	Peak flow (m ³ /s):	0.24

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	1.3163	0.0000	1.3163	0.0000	0.00277	0.00277
00:40:00	2.4697	0.0000	2.4697	0.0019	0.00273	0.00463
01:20:00	4.5921	0.0000	4.5921	0.0093	0.00269	0.012
02:00:00	8.3885	0.0000	8.3885	0.0267	0.00265	0.0294
02:40:00	12.5269	0.0000	12.5269	0.0588	0.00261	0.0614
03:20:00	8.3885	0.0000	8.3885	0.1113	0.00257	0.114
04:00:00	4.5921	0.0000	4.5921	0.1759	0.00254	0.178
04:40:00	2.4697	0.0000	2.4697	0.2272	0.0025	0.23
05:20:00	1.3163	0.0000	1.3163	0.2401	0.00247	0.243
06:00:00	0.0000	0.0000	0.0000	0.2184	0.00243	0.221
06:40:00	0.0000	0.0000	0.0000	0.1796	0.0024	0.182
07:20:00	0.0000	0.0000	0.0000	0.1377	0.00236	0.14
08:00:00	0.0000	0.0000	0.0000	0.0978	0.00233	0.1
08:40:00	0.0000	0.0000	0.0000	0.0632	0.0023	0.0655
09:20:00	0.0000	0.0000	0.0000	0.0360	0.00226	0.0382
10:00:00	0.0000	0.0000	0.0000	0.0176	0.00223	0.0198
10:40:00	0.0000	0.0000	0.0000	0.0076	0.0022	0.00977
11:20:00	0.0000	0.0000	0.0000	0.0027	0.00217	0.00485
12:00:00	0.0000	0.0000	0.0000	0.0006	0.00214	0.00273
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:12:27 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	132.58	Total runoff (ML):	7.05
Total Rainfall (mm):	83.94	Total flow (ML):	7.17
Peak Rainfall (mm):	22.83	Peak flow (m ³ /s):	0.44

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BFO (m ³ /s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
00:00:00	2.3990	0.0000	2.3990	0.0000	0.00277	0.00277
00:40:00	4.5010	0.0000	4.5010	0.0035	0.00273	0.00619
01:20:00	8.3690	0.0000	8.3690	0.0169	0.00269	0.0196
02:00:00	15.2880	0.0000	15.2880	0.0487	0.00265	0.0514
02:40:00	22.8301	0.0000	22.8301	0.1071	0.00261	0.11
03:20:00	15.2880	0.0000	15.2880	0.2028	0.00257	0.205
04:00:00	8.3690	0.0000	8.3690	0.3205	0.00254	0.323
04:40:00	4.5010	0.0000	4.5010	0.4140	0.0025	0.417
05:20:00	2.3990	0.0000	2.3990	0.4375	0.00247	0.44
06:00:00	0.0000	0.0000	0.0000	0.3980	0.00243	0.4
06:40:00	0.0000	0.0000	0.0000	0.3274	0.0024	0.33
07:20:00	0.0000	0.0000	0.0000	0.2509	0.00236	0.253
08:00:00	0.0000	0.0000	0.0000	0.1782	0.00233	0.18
08:40:00	0.0000	0.0000	0.0000	0.1152	0.0023	0.118
09:20:00	0.0000	0.0000	0.0000	0.0655	0.00226	0.0678
10:00:00	0.0000	0.0000	0.0000	0.0321	0.00223	0.0343
10:40:00	0.0000	0.0000	0.0000	0.0138	0.0022	0.016
11:20:00	0.0000	0.0000	0.0000	0.0049	0.00217	0.00705
12:00:00	0.0000	0.0000	0.0000	0.0011	0.00214	0.00321
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

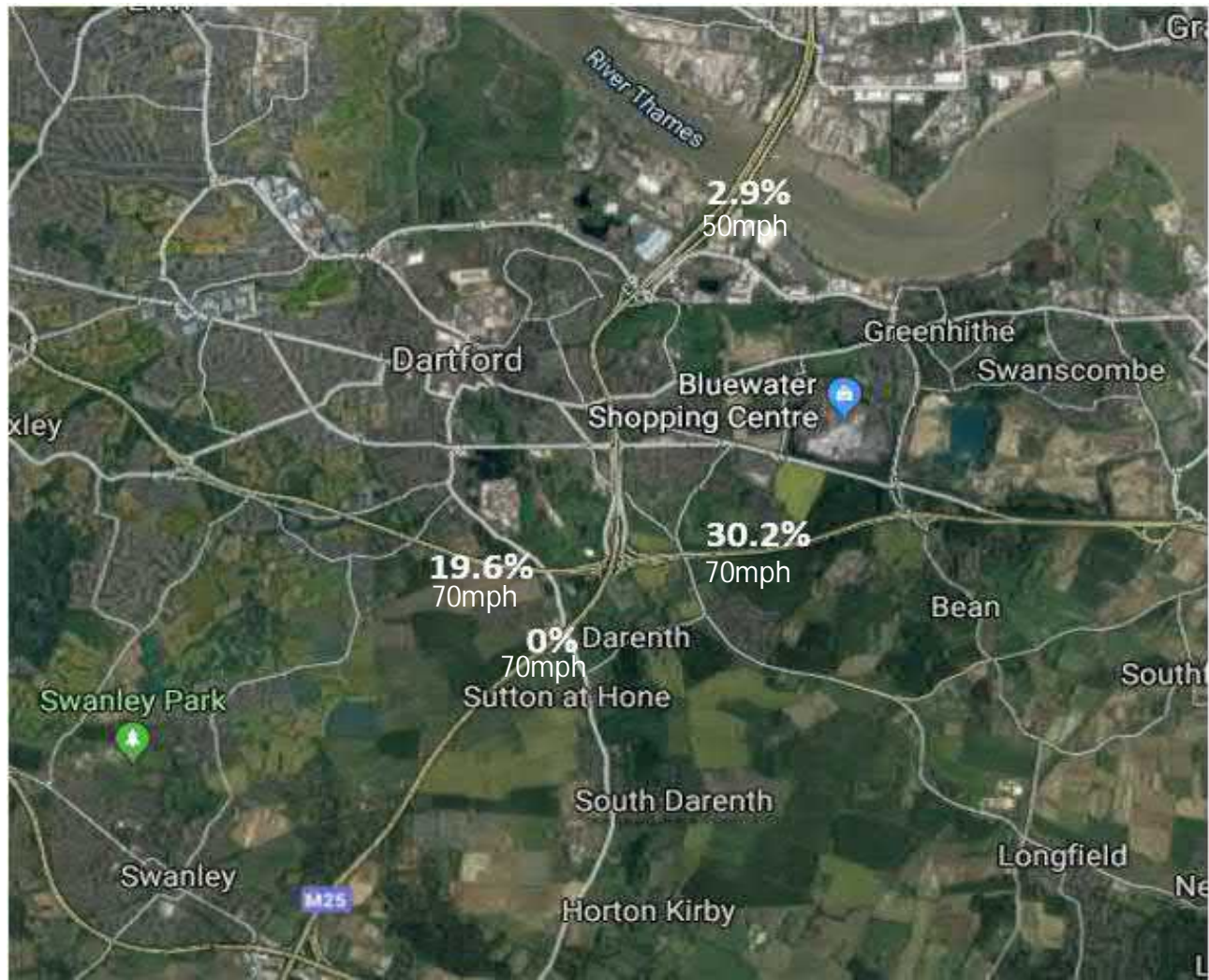
Appendix 10.A – Traffic Scenario

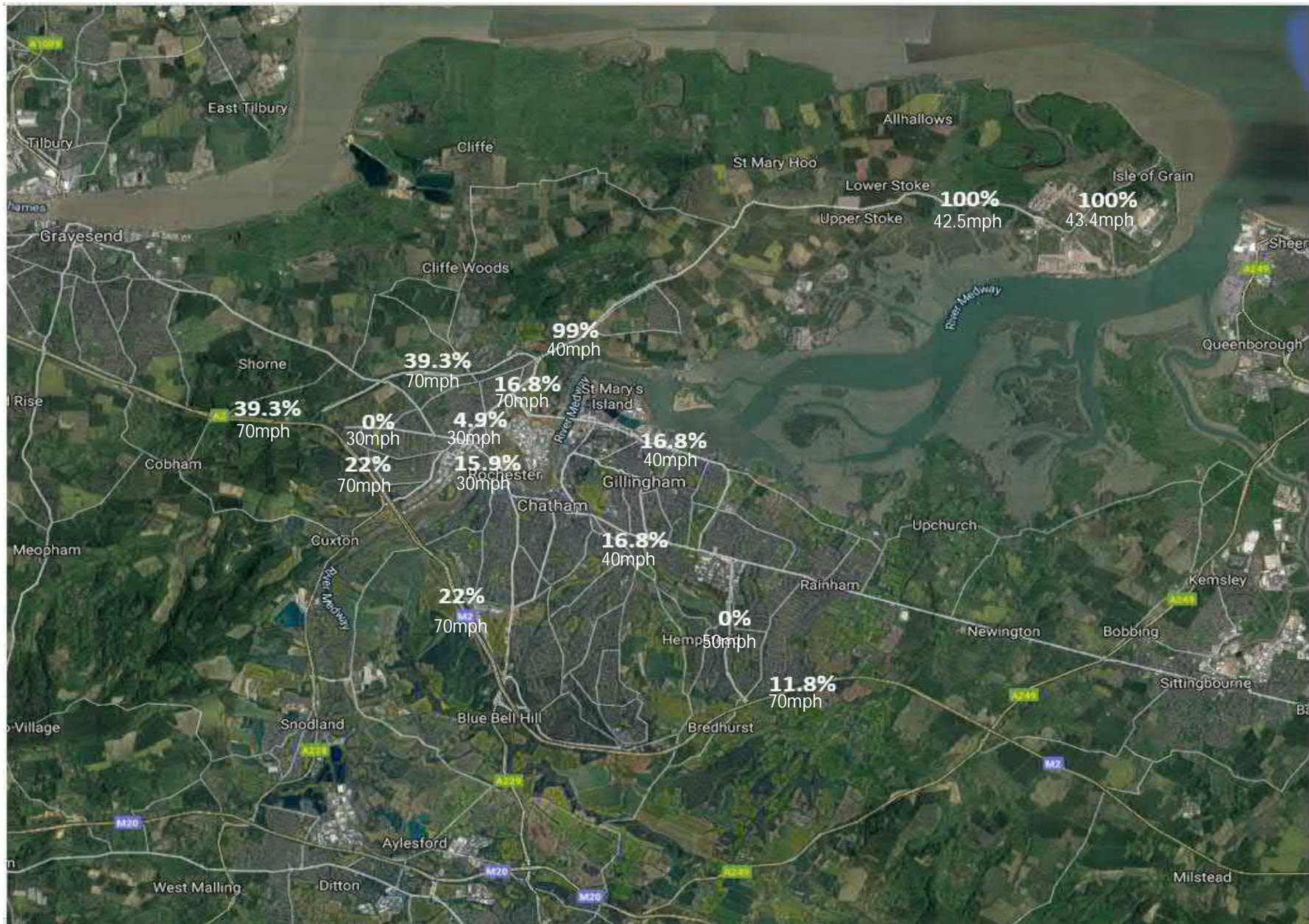
AADT

*baseline taken from ATCs and DFT counter points, see AADT Raw)

2021 and 2023 factored up using Tempo, see future years sheet

DFT CourCount Number	Location	Av. Speed	Base Year of Survey	Dev. Distribution	2021									2023											
					Base Year			Baseline			With Construction			Increase			Baseline			With Construction			Increase		
					HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %
N/A	ATC 1 B2001 Power Station Road	43.4mph	2018	0.0%	390	2946	13.2%	410	3099	13.2%	410	3099	13.2%	0.0%	0.0%	422	3188	13.2%	422	3188	13.2%	0.0%	0.0%		
N/A	ATC 2 A228 Grain Road Lower St	42.5mph	2018	100.0%	312	2947	10.6%	328	3100	10.6%	423	3275	12.9%	28.9%	5.6%	338	3189	10.6%	433	3364	12.9%	28.1%	5.5%		
N/A	ATC 3 B2001 W of Access	37.0mph	2017	100.0%	818	4241	19.3%	861	4462	19.3%	956	4637	20.6%	11.0%	3.9%	885	4590	19.3%	980	4765	20.6%	10.7%	3.8%		
56776	1 A228 Grain Road	*40mph	2017	100.0%	1584	8582	18.5%	1695	9181	18.5%	1790	9356	19.1%	5.6%	1.9%	1714	9444	18.2%	1809	9619	18.8%	5.5%	1.9%		
56827	2 A228 Four Elms Hill Beaco	*40mph	2017	99.0%	1355	33024	4.1%	1491	35329	4.1%	1585	35502	4.5%	6.3%	0.5%	1466	36343	4.0%	1560	36516	4.3%	6.4%	0.5%		
70385	3 A289 Wainscott Primary Sr	*70mph	2017	16.8%	2169	43021	5.0%	2387	46024	5.0%	2403	46053	5.2%	0.7%	0.1%	2347	47345	5.0%	2363	47374	5.0%	0.7%	0.1%		
56816	4 A228 Frindsbury Road	*30mph	2017	4.9%	376	15904	2.4%	414	17014	2.4%	418	17023	2.5%	1.1%	0.1%	407	17502	2.3%	412	17511	2.4%	1.2%	0.0%		
70384	5 A2 Chatham Docks	*40mph	2017	16.8%	686	34242	2.0%	755	36632	2.0%	771	36661	2.1%	2.1%	0.1%	742	37683	2.0%	758	37713	2.0%	2.1%	0.1%		
70386	6 A2 opposite Featherby Rd	*40mph	2017	16.8%	594	34882	1.7%	654	37317	1.7%	670	37346	1.8%	2.4%	0.1%	643	38388	1.7%	659	38417	1.7%	2.5%	0.1%		
70381	7 A289 between A226 and B	*70mph	2017	39.3%	3313	52386	6.3%	3646	56043	6.3%	3683	56111	6.6%	1.0%	0.1%	3585	57651	6.2%	3623	57720	6.3%	1.0%	0.1%		
56415	8 A228 Gun Lane	*30mph	2017	0.0%	146	6787	2.2%	161	7261	2.2%	161	7261	2.2%	0.0%	0.0%	158	7469	2.1%	158	7469	2.1%	0.0%	0.0%		
6099	9 Rochester Bridge	*30mph	2017	15.9%	448	35138	1.3%	493	37591	1.3%	508	37618	1.4%	3.1%	0.1%	485	38669	1.3%	500	38697	1.3%	3.1%	0.1%		
56008	10 M2 btwn J1 & J2	*70mph	2017	22.0%	10650	100486	10.6%	11720	107500	10.6%	11741	107538	10.9%	0.2%	0.0%	11525	110585	10.4%	11546	110623	10.4%	0.2%	0.0%		
6010	11 M2 btwn J2 & J3	*70mph	2017	22.0%	9823	99296	9.9%	10810	106227	9.9%	10831	106265	10.2%	0.2%	0.0%	10630	109275	9.7%	10651	109314	9.7%	0.2%	0.0%		
73645	12 M2 btwn J4 & J5	*70mph	2017	11.8%	6928	69055	10.0%	7624	73875	10.0%	7636	73896	10.3%	0.1%	0.0%	7497	75995	9.9%	7509	76016	9.9%	0.1%	0.0%		
78142	13 A287 btwn A2 & M2	*50mph	2017	0.0%	1146	35681	3.2%	1261	38172	3.2%	1261	38172	3.3%	0.0%	0.0%	1240	39267	3.2%	1240	39267	3.2%	0.0%	0.0%		
36100	14 A2 w of J1 of M2	*70mph	2017	39.3%	10217	126325	8.1%	11244	135142	8.1%	11281	135211	8.3%	0.3%	0.1%	11057	139021	8.0%	11094	139090	8.0%	0.3%	0.0%		
16092	15 A2 btwn M25 & B255	*70mph	2017	30.2%	10849	131863	8.2%	11939	141067	8.2%	11968	141120	8.5%	0.2%	0.0%	11741	145115	8.1%	11769	145168	8.1%	0.2%	0.0%		
38792	16 A282 Dartford Crossing	*50mph	2014	2.9%	18578	115926	16.0%	20848	130092	16.0%	20851	130097	16.0%	0.0%	0.0%	20105	133825	15.0%	20108	133830	15.0%	0.0%	0.0%		
7824	17 M25 S of A2	*70mph	2017	0.0%	13997	114976	12.2%	15404	123001	12.2%	15404	123001	12.5%	0.0%	0.0%	15148	126531	12.0%	15148	126531	12.0%	0.0%	0.0%		
36099	18 A2 W of M25	*70mph	2017	19.6%	4919	108301	4.5%	5413	115860	4.5%	5432	115895	4.7%	0.3%	0.0%	5323	119185	4.5%	5342	119219	4.5%	0.3%	0.0%		
Client: Neuconnect											Title: 24 hr AADT Traffic Flows						AECOM								
Project: Isle of Grain, Kent											Revision: 29/05/2019						Drawn: MB Checked: PK Approved: JS								





Appendix 11.A – Environmental Liability Desk Study

J Clubb Limited & E.E.M. Limited Land, Isle of Grain

Environmental Liability Review
Proposed Sub-Sea Cable Landfall Site

NeuConnect Britain Limited

Project number: 60571593

16 August 2018

Quality information

Prepared by	Checked by	Verified by	Approved by
Kirsten O'Donnell Senior Geo-environmental Specialist Kevin Shepherd Associate Geoscientist	Mike Nutting Technical Director	Phil Tyson Technical Director	Phil Tyson Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Rev0	16 August 2018	First Issue		Phil Tyson	Technical Director

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LIMITATIONS

AECOM Limited (“AECOM”) has prepared this Report for the sole use of NeuConnect Britain Limited (“Client”) in accordance with the terms and conditions of appointment (Agreement for the provision of Environmental and Planning Consultancy Services between NeuConnect Britain Limited and AECOM Limited dated 23rd March 2018). No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report may not be relied upon by any other party without the prior and express written agreement of AECOM.

Where any conclusions and recommendations contained in this Report are based upon information provided by others, it has been assumed that all relevant information has been provided by those parties and that such information is accurate. Any such information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between May 2018 and August 2018 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

It should be noted that the effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance values are potentially subject to change. The conclusions presented herein are based on the guidance values available at the time this Report was prepared, however, no liability by AECOM can be accepted for the retrospective effects of any changes or amendments to these values.

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Reference to historical Ordnance Survey (OS) maps and/or data provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between the release of successive maps and/or data.

Costs may vary outside the ranges quoted. Whilst cost estimates are provided for individual issues in this Report these are based upon information at the time which can be incomplete. Cost estimates for such issues may therefore vary from those provided. Where costs are supplied, these estimates should be considered in aggregate only. No reliance should be made in relation to any division of aggregate costs, including in relation to any issue, site or other subdivision.

No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made, these are based upon measures which, in AECOM's experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non-technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

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Table of Contents

1.	Introduction.....	2
1.1	General Introduction.....	2
1.2	Background.....	2
1.3	Objectives.....	3
1.4	Scope of Work.....	4
1.5	Sources of Information.....	4
2.	Site Setting.....	5
2.1	Introduction.....	5
2.2	Site History – On-Site.....	5
2.2.1	Perry’s Farm.....	5
2.2.2	J Clubb and E.E.M. Land.....	6
2.3	Site History – Off-Site.....	7
2.4	Potentially Contaminative Activities.....	7
2.5	Environmental Setting.....	10
2.6	Summary.....	13
3.	Landfill and Waste Management Operations.....	14
3.1	Introduction.....	14
3.2	Overview.....	14
3.2.1	Initial Operation.....	15
3.2.2	Later Operation.....	15
3.2.3	Current Status.....	15
3.2.4	Permit Variations.....	15
3.2.5	Permit Compliance.....	15
3.2.6	Monitoring.....	15
3.2.7	Subsistence and Financial Provision.....	17
3.2.8	Permit Transfer, Closure and Surrender.....	17
3.3	Area-Specific Details.....	17
3.3.1	Area 1.....	17
3.3.2	Area 2.....	18
3.3.3	Area 3.....	18
3.4	Transfer, Closure and Surrender.....	18
3.4.1	Transfer.....	18
3.4.2	Closure.....	18
3.4.3	Surrender.....	19
3.5	Summary.....	19
4.	Preliminary Conceptual Site Model and Risk Assessment.....	20
4.1	Approach.....	20
4.2	Potential Sources.....	20
4.3	Chemicals of Potential Concern (COPC).....	21
4.4	Potential Pathways.....	21
4.5	Potential Receptors.....	22
4.6	Review of Potential Source-Pathway-Receptor Linkages.....	23
5.	Preliminary Ground Constraints Review.....	26
5.1	Introduction.....	26
5.2	Perry’s Farm Land Parcel.....	26
5.3	E.E.M Limited Land Parcel and J Clubb Land Parcel.....	28
6.	Environmental Liability Review.....	29
6.1	Introduction.....	29
6.2	Identified Potential Liabilities.....	29

6.2.1	Perry's Farm Land Parcel	29
6.2.2	E.E.M Limited Land Parcel and J Clubb Land Parcel	31
7.	Conclusions and Recommendations	32
7.1	Conclusions	32
7.1.1	Perry's Farm	32
7.1.2	E.E.M Limited J Clubb Land.....	33
7.2	Recommendations	34
7.2.1	Perry's Farm Land Parcel	34
7.2.2	Cable Route Land	35
Appendix A – Figures		36
Appendix B – Document Request.....		37
Appendix C – Document Review List.....		38
Appendix D – [REDACTED].....		39

Figures

Figure A: Site Layout.....	2
Figure B: Perry's Farm Permit Area and Reported Historical Landfills	6
Figure C: Environmentally Sensitive Areas and Surface Water Features	13
Figure D: Perry's Farm Landfill Layout and Infrastructure	14

Tables

Table A – Site Information.....	3
Table B – On-Site Regulatory Information	8
Table C – Off-Site Regulatory Information (within 500m of whole site).....	9
Table D – Site Surface	10
Table E – Surrounding Land Use.....	10
Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology	10
Table G – Human Health and Property CSM.....	23
Table H – Controlled Waters and Ecological Receptors CSM.....	25
Table I: Potential Liabilities Identified in Relation to the Perry's Farm Landfill Site	29

Executive Summary

This report presents the findings of a review of potential environmental liabilities that could be incurred by NeuConnect Britain Limited (NeuConnect) if it acquires the land at, and to the north of, Perry's Farm, Isle of Grain, Kent, UK for a proposed a sub-sea cable landfall site. It has been prepared on behalf of NeuConnect by AECOM Limited (AECOM) under project number 60571593 and the associated contractual terms.

NeuConnect is planning to acquire three parcels of land on the Isle of Grain, Kent in which to develop the UK landfall site for the sub-sea cable. Based on information provided by NeuConnect, these are:

- Perry's Farm: Land parcel to be acquired from J Clubb Limited (J Clubb) and a private farm landowner in which the cable route, converter station and substation would be developed. This parcel is sub-divided into 'Area 1', 'Area 2' and 'Area 3';
- J Clubb Land: Land parcel to be acquired from J Clubb Limited in which the cable route would be developed; and
- E.E.M. Land: Land parcel to be acquired from E.E.M. Limited in which the cable route would be developed.

The objective of the due diligence study is to assess environmental liabilities associated with the three parcels of land to inform NeuConnect's negotiation of the Option Agreements for the purchase of the land. Potential ground constraints on the proposed development have also been identified. This was achieved through a desktop review of relevant data sources.

Perry's Farm

The key liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

The review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous release of leachate at the landfill surface. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater. A notice of non-compliance against the permit was issued by the Environment Agency (EA) in 2018, but has since been discharged. Measures have been implemented (drainage and the installation of a 'siltbuster') to address this, and further treatment is proposed (polishing lagoons). However, the EA has also raised the prospect of re-capping the landfill site (for Area 1).

With the Perry's Farm landfill and associated permit still operational, although not currently receiving waste, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [REDACTED]

J Clubb and E.E.M. Land

For the E.E.M. and J Clubb land parcels (cable route) to the north of Perry's Farm landfill, the relevant regulatory regime in relation to risks from land contamination is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas relate to risks to sensitive receptors from possible sources of ground contamination due to previous land use. [REDACTED]

1. Introduction

1.1 General Introduction

This report presents the findings of a review of potential environmental liabilities that could be incurred by NeuConnect Britain Limited (NeuConnect) if it acquires the land at, and to the north of, Perry's Farm, Isle of Grain, Kent, UK for a proposed a sub-sea cable landfall site. It has been prepared on behalf of NeuConnect by AECOM Limited (AECOM) under project number 60571593 and the associated contractual terms.

1.2 Background

NeuConnect is planning to acquire three parcels of land on the Isle of Grain, Kent on which to develop the UK landfall site for the sub-sea cable. Based on information provided by NeuConnect, these are:

- **Perry's Farm:** Land parcel to be acquired from J Clubb Limited (J Clubb) and a private farm landowner in which the cable route (understood likely to be below ground), converter station and substation would be developed. This parcel is sub-divided into 'Area 1', 'Area 2' and 'Area 3';
- **J Clubb Land:** Land parcel to be acquired from J Clubb Limited in which the cable route would be developed; and
- **E.E.M. Land:** Land parcel to be acquired from E.E.M. Limited in which the cable route would be developed.

These parcels of land are shown on **Figure A** and described in more detail in **Table A** below,

Figure A: Site Layout

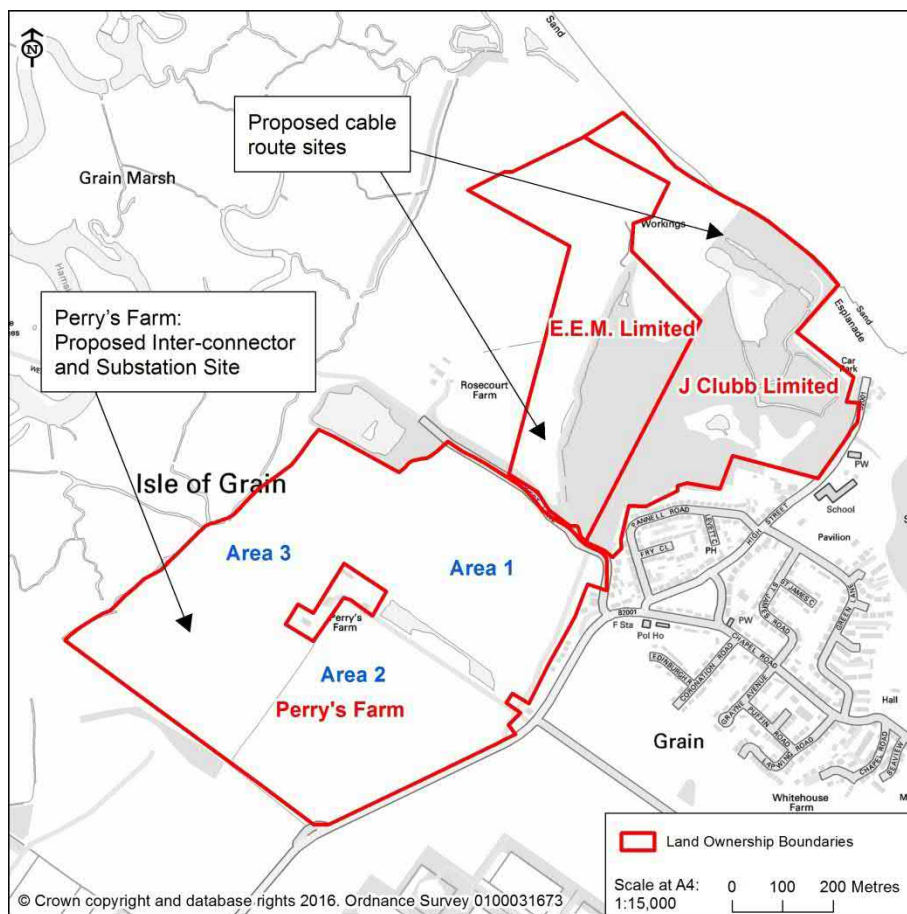


Table A – Site Information

Site Name	Proposed Landfall Sites, Isle of Grain
Site Operation	<p>Perry's Farm is currently an active landfill site, but is understood to be no longer receiving waste, with some areas have been returned to agricultural use, and others never developed from agricultural use. This area is largely owned by J Clubb. However there is a farm property in the centre of the overall parcel which is not owned by J Clubb; details of current ownership not provided to AECOM.</p> <p>J Clubb Land is a second land parcel owned by J Clubb. This parcel is not part of the active landfill site, but is adjacent and to the northeast of it.</p> <p>The northern part of the parcel is understood to contain former sand and gravel workings, with a water body occupying a former quarry and a current, loading / storage / parking area at the northern boundary, on the coast. Based on review of aerial photography, the central part of the land parcel appears to be heavily vegetated and undeveloped, apart from possible agricultural use.</p> <p>E.E.M Land lies directly west of J Clubb Land and forms part of the same former sand and gravel workings, located in the northern part of the land parcel. Three water bodies occupy the former workings, one of which is largely off-site. It is understood that the discharge to surface water from the leachate management treatment plant ('siltbuster') discharges to the main water body.</p> <p>A track runs through the central / southern part of the land parcel from Perry's Farm to the south, running northwards to the loading / storage / parking area in the adjacent J Clubb Land. Based on review of aerial photography, east of the track, the land is heavily vegetated, while the land to the west appears to be cultivated agricultural fields.</p> <p>It is understood that a variation to the Environmental Permit for the waste operation at Perry's Farm was submitted in 2017 to extend the permitted area into this land parcel. The purpose of the variation was to use the southern part of the land to construct a secondary treatment system for landfill leachate.</p>
Site Location	The site is located to the west and northwest of the village of Isle of Grain, which is at the easternmost point of the Hoo Peninsula in Medway, Kent. The site is bounded by the B2001 road to the south. West Lane runs through the centre of the site.
Grid Reference (easting and northing)	The site is centred approximately around National Grid Reference 588100 / 176700.
Reported Site Area	Approximately 80 hectares

The site location and layout, including the boundaries of the areas subject to the proposed land acquisition, is shown on **Figure 1** (see **Appendix A**).

1.3 Objectives

The objective of due diligence study is to assess potential environmental liabilities associated with the three parcels of land to inform NeuConnect's negotiation of the Option Agreements for the land. This includes consideration of:

- Liabilities associated with the acquisition of an permitted, operational, landfill site at Perry's Farm;
- Liability for potential soil and groundwater contamination associated with the Perry's Farm land;
- Liability for the historical landfills and potential soil and groundwater contamination associated with the cable route sites; and
- Options going forwards regarding liability and land-blight (land-use) management, e.g. reduction of permit area for Perry's Farm to more tightly encompass deposited waste, thus de-blighting virgin land.

1.4 Scope of Work

The Scope of Work for this Phase 1 Assessment includes:

- Completion of a desktop review of relevant data sources;
- Development of a Preliminary Conceptual Site Model;
- Completion of a Preliminary Risk Assessment with respect to risks from existing soil and groundwater contamination ;
- Completion of a preliminary review of ground conditions that could impose constraints upon the proposed landfall site; and
- Identification of potential environmental liabilities and management options.

This assessment has been limited to desk-based review of available information and discussion of the site with current owner and operator, J Clubb. Due to access constraints, it was not possible to complete a site walkover during the assessment.

1.5 Sources of Information

This report is based on information provided by the client as well as publically accessible sources of information.

AECOM has reviewed relevant documentation provided by J Clubb in relation to the site. These were obtained via the following sources:

- Via NeuConnect upon project commencement;
- Via email from J Clubb on 8th June 2018;
- Via NeuConnect's solicitor on 18th June 2018; and
- At a meeting between AECOM and J Clubb at the latter's office on 22nd June 2018.

The majority of the documents were obtained during the meeting on the 22nd June, during which J Clubb provided AECOM with an overview of the site history and current status, and answered questions about these aspects. A copy of AECOM's original document request is presented in **Appendix B**, and a list of documents provided is presented in **Appendix C**. References to documents in **Appendix C** within the report text are by the ref. number assigned to each document in the appendix (e.g.: ref. 02, 03).

Written responses to AECOM's request for information (RFI) were also provided by J Clubb and its consultant, WSP. These are presented in **Appendix D**.

Publically available sources of information consulted were as follows:

- Data obtained from public sources via Landmark in Geographic Information System (GIS) format (Landmark Envirocheck);
- British Geological Survey (BGS) Onshore GeoIndex website (<http://mapapps2.bgs.ac.uk/geoindex/home.html>) accessed June 2018;
- The Department for Environment, Food and Rural Affairs (DEFRA) MAGIC interactive mapping tool (<http://magic.defra.gov.uk/MagicMap.aspx>), accessed June 2018;
- Google maps (www.maps.google.co.uk), accessed June 2018;
- Details of establishments that are covered by the Control of Major Accident Hazards (COMAH) Regulations 2015 (<http://www.hse.gov.uk/comah/comah-establishments.htm>, accessed August 2018); and
- Aerial photography for 1940 to 2017, available via Google Earth Pro.

2. Site Setting

2.1 Introduction

This section presents a summary of the site history and environmental setting. This information will then provide the basis for assessing the environmental risks posed by the site, or surrounding land that may be impacting upon the site and giving rise to potential liabilities.

For the purpose of this assessment, the “site” refers to the overall landfall site, which comprises all three land parcels described in **Section 1.2**.

2.2 Site History – On-Site

A summary of the site history is provided below. This is based on documentation and information provided by J Clubb, aerial photography, plus historical mapping of the site obtained as points of interest data via Landmark.

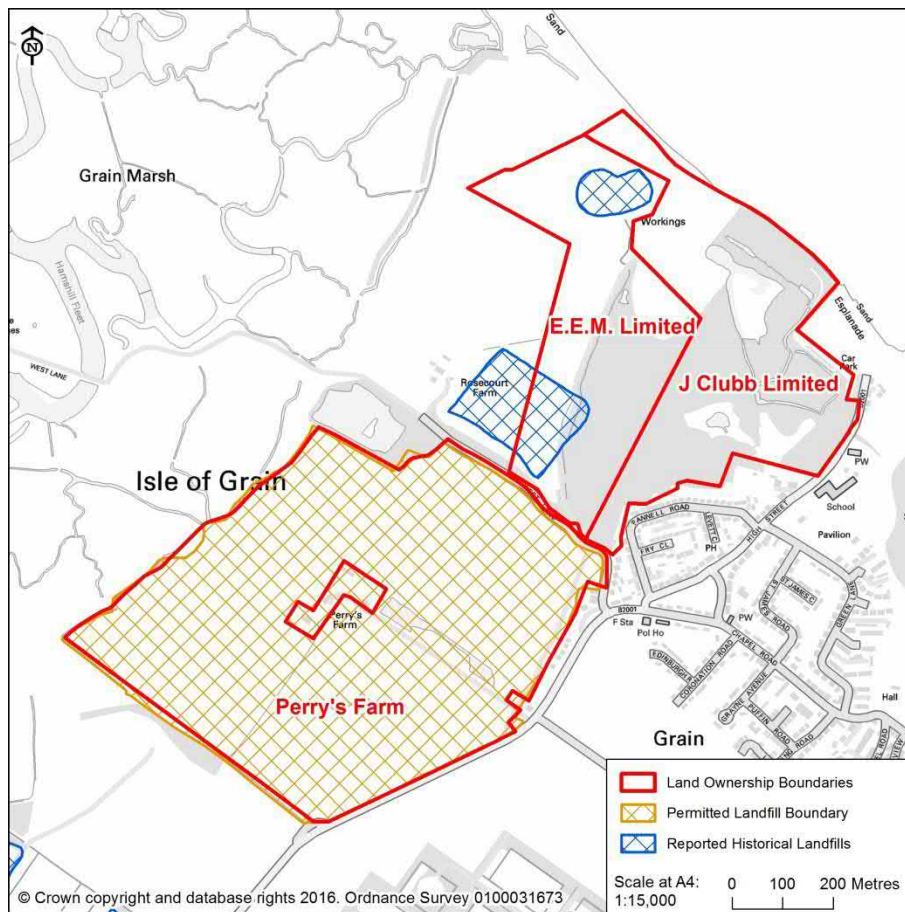
2.2.1 Perry’s Farm

The Perry’s Farm land parcel was historically quarried for sand and gravel, and is currently comprises a permitted landfill, operated in the past by J Clubb, although it is not currently receiving waste. The boundary of the Perry’s Farm land (as shown on **Figure A**) corresponds to the Permitted Boundary of the Landfill.

In summary, the history of the Perry’s Farm land parcel is as follows:

- J Clubb acquired the site in the late 1980s (ref. 02, 03). Prior to this, available aerial photography and mapping indicates the site to have comprised agricultural land;
- Planning permission for aggregate extraction and backfilling with waste was granted in 1990 by Kent County Council (KCC) (ref. 04);
- The site is reported to have been licensed to accept cement precipitator waste (also known as CDK, cement kiln dust, used hereafter) in 1990 (ref. 09) and the site continued to do so until 1999, ending due to cessation of cement manufacture by the waste producer;
- An Environmental Permit (ref. BP3335SR) was issued for the Perry’s Farm landfill on 9th November 2005 (ref. 11). Further details of the permitting and operation of the landfill are presented in **Section 3**.

Figure B: Perry's Farm Permit Area and Reported Historical Landfills



The Perry's farm land parcel comprises three areas (shown on **Figure A**):

- The north-eastern area (**Area 1**) is reported to have been worked for sand and gravel extraction, landfilled with CKD, covered (capped) with clay and restoration topsoil, and then returned to agricultural use;
- The south-eastern area (**Area 2**) has been worked for sand and gravel, was still nominally operational (receiving waste) as of May 2017, although it is understood no waste has been deposited since;
- The western part of the Perry's Farm land parcel (**Area 3**) is understood to comprise agricultural land from which sand and gravel have never been extracted due to limited sand and gravel reserves in this part of the site. However, despite not forming part of the current or restored landfill, it still lies within the extent of the site's Environmental Permit, as authorised by the EA, and will be subject to the same regulatory controls as the rest of the Perry's Farm landfill.

2.2.2 J Clubb and E.E.M. Land

This area is understood to have been worked for sand and gravel and has been restored. In summary, its history is as follows:

- Planning permission for extraction of sand and gravel was granted to Clubb Estates Limited by KCC in 1977 for a site identified as Whitehall Farm. The former location of the farm is within the J Clubb Limited land. The former workings in both this and the E.E.M. Limited land are referred to as Whitehall Farm in documents provided by J Clubb for review (ref. 16);
- Prior to this, available aerial photography and mapping indicates the site to have comprised mostly agricultural land, with a possible military installation present along the shoreline in 1940 (photographs obtained via Google Earth Pro);
- Washing plant is reported within this area during the extraction of aggregate at the sand and gravel workings at the Perry's Farm land. Material is understood to have been transferred to the washing plant via

a conveyor located along the eastern edge of the Perry's Farm workings. This passed under West Lane via a culvert, which is still present;

- Despite the reported historical landfills in this area (see
- **Figure B and Table B**) after being worked for sand and gravel it is reported to have been restored to a lower level than the surrounding land rather than used for waste deposition (ref. 16 and written response from WSP [**Appendix D**]). J Clubb also stated that no waste had been deposited in this Area at the meeting on 22nd June 2018.

2.3 Site History – Off-Site

The area surrounding the whole site appears to have comprised a mixture of industrial, residential and agricultural / natural land uses. Tanks associated with an oil refinery / storage depot, were developed within 100 m southeast of the Perry's Farm land by 1960. A historical railway station was located at the head of a pier on the River Medway estuary to the south of the site until 1951 (Port Victoria Railway Station). Two historical landfills are indicated to the southwest of the site.

The main industrial area is to the south and southeast of the site. Current operators include:

- National Grid LNG Terminal;
- BP Aviation Bitumen Terminal;
- SSE Plc, Medway Power Station;
- Midland Steel Reinforcement Supplies;
- London Thamesport Ltd (shipping company).

Note: whilst all of these operations may not necessarily be close enough to the landfall site to be of concern for assessment of potentially contaminative activities, it is noted that some fall under the COMAH Regulations (2015). As such, proximity between them and the landfall site could be a consideration under the Planning Regime. Details as recorded in the Public Information Record are given below (distances based on post code entries for each establishment as given in the Public Information Record; actual establishment boundaries may be closer):

- National Grid Grain LNG Limited, Isle of Grain LNG Site Upper Tier, for fuel storage/distribution, 1.4 km southwest. In the case of this establishment, the boundary may lie within 500 m of Perry's Farm;
- BP Oil UK Limited, Isle of Grain, Upper Tier, for fuel storage/distribution, 1.8 km southwest;
- Monarch Chemicals Limited, Sheerness, Lower Tier, for chemical installations, 3.7 km northwest;
- Aesica Queenborough Limited, Queenborough, Lower Tier, for production of pharmaceuticals, 4.5 km northwest.

2.4 Potentially Contaminative Activities

A summary of regulatory information and other land use information is provided in **Table B** and **Table C** below. This is based on the Envirocheck GIS data and supplementary information taken from the review of documents provided by J Clubb. The information is limited to the categories provided in the GIS layers and a search radius of 500m from the full extent of the site.

Only features that are considered to be potentially relevant to the environmental or geotechnical constraints at the site have been included in the tables below.

Table B – On-Site Regulatory Information

Discharge Consents	<ul style="list-style-type: none"> No entries
Pollution Incidents	<ul style="list-style-type: none"> No entries
Pollution Incidents Register	<p>Perry's Farm:</p> <ul style="list-style-type: none"> Pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 19/09/2013
Integrated Pollution Prevention Controls	<p>Perry's Farm:</p> <ul style="list-style-type: none"> Two entries for J Clubb Limited, ref. BP3335SR, effective date 31/03/2008 and YP3733MV (both listed as revoked)
Registered and Historical Landfill Sites	<p>Perry's Farm:</p> <ul style="list-style-type: none"> J Clubb Ltd, Perry's Farm. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Operational as far as is known (since 1996). Reference: P/03/34. In addition, there is a superseded record (from 1990) for this ref. stating large input (Equal to or greater than 75,000 and less than 250,000 tonnes per year), with no known restriction on source of waste. <p>J Clubb and E.E.M. land:</p> <ul style="list-style-type: none"> J Clubb Ltd, Whitehall Farm. Deposited waste included inert waste. First input 1983, last input 1993. References: EAHL19253 & P/06/25, P/03/25, 21DP. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Licence lapsed/cancelled/defunct/not applicable/surrendered.
Licensed Waste Management Facilities	<p>Perry's Farm:</p> <ul style="list-style-type: none"> J Clubb Limited (expired). Class: A4: Household, Commercial & Industrial Waste Landfill, ref. 19397. Issue date: 02/07/1990 J Clubb Limited (modified). Process: Inert Landfill. Issue date: 09/11/2005; modified date: 12/05/2010
BGS Recorded Mineral Sites	<p>Perry's Farm:</p> <ul style="list-style-type: none"> Perry's Farm (ceased). Opencast, sand and gravel, ref 50748 Perry's Farm Quarry (dormant). Opencast, sand and gravel, ref 5882 <p>J Clubb Land:</p> <ul style="list-style-type: none"> Rose Court Farm (ceased). Opencast, sand and gravel, ref 2527 <p>J Clubb and E.E.M. land:</p> <ul style="list-style-type: none"> Whitehall Farm Quarry (active). Opencast, common clay and shale, ref 2502 Rose Court Farm (ceased). Opencast, sand and gravel, ref 50746
Hazardous Substances Consents	<p>Perry's Farm:</p> <ul style="list-style-type: none"> Perry's Farm, storage of unknown hazardous substances (status unknown). Reference MC2007/2081, dated 21/12/2007
Historical Tanks	<ul style="list-style-type: none"> No entries
Trade Directory Entries	<p>J Clubb and E.E.M. land:</p> <ul style="list-style-type: none"> J Clubb Ltd. Office - sand, gravel and other aggregates (inactive)
Contaminative Land Uses	<p>Perry's Farm:</p> <ul style="list-style-type: none"> Drawings provided by J Clubb (ref. 05, 25) indicate an oil pipeline runs approximately northwest to southeast through the centre of the Perry's Farm land. This is reported to be disused <p>J Clubb Limited land:</p> <ul style="list-style-type: none"> Mineral railway (1908) in northeastern corner, running perpendicular to coastline Unspecified pit in centre of site (1968)
Points of Interest	<p>Perry's Farm:</p> <ul style="list-style-type: none"> 5no. entries for conveyors on Area 1 (manufacturing and production) 3no. entries for sand, gravel and clay extraction and merchants (sand pit) on Area 1 2no. electricity pylons in southern part of Area 1, running northwest to southeast. <p>J Clubb Limited land:</p> <ul style="list-style-type: none"> 2no. entries for conveyors (manufacturing and production) 1no. entry for sand, gravel and clay extraction and merchants (sand and gravel works) 1no. entry for DIY and Home Improvement (retail) in northwestern part of land parcel Electricity substation in northwestern part of J Clubb Land Weighbridge in northern part of J Clubb Land

Table B – On-Site Regulatory Information

	<p>E.E.M. land:</p> <ul style="list-style-type: none"> • 1no. entry for conveyors (manufacturing and production) • 2no. entries for sand, gravel and clay extraction and merchants (sand pit) (extractive industries)
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Table C – Off-Site Regulatory Information (within 500m of whole site)

Discharge Consents	<ul style="list-style-type: none"> • 455m southwest of Perry's Farm: CB&I UK Ltd. Domestic Property (single) (incl. farm house) at Isle of Grain tanks expansion [project adjacent to long storage] facility, Ref P20665. Discharge Type: sewage discharges – final / treated effluent – not water company. Receiving Water: The Millmarsh Fleet.
Pollution Incidents	<ul style="list-style-type: none"> • 140m northeast of J Clubb Land: Grain Village; Boats/Ships. Pollutant: Oil Slick / Oils – diesel (including agricultural), Date: 1993. Category 3 – Minor Incident.
Pollution Incident Register	<ul style="list-style-type: none"> • 55m northeast of Perry's Farm: pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 27/05/2014
Integrated Pollution Prevention Controls	<ul style="list-style-type: none"> • No entries shown within 500m radius of site.
Historical Landfill Sites	<ul style="list-style-type: none"> • 370m southwest of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input not listed, last input not listed. References: EAHL19264 & P/03/1A. • 375m southwest of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input 1952, last input 1992. References: EAHL19260 & P/03/01, P/03/1A, 21EG. • 510m south of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input 1977, last input 1992. References: EAHL19270 & P/03/1A, 21EF.
Licensed Waste Management Facilities	<ul style="list-style-type: none"> • No entries shown within 500m radius of site.
Hazardous Substances Consents	<ul style="list-style-type: none"> • No entries shown within 500m radius of site.
Historical Tanks	<ul style="list-style-type: none"> • 80m east of J Clubb Land: historical tanks point (1972). Isle of Grain village • 180m – 500m south of Perry's Farm: 17no. historical tank entries within oil refinery land (various dates: 1968, 1969, 1972, 1983) • 275 and 360m southeast of J Clubb Land: historical tanks point classed as electrical substation facilities (1972). Isle of Grain village • 375m south of Perry's Farm: historical tanks point classed as electrical substation facilities (1987)
Trade Directory Entries	<ul style="list-style-type: none"> • 115m southeast of J Clubb Land: office, air conditioning and refrigeration contractors (inactive) • 150m southeast of J Clubb Land: business at home, cladding suppliers and installers (inactive) • 240m southeast of J Clubb Land: business at home, cleaning services – commercial (inactive)
Contaminative Land Uses	<ul style="list-style-type: none"> • 25m north of E.E.M. Land: military land (1961) • 120m southeast of Perry's Farm: tanks (1968) • 150m southeast of J Clubb Land: military land (1869) • 250m east of J Clubb Land: transport support and cargo handling (1869) • 260m south of Perry's Farm: pipeline running approx. southwest to northeast (1968, 1969) • 370m southwest of Perry's Farm: Kent Oil Refinery (1968, 1969) • 440m northeast of Perry's Farm: dismantled railway running approx. southwest to northeast (1968)

Table C – Off-Site Regulatory Information (within 500m of whole site)

Points of Interest	<ul style="list-style-type: none"> • 10m east of Perry's Farm: Medway Skip Hire Ltd – waste storage, processing and disposal • 80m southeast of J Clubb Land: tank for manufacturing and production • 130m east of Perry's Farm: Grain Fire Station • 150m – 500m southeast of Perry's Farm: 12no. tanks for manufacturing and production • 340m east of Perry's Farm: Electricity Substation • 460m east of Perry's Farm: Electricity Substation • 510m east of Perry's Farm: Electricity Substation • 525m southeast of J Clubb Land: Granite 4 You stone quarrying and preparation, extractive industries
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2.5 Environmental Setting

Details of the site surface cover are provided in **Table D**, whilst the surrounding land use is described in **Table E**. Further site-specific environmental information is provided in **Table F**.

Table D – Site Surface

Perry's Farm:	Aerial photography shows Area 1 and Area 3 surface cover to comprise agricultural land and access roads to Perry's Farm and the southern edge of the Area 1. Cover in Area 2 comprises bare surface (soil / mineral), vegetation and possible stockpiled material, with possible small water-body
J Clubb Land:	Vegetation with a possible open area in the north-western corner
E.E.M. Land:	Vegetation, access track with a pond in the north-western corner

Table E – Surrounding Land Use

North	Undeveloped, vegetated areas with Grain Marsh beyond
South	Agricultural land with the Oil Storage Facility and Grain Power Station beyond
East	Agricultural land and Grain village
West	Agricultural land, farm buildings (Rosecourt Farm), with Grain Marsh beyond

Note, Perry's Farm and associated buildings are located within the centre of the Perry's Farm land. At the date of reporting, it is not known if this will form part of the land for development.

Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Site Elevation and Topography	<p>The site falls from an approximate elevation of 12 metres above Ordnance Datum (maOD) around the eastern edge of Perry's Farm to approximately 3 mAOD along the western edge of the Perry's Farm land parcel. A shallow slope to the northwest is shown across Areas 1 / 2 on plans provided by J Clubb (ref. 25). There is then a break in slope along the south-eastern edge of Area 3 and a steeper gradient across this part of the site.</p> <p>The J Clubb and E.E.M. land falls from approximately 12 mAOD in the south to sea level in the north.</p>
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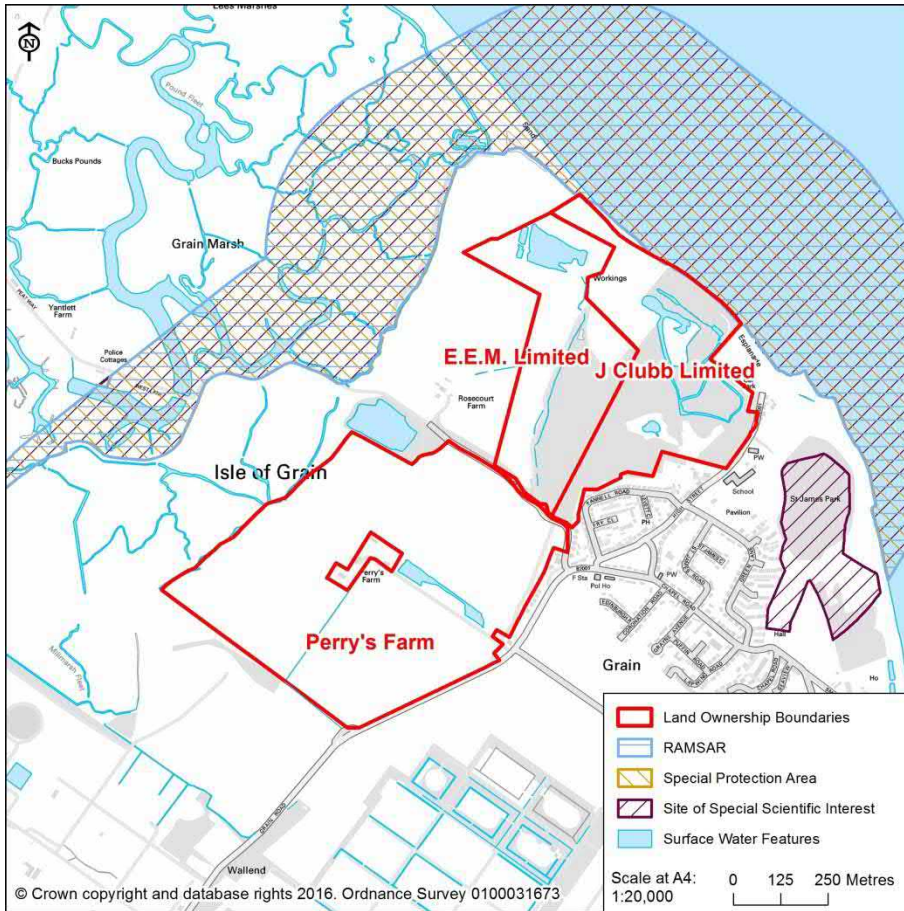
Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Environmentally Sensitive Areas (e.g. SSSI)	<p>The Envirocheck information indicates that the site is within 500 m of the following environmentally sensitive areas:</p> <ul style="list-style-type: none"> • South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI) borders the northeast shoreline of the J Clubb and E.E.M. land and then extends westwards, being situated approximately 100 m west of the western edge of the of the whole site; • Medway Estuary and Marshes SSSI lies approximately 150 m south of the J Clubb Limited land; • Thames Estuary & Marshes Special Protection Area (SPA) and RAMSAR site borders the northeast shoreline of the J Clubb and E.E.M. land and then extends westwards, being situated approximately 100 m west of the western edge of the whole site; • Medway Estuary Marine Nature Reserve (MNR) borders the northeast shoreline of the J Clubb and E.E.M. land; and • North Kent Marshes Environmentally Sensitive Area (ESA) borders the whole site to the west. <p>These are illustrated on Figure C.</p>
Surface Water Features	<p>Surface water features within 500 m of the site comprise:</p> <ul style="list-style-type: none"> • A small water body lies in the southwestern corner of Area 2 of the Perry's Farm landfill; • A pond lies within the northern part of the E.E.M. Limited land and is fed by a drainage ditch that run southwards from the Perry's Farm land parcel. This is understood to form part of the drainage from the landfill and to be founded on the London Clay (ref. 16); • A pond and drainage ditches are located within the J Clubb land; • A pond is located adjacent to the north-west corner of Perry's Farm. During the meeting of 22nd June, J Clubb reported this is used by a local fishing club; • A pond is located in centre of the Perry's Farm land, orientated north-west to south-east, along the access road to the Farm; • Numerous creeks and streams are located in the Grain Marshes, west of the whole site; and • The J Clubb and E.E.M. land extend to the shoreline of Thames Estuary, an Estuarine and Coastal Water Body under the Water Framework Directive (WFD).
Flood Vulnerability	<p>The western part of the Perry's Farm land lies within an area classified as having a low risk of flooding from rivers or sea, whilst the northern most part of the J Clubb land parcel lies within areas with medium, or high risk of such flooding.</p> <p>Lower-lying parts of the land parcels may be susceptible to flooding by surface water and groundwater.</p>
Made Ground and Superficial Geology	<p>BGS data does not show the presence of artificial deposits, such as made ground or fill. The Quaternary, superficial geology are reported to comprise River Terrace Deposits, comprising sand and gravel. In the south west of the Perry's Farm land parcel, Head Deposits are indicated. These comprise clay, silt, sand and gravel.</p> <p>BGS borehole record, TQ87NE45, located immediately east of Perry's Farm (grid ref.: 588120, 176130) indicates approximately 4.7 m of sand, loam and gravel, overlying the London Clay. At TQ87NE40 located east of Perry's Farm (grid ref.: 587500, 176270) 1.9 m of sand, gravel and loam, overlies the London Clay</p> <p>Within the Perry's Farm landfill, the documents provided by J Clubb (ref. 08, 09) indicate:</p> <ul style="list-style-type: none"> • Area 1: approximately 5 m thickness of River Terrace Deposits sand and gravels; • Area 2: approximately 2 m thickness of gravelly clay; • No economically viable sand and gravels were present in Area 3 of Perry's Farm and this area has not been subject to sand and gravel extraction; • Area 1 has been restored to pre-extraction level through landfilling (described in Section 3) and Area 2 has not yet been in-filled or restored. <p>(Note: borehole logs for the monitoring locations around the landfill were not available to AECOM for review).</p> <p>In the J Clubb and E.E.M. land parcels to the northeast, the River Terrace sand and gravel is reported to have been extracted down to the London Clay. It is understood that this area was not infilled with waste following extraction ending (ref. 09, 16 and written response from WSP [Appendix D]) and was restored at a lower level than the surrounding land.</p>

Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Bedrock Geology	<p>BGS data indicates that the site is underlain by the London Clay. This comprises blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt, plus sometimes silt and layers of sandy clay.</p> <p>Documents provided by J Clubb (Ref. 25) indicates that the London Clay was encountered at 7.6 maOD at chamber IC3 during the installation of the leachate collection drainage in 2016, compared with 8.8 maOD in the northwest and southeast of the Perry's Farm land.</p> <p>BGS borehole record, TQ87NE45, located immediately east of Perry's Farm (grid ref.: 588120, 176130) reports that the London Clay was encountered at approximately 6.5 maOD. At TQ87NE40 located east of Perry's Farm (grid ref.: 587500, 176270), the London Clay was encountered at approximately 6.2 maOD.</p> <p>No faulting is reported in the area of the site.</p>
Groundwater	<p>The London Clay bedrock is classified as Unproductive strata. These are defined as geological strata with low permeability with negligible significance for water supply or river base flow.</p> <p>The River Terrace Deposits are classified as a Secondary A aquifer. These are defined as permeable strata capable of supporting water supplies at a local scale and, in places, form an important source of base flow to rivers.</p> <p>Groundwater in monitoring wells at the Perry's Farm land has been measured at between approximately 6 maOD and 12 maOD (ref. 08, 09). Based on the information provided about the geology, this places it within the River Terrace Deposits. The inferred direction of groundwater flow is broadly to the northwest.</p> <p>Long-term groundwater monitoring data are discussed further in Section 3.</p>
Groundwater Abstractions	<p>The Envirocheck information does not list groundwater abstractions.</p>
Source Protection Zones	<p>The site is not located within a Source Protection Zone (SPZ).</p>
Other Information Coal Mining; Radon; Ground Stability Hazards; Landslides.	<p>The site is not considered to not be located in an area likely to be affected by coal mining or radon gas.</p> <p>The Envirocheck data gives the following information regarding ground stability hazards:</p> <ul style="list-style-type: none"> • Collapsible ground – very low to no hazard; • Landslide – very low hazard; • Running sand – very low hazard; • Shrink-swell clays – moderate to no hazard; • Compressible ground – moderate to no hazard; and • Ground dissolution – no hazard.

Figure C: Environmentally Sensitive Areas and Surface Water Features



2.6 Summary

The review of the site's environmental setting has identified a number of potential sources that could result in soil and groundwater contamination and give rise to potential environmental liabilities (including current and historical use of the site for waste deposition), receptors that could be adversely effected (including surrounding surface waters, ecologically sensitive sites, residents of neighbouring properties) and pathways by which such impacts could take effect (e.g. migration in permeable sub-surface strata). These are described further in **Section 4**.

3. Landfill and Waste Management Operations

3.1 Introduction

The section presents a summary of the permitting and operation of the Perry's Farm landfill site, based on documents provided by J Clubb, written responses by J Clubb and WSP and information presented at the meeting between J Clubb and AECOM on 22nd June 2018. At this stage, no information has been obtained from regulators and AECOM were not authorised to contact them regarding the site.

The historical landfills reported in the E.E.M. and J Clubb land parcels to the north have not been assessed further in this section, given the information presented in **Section 2** which reported that they had not been subject to infilling with waste.

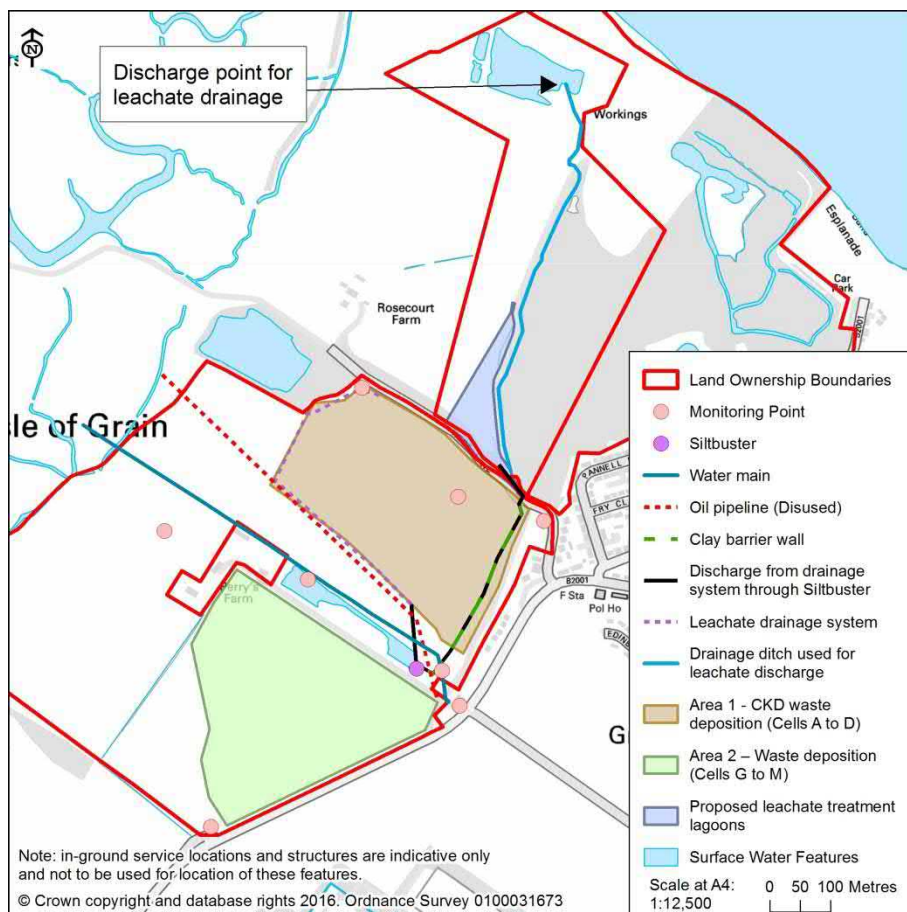
3.2 Overview

Permit BP3335SR, an authorisation to deposit waste to land (subject to conditions), covers all parts of the Perry's Farm land parcel, which comprises the landfill site (LFS). It is understood that this reference was now been superseded and the site is now operated in accordance with environmental permit reference EPR/GP3899LW (Waste Management Licence 210005; not seen by AECOM).

Permit BP3335SR was issued 9th November 2005 (ref. 11) as a transfer of the previous Waste Management Licence (WML; reference P/3/34) into the IPPC (Integrated Pollution Prevention and Control) regime, for the deposit of what at the time was considered inert and non-hazardous waste to land at Perry's Farm; it was prefaced by the submission of a number of documents in 2002, the Regulation 15 Assessment (ref. 08) and the Site Conditioning Report (ref. 09). The 2005 EPR PB3335SR permit document (ref. 11) references less than 20,000m³ capacity remaining.

Significant features of the landfill are presented on **Figure D**, below.

Figure D: Perry's Farm Landfill Layout and Infrastructure



3.2.1 Initial Operation

WML P/3/34 (not seen by AECOM) was issued in 1990 (month unknown), at which time the site received both inert waste and what was then classed as non-hazardous waste, namely CKD in the majority of what is referred to as Area 1 of the site. This disposal area was subdivided into a series of 13 north-west to south-east aligned cells (designated A to M), as shown on plans provided by J Clubb (ref. 05). CKD is now classified as hazardous waste.

The deposit of CKD took place in cells A to D inclusive. It is noted that the footprint of the cells defined on the J Clubb plan of the LFS (ref. 05) do not exactly match the CKD disposal Area 1 as per the WSP permit variation application drawings (ref. 16, 23, 25).

The 2005 EPR PB3335SR permit document (ref. 11) states that Cells A to D had been filled with inert and non-hazardous waste and restored. Cells E and F had not been worked due to the presence of deep-lying services. Plans provided by J Clubb (ref. 05) indicate these comprise a water main and disused oil pipeline.

3.2.2 Later Operation

Since issue, EPR BP3335SR has been modified once, dated 12th May 2010, in order to restrict the waste to be accepted at the remainder of the site (Area 2 only thus far) to inert waste only, at less than 24,999 tonnes per annum, thereby triggering its removal from IPPC management requirements as an installation, into its regulation as a waste operation.

The site is now operated in accordance with environmental permit reference EPR/GP3899LW.

3.2.3 Current Status

At the date of this report (July 2018) EPR/GP3899LW (previous reference BP3335SR) remains active, and the site is not in formal closure, although no waste has been received for some years, noting:

- Area 1 ceased to receive waste by the end of 1999, has since been capped, and is therefore effectively non-operational (see **Section 3.3.1**);
- Area 2 contains the remaining disposal capacity (air space), but remains unfinished (see **Section 3.3.2**);
- Area 3 has never received waste, there being insufficient sand and gravel to extract in order to create air space (see **Section 3.3.3**).

3.2.4 Permit Variations

An application to vary EPR/GP3899LW (formerly EPR BP3335SR) was made (by WSP, acting on behalf of J Clubb) in May 2017 in order to provide for the installation and operation of a system to manage, treat and dispose (to surface water course) high pH leachate emanating from Area 1, following unplanned leachate discharge which commenced during 2013 (precise date unknown) (ref. 16) – treatment using the ‘siltbuster’.

3.2.5 Permit Compliance

A notice of non-compliance against EPR/GP3899LW (previous reference BP3335SR) was issued by the EA against J Clubb on 27th April 2018 (dated 9th May 2018) as a result of uncontrolled discharge of leachate to land, despite the prior installation of a management system, which has since been confirmed as discharged to the satisfaction of the EA, effective from 15th June 2018 (ref. 37, 38, 39, 40).

3.2.6 Monitoring

Gas and groundwater monitoring of the Perry's Farm landfill has been carried out since at least 2006. The monitoring locations include up-gradient and down-gradient groundwater monitoring wells, one landfill leachate monitoring well in Area 1 and one surface water body monitoring point within the Perry's Farm land, to the west of Area 1. Formal quarterly notifications for permit exceedances are provided to the Environment Agency.

The results of the monitoring have not been assessed in detail at this stage. However notable observations made during a review of the results include the following:

- Significantly elevated chloride, sulphate and ammoniacal nitrogen have been detected in the landfill leachate samples (W6) compared to samples of surrounding groundwater (e.g. sulphate levels measured in W6 were on average approximately six times the average concentration in the groundwater monitoring wells). The leachate concentrations are significantly higher (up to nine times greater) than the trigger values used in the monitoring reports (250 mg/l), which indicate potential risks to Controlled Waters, if leachate was to escape the landfill;
- Minor exceedances of the trigger limits for downgradient groundwater have also been recorded consistently since the monitoring began, in particular for sulphate (on average 1.5 times greater than the trigger value);
- In addition, the head of leachate above the base of the waste (as measured in W6) has been higher than the 2005 permit limits since the monitoring began (circa 2006) with an average head of approximately 2.5 m compared to a limit of 1 m;
- Since 2016, an overall increase in the concentration of sulphate, as well as higher pH has been recorded in the leachate (W6), compared with previous years;
- A steady increase in the alkalinity / water hardness of the on-site surface water feature was recorded between 2015 and 2017 consistent with the deposit of CKD. From 2017 to 2018, the water hardness in the surface water has levelled off at approximately 360 mg/l CaCO₃. Concentrations were typically <300 mg/l before 2016;
- Chloride concentrations were above the trigger level used in the monitoring reports (250 mg/l) in one up-gradient monitoring well (W1A) on three occasions in 2017;
- Ground gas concentrations recorded since 2010 were generally low, with a maximum of 0.4 % v/v methane (CH₄), 13.7 % v/v carbon dioxide (CO₂) and a maximum flow rate of 16.5 l/hr. The lowest recorded oxygen (O₂) concentration was 0.4 % v/v;
- During the most recent gas monitoring period reported (February 2017 to February 2018) concentrations of CO₂ were above the maximum permissible limit of the current permit (1.5% v/v) on a number of locations at position W1. The permitted limit is given as 1.5% v/v above natural background levels but the monitoring reports reviewed did not specify the background level.

Monitoring locations are shown on **Figure D**.

It is understood that a primary leachate treatment system was installed in 2016, including a leachate capture drain around Area 1 (see section 3.3.1) and a siltbuster, a simple treatment system which uses gaseous CO₂ in order to reduce the pH of the leachate, prior to off-site discharge. Review of the monitoring data indicates a number of changes in long term concentration trends at around the same date, as indicated in the above summary. The extent to which the changes in drainage could potentially be affecting downgradient groundwater and surface water quality, however, has not been assessed.

It is noted that the monitoring locations do not include potential surface water receptors, such as the adjacent fishing pond to the northwest of Area 1, or any groundwater monitoring points within the partially landfilled area in Area 2.

AECOM has not been given access to any routine monitoring data for the leachate immediately following treatment with CO₂ or at the current discharge point, which would demonstrate the effectiveness of the initial treatment. The chemical quality of the leachate was recorded by laboratory analysis during the period between June 2014 and February 2017 (ref. 24) to inform the leachate treatment system design.

A Compliance Assessment Report (CAR) was issued by the EA in response to the reported breach of trigger levels during 2017 (ref. 35). This documented the non-compliance, stated that compliance limits must be met and noted that although the EA would not take further action in relation to the non-compliance at this time, this did not preclude action being taken at a later date.

Additional work would be required to assess the potential geochemical evolution of the leachate, groundwater and surface water at the site.

3.2.7 Subsistence and Financial Provision

As Permit BP3335SR remains active, all annual subsistence charges remain to be paid at their current level (as a minimum), subject to any changes resulting from the variation application currently with the EA (ref. 16). [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3.2.8 Permit Transfer, Closure and Surrender

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3.3 Area-Specific Details

3.3.1 Area 1

Area 1 received CKD for deposit across the 1990's (approximately 165,000 tonnes in all [details provided by J Clubb; see **Appendix D**]) in accordance with the development / operational requirements of the day, i.e. it was deposited into individual cells, underlain by in-situ London Clay (currently considered as a geological barrier, then considered as a low permeability liner), separated from the adjacent unworked sand and gravel by engineered London Clay. It is noted that clay placement was not compacted to a specification, as would be required currently, until later in the 1990's (ref. 09).

Area 1 was capped on completion of the deposit of CKD (date not known), using re-worked London Clay, in accordance with the standards of the day (ref. 09) which provided for a 500 mm thick cap. It is noted that current standards would be for a minimum of 1,000 mm thick clay layer by way of a cap.

In 2013 an issue with the discharge of high pH leachate derived from the CKD within Area 1 was noticed. This was addressed in 2016 with the installation of a collection, treatment and discharge system, comprising pipework and pumping chambers running along the north-western and south-western site boundaries, interim storage tanks and a treatment system (so-called silt-buster, which used gaseous CO₂ to reduce the pH of the treated liquid) close to the site access (south-western corner) and a discharge pipe running along the southern site boundary, discharging to a surface water pond in what was the Rose Court Farm clay working as shown on **Figure D**. Interim polishing lagoons are proposed to complete this treatment system (ref. 16). The permit variation application proposes that these are to be excavated to the northeast of West Lane (approximate locations are shown on **Figure D**).

This system is operational, but requires high levels of management input and is not yet considered overly robust; recent issues with intense rain fall coupled with a shortage of CO₂ resulted in the enforcement notice previously referred to (ref. 37, 38, 39, 40).

The driver for leachate emissions has never been fully determined, although J Clubb has, since 2013 (2016, it is understood) installed a new engineered clay barrier to the south-east corner of Area 1 in an attempt to better isolate shallow groundwater in the unworked sands and gravels, the excavation of which resulted in the air space into which waste has been / can still be deposited. The approximate location of this barrier is shown on **Figure D**.

The EA has not yet determined the application to vary EPR/GP3899LW, and may yet require additional management and / or technical underpinning before it does so. As part of recent discussions (see ref. 40), the EA has introduced the possibility of the site needing to be re-capped to today's standards, as it perceives the driver for leachate emissions is infiltrating rainfall, as the site has a dome of far gentler gradient than what would be accepted against today's standards.

3.3.2 Area 2

Area 2 contains the remaining saleable airspace at Perry's Farm LFS, this this now comprising less than approximately 20,000m³.

Area 2 is maintained by J Clubb in an unfinished state as a matter of principle, pending a decision by Peel Holdings regarding its possible Development Consent Order (DCO) application for the development of a hazardous waste landfill site across Areas 2 and (part of) Area 3, although a possible time-line for such a development is not known. Little further information is available concerning this option, and no definitive timescale exists for its development, as confirmed by J Clubb.

[REDACTED]

3.3.3 Area 3

Area 3 is contained within the boundary of EPR/GP3899LW, but is effectively untouched by it, as no sand and gravel have been removed from it and no waste deposited in it.

3.4 Transfer, Closure and Surrender

3.4.1 Transfer

[REDACTED]

3.4.2 Closure

[REDACTED]

3.4.3 Surrender

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3.5 Summary

The review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous discharge of leachate at the landfill surface. Measures have been implemented (drainage and 'siltbuster') to address this and further treatment is proposed (the polishing lagoons). However, the EA has also raised the prospect of re-capping the site. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater.

With the Perry's Farm landfill and associated permit still operational, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [REDACTED]

[REDACTED]

4. Preliminary Conceptual Site Model and Risk Assessment

4.1 Approach

A conceptual site model (CSM) and preliminary risk assessment (PRA) has been completed for the site. This identifies the potential sources, pathways, and receptors for the site, in order to assess the potential risks posed to human health, Controlled Waters, statutory ecologically receptors and property by the identified potential sources. When required, the viability of the Source-Pathway-Receptor pollutant linkage must be evaluated further to assess whether an actual risk is present.

The methodology adopted in this report is based upon the UK Defra and EA "best practice" in regard to the assessment of contaminated land. The approach taken reflects that promoted in CLR11¹ and R&D Publication 66² and the supporting guidance referenced within them.

Whilst this approach has been followed to provide a consistent CSM and PRA for the whole site, it should be noted that the operational landfill at Perry's Farm is regulated under the Environmental Permitting Regulations and can only be discharged from this by surrender of the permit once it has been demonstrated to the EA that the site is capable of being managed in closure such that it no longer poses an unacceptable risk to its surrounding environment. For the cable route land to the north, the relevant regulatory regime, with respect to risks from land contamination are considered to be Part 2A of the 1990 Environmental Protection Act and, in respect of the new development, the planning regime.

The scope of this risk assessment did not extend to assessment of geotechnical risk to existing proposed structures, archaeological aspects of the site (if present) or unexploded ordnance (UXO).

4.2 Potential Sources

On-site - Historical

- Historical landfills in cable route land;
- Disused oil pipeline through Perry's Farm;
- Historical quarrying operations in all areas of the site;
- Historical mineral railway on J Clubb land;
- Possible military land uses.

On-site - Current

- Landfill containing CKD waste in Area 1, Perry's Farm;
- Landfill in Area 2, Perry's Farm;
- Leachate breakthrough at surface (Area 1);
- Siltbuster plant and leachate drainage;
- Agricultural activities.

Off-site - Historical

- Historical tank farms to south (oil depot);
- Historical landfills to southwest;
- Historical pipeline to southwest;
- Military land uses in surrounding area;
- Historical railway station to south (Port Victoria).

¹ Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11.

² Environment Agency, Chartered Institute of Environmental Health and National House Building Council, 2008. R&D Publication 66, Guidance for the Safe Development of Housing on Land Affected by Contamination.

Off-site - Current

- Industrial area to the south, including:
 - National Grid LNG Terminal;
 - BP Aviation Bitumen Terminal;
 - SSE Plc, Medway Power Station;
 - Midland Steel Reinforcement Supplies;
- London Thamesport Ltd (shipping company);
- Military land use to east and west of site.

4.3 Chemicals of Potential Concern (COPC)

Based on these potential sources, the following COPC may be present in soil or groundwater at the site:

- Cement waste and landfill leachate – high pH, sulphate, chloride, metals;
- On-site and off-site industrial activities – total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), metals (arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, vanadium and zinc);
- Asbestos – potentially in the Made Ground arising from demolition of the former structures or within the landfill areas if present in demolition or construction waste;
- Agricultural use – fuel oil, plus pesticides, herbicides and fertilizers;
- Ground gases including methane and carbon dioxide.

4.4 Potential Pathways

Potential pathways associated with the proposed development of the site have been identified as the following:

Human Health

- Ingress of ground gas or vapour into buildings. Inhalation of VOC or ground gas;
- Ingestion of, inhalation of and dermal contact with soil particulates;
- Dermal contact with or ingestion of leachate following uncontrolled discharge at the landfill surface;
- Permeation of plastic potable water supply pipes by VOC or hydrocarbons.

Property (including buried infrastructure)

- Ingress of ground gas or vapour into buildings or service conduits;
- Direct contact with COPC in soil, groundwater or contact with leachate;
- Ingestion / uptake by crops and livestock.

Controlled Waters

- Partitioning / leaching of COPC from soil into pore water;
- Migration of COPC in recharge to groundwater in the River Terrace Deposit or other superficial deposits;
- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into surface water receptors;
- Overland flow into surface water features and shallow groundwater arising from uncontrolled leachate discharge at the landfill surface.

Ecology

- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into protected areas (e.g. SSSI);
- Overland flow into protected areas, arising from uncontrolled leachate discharge at the landfill surface.

4.5 Potential Receptors

The potential receptors associated with proposed development of the site have been identified as follows:

Human Health

- Construction and maintenance workers;
- On-site staff;
- On-site general public and visiting staff (such as contractors, including those conducting excavation works);
- Off-site residents and workers in Isle of Grain village;
- Off-site workers in industrial area to southwest of the site.

Property

- Existing or future buildings and structures;
- Proposed interconnector cable and associated infrastructure;
- Other buried services or conduits;
- Crops and livestock on the reclaimed landfill or on neighbouring land.

Potential Receptors - Controlled Waters

- Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site; Thames Estuary to northeast of site).

The critical Controlled Waters receptor is considered to be the fishing pond adjacent to Area 1 of Perry's Farm (to the west), assuming this is downgradient of the landfill and receives base flow from shallow groundwater in the superficial deposits. The on-site surface water features are considered to be of lower sensitivity in comparison to the fishing pond; however this may need to be reviewed following any future site visits or assessments.

The River Terrace Deposits are classified as a Secondary A aquifer. However, these are reported to have been extracted across much of the site, with the exception of Area 3 of the Perry's Farm land. Where present, they are considered to be of more relevance as a potential pathway than as a receptor. In this respect, COPC could migrate via the groundwater in these Deposits to off-site surface water features such as the creeks in the marsh areas to the north and west, or to the Thames estuary, and to the associated ecological receptors.

Potential Receptors - Ecological

- Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR);
- North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA);
- Medway Estuary Marine Nature Reserve (MNR) to the northeast; and
- Medway Estuary and Marshes to the south (SSSI).

4.6 Review of Potential Source-Pathway-Receptor Linkages

The pollutant linkages identified are summarised in Table G and Table H, below.

Table G – Human Health and Property CSM

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
COPC in soil / leachate / groundwater / ground gas from the site and identified potential off-site sources.	Ingress of ground gas or vapour into buildings or service conduits. Inhalation of VOC or ground gas.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds. However, risks may be greater within the landfill areas, particularly in Area 1 of Perry's Farm, based on the detected levels of CO ₂ . Risks to contractors and staff during ground works, construction or maintenance should be controlled using appropriate health and safety procedures.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds.
		Existing or future buildings and structures, proposed interconnector cable and associated infrastructure, plus other buried services or conduits.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds.
Ingestion of, inhalation of and dermal contact with soil particulates.		On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. Presence of the existing cap in Area 1 of Perry's Farm landfill may mitigate risks from the CKD, but removal or breakage of the cap during ground works at the site could increase risks, albeit temporarily. Risks to contractors and staff during ground works, construction or maintenance should be controlled using appropriate health and safety procedures.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, risks may be elevated within or close to the landfill areas.
Ingestion / uptake by crops and livestock.		Crops and livestock on the reclaimed landfill or on neighbouring land.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
	Dermal contact with or ingestion of leachate following uncontrolled discharge at the landfill surface.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low.
	Direct contact with COPC in soil, groundwater or contact with leachate.	Existing or future buildings and structures, proposed interconnector cable and associated infrastructure, plus other buried services or conduits.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the high pH of the cement kiln dust, which may have potential to damage buried structures or services placed in or near that area depending upon the type of materials used.
	Permeation of plastic potable water supply pipes by VOC or hydrocarbons.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	A potentially significant pollutant linkage may occur, if potable water pipes are located within or near to the landfill areas at Perry's Farm.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	A potentially significant pollutant linkage may occur, if potable water pipes are located within or near to the landfill areas at Perry's Farm.

Potential risks to site staff or visiting contractors undertaking intrusive works / ground works should be managed by appropriate health and safety controls such as risk assessment and method statements, plus personal protective equipment (PPE).

Table H – Controlled Waters and Ecological Receptors CSM

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
COPC in soil / leachate / groundwater from the site and identified potential off-site sources.	Partitioning / leaching of COPC from soil into pore water. Migration of COPC in recharge to groundwater in the River Terrace Deposits or other superficial deposits. Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into surface water receptors.	Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site; Thames Estuary to northeast of site). <hr/> Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR); North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA); Medway Estuary Marine Nature Reserve (MNR) to the northeast; and Medway Estuary and Marshes to the south (SSSI).	The site is not located within a groundwater SPZ. In the absence of information on groundwater abstractions in the area of the site, the critical Controlled Waters receptor is considered to be the fishing lake adjacent to the site to the west. However a number of surface water features are present within the area of the site. Groundwater in the River Terrace Deposits is considered a potential pathway rather than a receptor. COPC could migrate via these Deposits to off-site surface water features such as the creeks in the marsh areas to the north and west, or to the Thames estuary, and to the associated ecological receptors. Based on review of the available data, a pollutant linkage has been identified and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Overland flow arising from uncontrolled leachate discharge at the landfill surface.	Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site). <hr/> Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR); North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA); Medway Estuary Marine Nature Reserve (MNR) to the northeast; and Medway Estuary and Marshes to the south (SSSI).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.

5. Preliminary Ground Constraints Review

5.1 Introduction

Based on the preliminary CSM, site environmental setting and review of landfill and waste operations, a number of potential environmental and geotechnical constraints on the proposed development have been identified for the site. These are summarised below and are described in relation to the three separate land parcels proposed for acquisition (Perry's Farm, plus the cable route land [J Clubb and E.E.M. land]).

Note that the constraints are based on information available at the time of writing. Other constraints, for example other oil or gas pipelines or buried services, may be present that have not been identified at this stage.

5.2 Perry's Farm Land Parcel

The following potential ground constraints have been identified for the Perry's Farm area:

1. Area 1 – landfill containing CKD waste:
 - Risk of chemical attack (e.g. on foundations, pipework and cables);
 - Unsuitable ground conditions for redevelopment (including partially cemented areas);
 - Variable ground conditions of the landfill and surrounding area could result in differential settlement;
 - Hazardous waste classification and associated disposal for excavated materials;
 - Potential for creation of new contamination pathways if hazardous waste is disturbed or existing landfill cover is breached;
 - A leachate treatment system is in place, including a drainage ditch and buried delivery main, which could affect suitable routes for cables / other structures;
 - A clay barrier wall is in place along the eastern margin of the landfill (below ground) which cannot be breached by the development works (see **Figure D**);
 - Area 1 may need to be re-capped to current standards to reduce infiltration into the landfill material, although whether this would be through the addition of clay or the use of a manufactured equivalent (geomembrane (FML) or geosynthetic clay layer (GCL) remains undecided. The likelihood of this is subject to the decision of the EA;
 - Additional / alternative leachate treatment measures may need to be developed if the proposed leachate treatment system is not proven to be effective over time, which could result in further development constraints;
 - A large linear surface water feature is located between the landfilled cells of Area 1 and Area 2 which may be a constraint if located in a proposed area for development works, although options for this to be infilled could be pursued once its use is known (see **Figure D**);
 - A water main runs northwest to southeast between the landfilled cells of Area 1 and Area 2 which could cut across a proposed cable route from Perry's Farm to the other land parcels and the landfill (see **Figure D**). This could potentially require the cable crossing above or below the main with agreement of the water main operator or rerouting of the water main;
 - A disused oil pipeline runs from southeast to northwest, along the southwestern edge of the landfill (see **Figure D**) which is likely to cut across the proposed cable route. The likelihood of others is not currently known;
 - Two electricity pylons are located in Area 1 – one is in the western corner and one in the south-eastern corner (see **Figure D**). The overhead lines are expected to run northwest to southeast between the landfilled cells of Area 1 and Area 2.

- There is potential for other buried utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

The landfilled area potentially covers the whole area between the Perry's Farm land parcel and the J Clubb / E.E.M. land parcels, which may limit options to avoid the intersection of the landfill material and interconnector cable route (see **Figure B**). Ground investigation works would be necessary to assess the extent, depth and type of waste. The drainage ditch surrounds the landfill to the west and south, which could also cut across potential cable route sites. The buried delivery main runs along the eastern edge of the landfill (see **Figure D**).

The disused oil pipeline would also need to be investigated to assess if it can be left in-situ or would need to be removed. There could be contamination risks associated with the pipe if left in-situ (if damaged); however new contamination pathways could be created by removing the pipe or sections of the pipe if the work is not carried out appropriately.

2. Area 2 – landfill containing inert waste:

- Restoration to infill unfinished areas of the landfill to required engineering specifications (the remaining capacity could be 20,000m³) although it might be possible to agree a lower level of restoration with regulators;
- Ground conditions may be unsuitable for development or require ground improvement;
- Variable ground conditions of the landfill and surrounding area could result in differential settlement;
- There is potential for contamination to migrate from Area 1 into Area 2 which could impact structures and services as well as humans and environmental receptors;
- The disused oil pipeline described for Area 1 also cuts across the eastern corner of Area 2;
- There is potential for other utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

3. Area 3 – unworked area of permitted landfill site:

- Ground improvement may be required for structures depending upon sequence and structure of the Superficial deposits and the design of the proposed development;
- There is potential for flooding in the western part of Area 3 (Flood Zones 2 and 3), but this may be mitigated by local flood defences;
- There is potential for contamination to migrate from Area 1 into Area 3, i.e. down topographic gradient and along inferred groundwater flow vectors, which could impact structures and services as well as humans and environmental receptors;
- The water main described for Area 1 also runs northwest to southeast through Area 3 (see **Figure D**). This could potentially require the cable crossing above or below the main with agreement of the water main operator or rerouting of the water main;
- The disused oil pipeline described for Area 1 also runs through Area 3 from southeast to northwest (see **Figure D**) which is likely to cut across the proposed cable route;
- An overhead electricity line crosses Area 3 from east to west (see **Figure D**). This may be connected to underground electricity services within the site;
- There is potential for other utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

4. Farm Buildings:

- Disturbance of the buildings at Perry's Farm, or access road (West Lane). The Perry's Farm buildings are surrounded by the landfill land parcel. At this time, they are not part of the J Clubb property and as such, the assessment has assumed the area would not be developed;

- There is potential for contaminated leachate to migrate from Area 1 which could impact structures and services as well as humans and environmental receptors.

5.3 E.E.M Limited Land Parcel and J Clubb Land Parcel

Unless otherwise stated, the following ground constraints apply to both the E.E.M. and J Clubb land parcels that comprise the cable route land:

- The proposed site for the secondary leachate treatment system (polishing lagoons) within the southern part of the E.E.M land parcel (see **Figure D**). The construction of the lagoons could constrain possible locations for the cable route or other development features;
- Former workings (quarries) are indicated as historical landfills but are reported not to have been infilled significantly (see **Figure B**). There may still be constraints due to topographical depressions caused by worked areas and by the surface water bodies that have formed in the former quarry (see **Figure D**);
- There is potential for aggressive ground conditions to be present;
- There is potential for buried structures to be present in locations of former buildings or sand and gravel extraction operations;
- There is potential for utilities (existing or redundant) to be present;
- There is potential for contamination related to the historical sand and gravel extraction operations, including the former mineral railway, historical military land uses and historical / current shipping activities to the northeast;
- There is potential for localised contamination of Controlled Waters / ecological receptors arising from discharge of the partially treated landfill leachate into the E.E.M land parcel via the drainage ditch;
- There is evidence on aerial mapping of dense vegetation in some areas. Ecological surveys are likely to be required in advance of any disturbance of vegetation or ecological habitats;
- Potential UXO risk;
- There is potential for flooding, particularly in the northern part of the J Clubb land parcel and a small area of the E.E.M. land parcel (Flood Zones 2 and 3).

6. Environmental Liability Review

6.1 Introduction

A review of potential environmental liabilities was completed for the three land parcels. [REDACTED]

[REDACTED]

[REDACTED] This identified key issues that could pose a material liability to NeuConnect if it purchases the three land parcels.

The liability assessment considered the following aspects of the site:

- Leachate breakout;
- Ground conditions;
- Transfer of the permit;
- On-going operation;
- Financial provisioning;
- Formal closure; and
- Permit surrender.

[REDACTED]

6.2 Identified Potential Liabilities

6.2.1 Perry's Farm Land Parcel

The key environmental liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

The identified potential liabilities include the following:

Table I: Potential Liabilities Identified in Relation to the Perry's Farm Landfill Site

Category	Description	Details
Leachate Breakout	Permit variation	In 2016 a leachate collection and treatment system (drainage and 'siltbuster') was installed to manage the discharge of high pH leachate derived from the CKD within Area 1. An application to vary the site's Environmental Permit (EP) to retrospectively approve the treatment system was submitted to the EA in 2017, which also seeks approval for the proposed polishing lagoons sited in the EEM Ltd land. As of June 2018, the EA has not determined this variation (no details for the EA's considerations with respect to this variation were available to AECOM).
	Lagoon installation	The application to vary the site's EP allows for interim polishing lagoons for leachate treatment. As of June 2018, they are yet to be installed.
	Recapping of Area 1	Recent issues (2018) with intense rainfall coupled with a shortage of CO ₂ for the leachate treatment system resulted in release of leachate to land followed by the EA issuing an enforcement notice against J Clubb. Subsequent exchanges of correspondence provided by J Clubb confirm that, in response, the EA has raised the issue of re-capping Area 1 to today's standards in order to better manage leachate. [REDACTED]

[REDACTED]

6.2.2 E.E.M Limited Land Parcel and J Clubb Land Parcel

For the cable route land to the north of Perry's Farm (E.E.M. and J Clubb land parcels), the relevant regulatory regime, in relation to risks from land contamination, is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas would relate to risks to sensitive receptors from potential sources of contamination as described in **Table G** and **Table H**. Possible sources identified in this area of the site are:

- Historical landfills;
- Historical quarrying operations;
- Historical mineral railway; and
- Possible military land uses.

[REDACTED]

- Historical landfills are reported in this area. However, review of topographic maps suggests the area of the northern most landfill now contains the pond to which the drainage ditch discharges (compare **Figure B** and **Figure C**). Comments made in the 2017 permit variation and communication from WSP indicate that the area was restored at a lower level than the surrounding land, on top of the London Clay, and shows no evidence of waste deposition (ref. 16 and **Appendix D**). This suggests that landfilling may have been limited and the areas pose a lower level of risk. However, this assumption should be tested through a topographic survey and intrusive investigation of the area;
- Potential contaminative sources might be associated with the former sand and gravel workings, mineral railway and military land, such as possible former use of fuel or lubricating oils in mechanical plant on site.

[REDACTED]

[REDACTED] Again, this assumption should be tested through an intrusive investigation.

7. Conclusions and Recommendations

7.1 Conclusions

7.1.1 Perry's Farm

The key liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

Permit BP3335SR, an authorisation to deposit waste to land (subject to conditions), covers all of the Perry's Farm landfill site (LFS). It is understood that this reference was now superseded and the site is now operated in accordance with environmental permit reference EPR/GP3899LW (Waste Management Licence 210005).

AECOM's review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous release of leachate at the landfill surface. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater. A notice of non-compliance against the permit was issued by the Environment Agency (EA) in 2018, but has since been discharged. Measures have been implemented (drainage and siltbuster) to address leachate discharge and further treatment is proposed (polishing lagoons). However, the EA has also raised the prospect of re-capping that part of the site. Area 1, into which leachate generating waste (CKD) has been deposited.

With the Perry's Farm landfill and associated permit still operational, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [REDACTED]

Potential liabilities have been identified as follows:

- Those associated with ownership and operation of the landfill site, if the permit is transferred. Such a transfer has been assumed in completing this liability assessment as it would provide NeuConnect with control of site to implement the proposed development;
- Liabilities resulting from with operation of the permit. These include on-going operation, maintenance and monitoring of the site in accordance with the conditions of the permit, plus addressing the leachate management issue and completion of Area 2. They also take in the existing application for variation of the permit for installation of the proposed lagoons and retrospective approval for the leachate drainage system and 'siltbuster' and, subject to the requirements of the EA, could extend to needing to re-cap Area 1 of the landfill;
- The on-going operation would also include payment of the annual permit subsistence charges and maintaining / topping up the Financial Provision that has to be maintained for the site;
- [REDACTED]
- The responsibility and associated liability would continue into Formal Closure and Surrender of the permit:
 - [REDACTED]

Whilst these items are identified as the key potential liabilities associated with the Perry's Farm land, the disused oil pipeline reported to cross the site could represent a source of land contamination, relevant under Part 2A of the Environmental Protection Act (1990) and the planning regime. [REDACTED]

[REDACTED] This assumption should be tested through further investigation of the pipeline, its location, condition and potential impact upon soil and groundwater. [REDACTED]

Possible development constraints identified in this area which could require management during the development of the interconnector include:

- Those relating to unsuitable or variable ground conditions in landfilled areas, and management of waste in terms of risk to in-ground infrastructure and disposal if excavated;
- Constraints resulting from the need to avoid creating new contamination pathways if hazardous waste is disturbed or the existing landfill cover, walls or buried infrastructure are damaged during development;
- The presence of other existing in-ground infrastructure;
- Limited space for the cable route between the site boundary and the waste in Area 1;
- Restoration of unfinished parts of Area 2 to the required engineering specification; and
- Further constraints that may arise if additional measures are required by the EA to address leachate release, including re-capping or re-profiling of the site, or additional / alternative leachate treatment measures.

7.1.2 E.E.M Limited J Clubb Land

For the E.E.M. and J Clubb land parcels (cable route) to the north of Perry's Farm landfill, the relevant regulatory regime in relation to risks from land contamination is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas relate to risks to sensitive receptors from possible sources of ground contamination. Possible sources identified in this area of the site are:

- Historical landfills;
- Historical quarrying operations;
- Historical mineral railway; and
- Possible military land uses.

[REDACTED]

Other preliminary development constraints identified in this area which may require management during the development include:

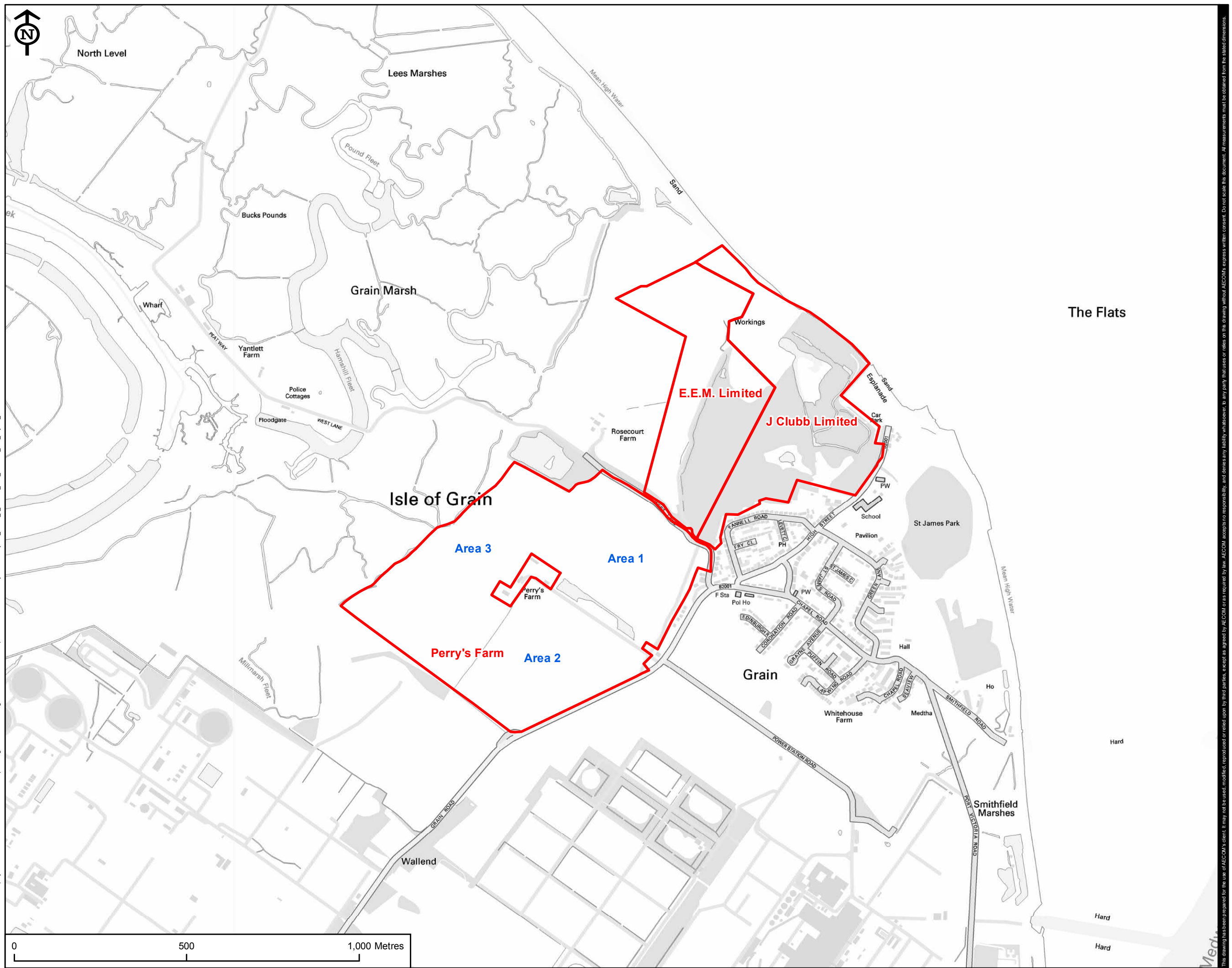
- Those relating to unsuitable or variable ground conditions in quarried areas;
- Buried structures present at the locations of former buildings or sand and gravel extraction operations;
- The presence of other existing in-ground infrastructure; and
- The proposed site for the secondary leachate treatment system (lagoons) within the southern part of the E.E.M land parcel. Its installation may constrain possible locations for the cable route or other development features.

7.2 Recommendations

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Appendix A – Figures



LEGEND

▭	Land Ownership Boundaries
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REVISION:

REV.	DATE	DESCRIPTION
1	13/07/18	ORIGINAL ISSUE

FIGURE NO.
NC_180713_ELDS_1

FIGURE TITLE
SITE LOCATION AND LAYOUT

SHEET NUMBER
1 of 1

NOTES

Date: 13/07/18 **Scale at A3:** 1:10,000

Appendix B – Document Request

Appendix B
Perry's Farm Landfill Site
Neuconnect

ID	Document file name	Author	Date	Description
01	Planning Permission - TH_6_72_621.pdf	Kent County Council	18-Oct-77	Letter re. planning permission
02	Let to P Osenton & F Osenton Limited 18.06.1985.pdf	J Clubb	18-Jun-85	Letter re. purchase of land
03	Let to Mr A Osenton 24.10.1988.pdf	J Clubb	24-Oct-88	Letter re. purchase of land
04	Planning Permission - ME_88_1389.pdf	Kent County Council	30-Jan-90	Letter re. planning permission
05	Excerpt of Drawing no. 93/4/995	J Clubb Limited	Apr-93	Drawing showing planned extraction workings at Perry's Farm
06	Water Resources Act 1991 Licence 13 September 1993.pdf	National Rivers Authority	13-Sep-93	Abstraction Licence documents
07	River Works Licence 09 April 1996 (Part 2).pdf	Port of London Authority	09-Apr-96	Documents re. licence for surface water outfall
08	Regulation 15 Assessment.pdf	Hyder Consulting Ltd	Feb-02	Summary of desk study and monitoring, and risk assessment
09	Site Conditioning Plan Accompanying Report.pdf	Hyder Consulting Ltd	Jul-02	Part of the site conditioning plan submission and contains additional info requested
10	Deed of Trust and email.pdf	Environment Agency	03-Nov-05	Deed of Trust
11	Pollution Prevention and Control Licence - Perry_s Farm.pdf	Environment Agency	09-Nov-05	Permit
12	Financial Provision.pdf	Environment Agency	07-Jun-11	Financial Provision letter
13	River Works Licence 09 April 1996.pdf	J Clubb; Humberts for Crown Estates; Port of London Authority	14-Aug-14;05-Aug-14; 09-Apr-96	Documents re. licence for surface water outfall
14	ESG Annual & Quarterly Monitoring Report - January 2017.pdf	ESG	Jan-17	Monitoring report
15	Perry_s Farm Environmental Permit Variation Application - May 2017.docx	WSP	May-17	Permit variation application
16	170531 Perrys Farm EP Variation Application_r3_formatted.pdf	WSP / Parsons Brinkerhoff	May-17	Overview of the application for variation of a waste management operation - same as ID08
17	Application Form A 12.4.17.pdf	Form completed by J Clubb Limited	12-Apr-17	Appendix to ID23, Application for an environmental Part A – About you
18	Application Form C2 25.5.17.pdf	Form completed by J Clubb Limited	25-May-17	Appendix to ID23, Application for an environmental permit – Part C2 – General – varying a bespoke permit
19	Application Form C4 21.07.17.pdf	Form completed by J Clubb Limited	21-Jul-17	Appendix to ID23, Application for an environmental permit Part C4 – Varying a bespoke waste operation permit
20	Application Form C4 25.5.17.pdf	Form completed by J Clubb Limited	25-May-17	Appendix to ID23, Application for an environmental permit Part C4 – Varying a bespoke waste operation permit

Appendix B
Perry's Farm Landfill Site
Neuconnect

ID	Document file name	Author	Date	Description
21	Application Form F 23.5.17.pdf	Form completed by J Clubb Limited	31-May-17	Appendix to ID23, Application for an environmental permit Part F1 – Opra, charges and declarations
22	APP B_Figure 1_287127C-F01 Rev C.pdf	Parsons Brinkerhoff	30-May-17	Appendix to ID23, Figure - general arrangement of Perrys Farm Landfill
23	APP B_Figure 2_287127C-F02 Rev A.pdf	Parsons Brinkerhoff	17-May-17	Appendix to ID23, Figure - preliminary long section sketch of balancing ponds
24	APP C_Perrys Farm_Leachate Treatment (Rev C).pdf	Parsons Brinkerhoff	10-May-17	Appendix to ID23, Description of proposed leachate treatment and disposal
25	APP D Perrys Farm CQA Report_Issue No.2 formatted for print.pdf	WSP / Parsons Brinkerhoff	Nov-16	Appendix to ID23, Perry's farm landfill - installation of perimeter leachate drainage - construction quality assurance report
26	APP E Perrys Farm SCR_Final formatted.pdf	WSP / Parsons Brinkerhoff	May-17	Appendix to ID23, Site Condition Report
27	APP E SCR Figure 1 - Site Location.pdf	WSP	31-May-17	Appendix to ID23, Figure - Site Location Plan
28	APP E SCR Figure 2 - 287127C-F01 Rev C.pdf	Parsons Brinkerhoff	30-May-17	Appendix to ID23, Figure - general arrangement of Perrys Farm Landfill, Permit variation
29	APP F RPS leachate In vitro irritancy 1808901_rep.pdf	Envigo	11-Apr-17	Appendix to ID23, In-vitro leachate testing report
30	APP G_170530 Perrys Farm LTP H1 ERA formatted for print.pdf	WSP / Parsons Brinkerhoff	May-17	Appendix to ID23, Environmental Risk Assessment
31	APP H I Rayner WAMITAB & continuing competence.PDF	WAMITAB	27-Apr-99 , 08-Feb-16	Appendix to ID23, Certificate of Technical Compliance
32	Perrys Farm EPR 110717.PDF	Environment Agency	11-Jul-17	Compliance Assessment Report
32	Annual & Quarterly Monitoring Report - January 2018.pdf	Socotec	Feb-18	Monitoring report
33	EA Financial Provision.PDF	Environment Agency	09-May-17; 12-Jul-17	Correspondence relating to Financial provisions
34	o0243PF_AMR2018 socotec annual report 2017-18.pdf	Socotec	Feb-18	Monitoring report
35	Perrys Farm EPR 180418.PDF	Environment Agency	18-Apr-18	Compliance Assessment Report
36	o0243PF_Q12018 socotec qtly report q1 perrys Grain.pdf	Socotec	May-18	Monitoring report
37	Perrys Farm EPR 090518.PDF	Environment Agency	09-May-18	Compliance Assessment Report
38	Perrys Farm Enforcement Notice.PDF	Environment Agency	17-May-18	Enforcement Notice
39	Enforcement Notice.pdf	Environment Agency	17-May-18	Details of enforcement notice
40	Enforcement notice email chain and siltbuster method statement.pdf	Environment Agency	21-Jun-18	Enforcement notice email chain and siltbuster method statement

Appendix C – Document Review List

14 May 2018 - by email

Our Reference
60571593

Mr. J Lovett
J Clubb Ltd
Church Hill
Wilmington
Dartford
Kent
DA2 7DZ

Request For Information - Perry's Farm Landfill Site

Dear Jon

AECOM are conducting an environmental desk study of the landfill site located at Perry's Farm, Isle of Grain, on behalf of NeuConnect. Kevin Lee has provided your details as a contact for a request for information in relation to this site.

We understand that J Clubb is the holder of the permit for the Perry's Farm landfill site and would be grateful if you could please provide answers to the following questions and copies of the documents listed below.

If J Clubb does not hold any of the information listed, then we would be grateful if you could please confirm this via return email. AECOM will then make a request for publically held records in relation to the site's permit number from the Environment Agency (EA).

Perry's Farm (extant site)

Please confirm the following:

- Is the site still receiving waste, and if not, is it in formal closure? If the latter, please provide evidence of formal closure / agreement with the EA; and
- Has waste ever been deposited in the southern part of the site (area reported to have been worked for minerals but yet to be land filled).

Please provide copies of the following documents:

1. All and every application for authorisations, including but not limited to planning, permitting, etc., as well as copies of all such issue documents arising therefrom, e.g. planning permissions, permits, etc. plus copies of any issued variations to the same - note this also includes the same for the Leachate Treatment Plant (LTP);
2. All correspondence with the EA, including but not limited to Compliance Assessment Reports (CAR), etc.;
3. Evidence relating to any Financial Provisions (FP), including how this may need to be increased regards the LTP;
4. All designs and the equivalent Construction Quality Assurance (CQA) records, or other construction records, evidencing their delivery;
5. All monitoring information / periodic reports to the Environment Agency (EA);
6. Evidence of the amount and type(s) of waste accepted and the locations deposited within site;
7. All communications between the site operator and the EA regards the need for the LTP;
8. All correspondence with Kent County Council (KCC) as mineral planning authority;
9. All correspondence relating to the LTP, including with the prospective supplier, also to include evidence of planning permission and the determination process relating to the application to vary the permit;

10. Evidence of fit and proper persons compliance;
11. Evidence of off-site nuisance, including correspondence with the planning authority, local authority (if different) and stakeholder groups;
12. Confirmation of any outcome regards the historical Development Consents Order (DCO) application for additional hazardous waste capacity (SLR on behalf of Peel Holdings);
13. Evidence of ongoing fees payable to the EA;
14. Evidence of on-going costs for operation and monitoring of the site and compliance with the Permit, including the LTP;
15. If the site is in formal closure, copies of the formal closure plan agreed with the EA.

We appreciate this is a considerable volume of information. Our priority are items numbered 1, 2 and 3 in the list above. As noted before, if you don't hold any of the documents requested, please confirm this.

Historical Landfill Site – Whitehall Farm

We understand J Clubb was also named as permit holder for a historical landfill site located at Whitehall Farm to the northeast of Perry's Farm. EA records (available at <https://data.gov.uk/dataset/historic-landfill>) indicate two areas of historical landfilling at the Whitehall Farm site.

Please confirm if there is a live permit for these landfilled areas. If there is a live permit, please provide a copy of the permit.

In the case that there is no permit, please provide evidence of its surrender, the site's movement into formal closure, and the acceptance of this by the EA and/or its predecessor organisations.

If available, please provide copies of any of the following information for each landfilled area:

1. Waste types deposited;
2. Any evidence of engineering / operations during the sites operation;
3. Any monitoring information which may be available;
4. All correspondence between the permit holder and the regulator (EA or otherwise); and
5. Any evidence of on- or off-site emissions / nuisance, and how (and if) this was addressed.

Thank you for your assistance with this request. If you have any questions about our request, please contact me at the numbers below.

Yours sincerely,



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Appendix D –



Appendix 11.B – Contaminated Land Assessment Methodology, Risk and Impact Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 11B – Contaminated Land
Assessment Methodology, Risk and
Impact Assessment

NeuConnect Britain Ltd

September 2019

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Table of Contents

1. Contaminated Land Assessment Methodology	1
Risk and Impact Assessment	1
Risk and Impact Assessment – Buried disused oil pipeline (within and extending outside of the application boundary)	16
Risk and Impact Assessment – Former ponds (assumed infilled) (outside of the application boundary)	22
Risk and Impact Assessment – Former Kent Oil Refinery (outside of the application boundary).....	28
Risk and Impact Assessment – Former military land use (outside of the application boundary).....	34
Risk and Impact Assessment – Farm land (outside of the application boundary)	39

1. Contaminated Land Assessment Methodology

Risk and Impact Assessment

Assessment Methodology

Table 11.B1.1: Proximity Definition

Zone	Definition
Zone 1	All land within, or within 10 m of, the application boundary.
Zone 2	All land from between 10m and 50m of the application boundary.
Zone 3	All land from between 50m and 250m of the application boundary.

Table 11.B1.2: Potentially Contaminative Land Uses

Class	Description	Example land uses ⁽¹⁾
Class 1	Low risk of potential contamination, or less hazardous chemicals in use	Farms (ancillary buildings and areas for storing chemicals, fuel etc.)
		Warehouses
		Goods yards
		Hospitals
		Builders yards
		Retail and business parks
Class 2	Medium risk of potential contamination, more hazardous chemicals in possible use	Engineering workshops
		Railways/ disused railway lines
		Brick works
		Dry cleaners (retail)
		Sewage works
		Former clay pits and quarries
		Cement/asphalt works
		Car breakers
		Garage workshops
		Waste transfer facilities
		Paper works
		Power stations
		Glass works
Timber treatment works		
Foot and mouth burials		

Class	Description	Example land uses ⁽¹⁾
		Metal manufacturing and plating
		Depots
		Scrap yards
Class 3	High risk of potential contamination, hazardous chemicals likely to be present	Gas and coke works
		Landfills and historical landfills
		Petrol filling stations
		Oil depots
		Iron and steel works
		Historical foundries
		Chemical works

⁽¹⁾ The list of land uses defined in Table 11.B1.2 is not intended to be an exhaustive list and professional judgement has been applied accordingly.

Table 11.B1.3: Determination of Site Rating

Potentially contaminative land use class	Proximity	Relationship to cut/fill/construction work	Site rating
Class 1 Low Risk	Zone 1	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	0
	Zone 2	Earthworks fill	1
		Earthworks cut/at grade	2
		Bored excavation	0
	Zone 3	Earthworks fill	0
		Earthworks cut/at grade	1
		Bored excavation	0
Class 2 Medium Risk	Zone 1	Earthworks fill	3
		Earthworks cut/at grade	4
		Bored excavation	2
	Zone 2	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	2
	Zone 3	Earthworks fill	1
		Earthworks cut/at grade	2
		Bored excavation	1
Class 3 High Risk	Zone 1	Earthworks fill	4
		Earthworks cut/at grade	5
		Bored excavation	3

Potentially contaminative land use class	Proximity	Relationship to cut/fill/construction work	Site rating
	Zone 2	Earthworks fill	3
		Earthworks cut/at grade	4
		Bored excavation	3
	Zone 3	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	2

Screening Assessment

Table 11.B2.1: Summary of sites excluded from Risk and Impact Assessment.

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/construction work	Baseline site rating
CL02	Current Farm	North of the Site to the north of West Lane	3	1	Earthworks cut	1
CL04	Current Fire station	East of the cable route on Chapel Road	3	1	Earthworks cut	1
CL08	Current undeveloped land/ former pond (assumed infilled)	North of the Site near West Lane	3	1	Earthworks cut	1

1. The area defined as the application boundary is interchangeably referred to as the 'Site' as appropriate within this table

Table 11.B2.2: Summary of sites included in Risk and Impact Assessment.

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/construction work	Baseline site rating
CL01	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)	Adjacent the Site east of proposed substation/ converter station area	1	1	Earthworks cut	3
CL03	Current Farm	Partially on the Site/ adjacent east of the cable route on Grain Road	1	1	Earthworks cut	3
CL05	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline	On the Site, extending off Site, south of West Lane and west of Grain Road	1	3	Earthworks cut	5
CL06	Current undeveloped land / former military land use	West of northern part of cable route near the coast line	3	3	Earthworks cut	3
CL07	Current unoccupied land / former Kent Oil Refinery	South of the Site south of Grain Road	3	3	Earthworks cut	3
CL09	Current pond / former pond (assumed infilled)	North of the substation/ converter station area to the south of West lane	1	1	Earthworks cut	3

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/construction work	Baseline site rating
CL10	Current undeveloped land / former pond (assumed infilled)	West of the Site off farm track	2	2	Earthworks cut	3
CL11	Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled)	On the Site across the northern part of the cable route and extending off Site to the west and east.	1	3	Earthworks cut	5
CL12	Buried disused oil pipeline	On the Site, extending off the Site, south of West Lane and west of Grain Road	1	3	Earthworks cut	5

1. The area defined as the application boundary is interchangeably referred to as the 'Site' as appropriate within this table

Risk and Impact Assessment – Historical infilled land and landfills (within and extending outside of the application boundary)

Table 11.B3.1: Risk and impact assessment for historical infilled land and landfills within and extending outside of the application boundary.

Site ID (IDS)	CL05, CL11
Site group	Historical infilled land and landfills (within and extending outside of the application boundary)
Site title (Site ID) and land use class	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline (CL05) - Class 3. Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled) (CL11) – Class 3.

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
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Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline (CL05) - Class 3.	<p><u>On-site:</u> Agricultural workers, landfill management operatives</p> <p><u>Off-site:</u> Residential and farm users</p> <p><u>Off-site (post-construction only):</u> Employees at the substation/ converter station</p>	<p>Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.</p>	<p>Pond between adjacent to the Perry's Farm access track and pond directly north of the application boundary</p>	None	<p><u>Off-site:</u> residential, farm buildings</p> <p><u>On-site (post-construction only):</u> Buildings, foundations, services</p>	None
---	--	--	---	------	--	------

Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled) (CL11) – Class 3.	<p><u>Off-site:</u> Residential and farm users, St James' Church of England Primary School</p>	<p>Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.</p>	<p>Thames Estuary, small ponds and connecting streams on site. Larger pond to the south west</p>	<p>South Thames Estuary and Marshes and Medway Estuary and Marshes (Sites of Special Scientific Interest (SSSI), RAMSAR, Special Protection Area (SPA), Marine Nature Reserve (NMR) present to the north</p>	<p><u>Off-site:</u> residential, farm buildings and St James' Church of England Primary School</p>	None
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Post-construction development description

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
-------------------------	--	---	--	--	--	-------

CL05 and CL11 – Located partly within the footprint of the application boundary, where earthworks (cut) are proposed.

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polyaromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Off-site Residential Farm users and St James' Church of England Primary School	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters – Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Likely	Mild	Moderate/low risk
	Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
	Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
Property receptors –	Exposure to explosive gases.	Low likelihood	Mild	Low risk	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
	Buildings, foundations, services (off-site)	Aggressive ground conditions	Low likelihood	Mild	Low risk
Notes/assumptions					
<ol style="list-style-type: none"> 1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure. 2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Construction CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination.		Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
Ground gas.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polycyclic aromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.		Inhalation of ground gases.	Low likelihood to likely	Medium	Moderate/low to moderate risk
	Off-site	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
	Residential	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
	Farm buildings and St James' Church of England Primary School	Inhalation of ground gases.	Low likelihood to likely	Medium	Moderate/low to moderate risk
	Controlled waters – Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Likely	Mild to medium	Moderate/low to moderate risk
	Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk	

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
	Property receptors – Buildings, foundations, services (off-site)	Exposure to explosive gases.	Low likelihood to likely	Mild	Low to moderate/low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. It is assumed that ground investigations will be undertaken specific to the application boundary prior to construction.
2. During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a Construction Environmental Management Plan (CEMP) (which will be prepared prior to the commencement of construction activities and signed off by Medway Council) will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. It is assessed that earthworks will require a cut operation to which might temporarily worsen groundwater quality, for example, as a result of dewatering activities, which may potentially draw contaminated groundwater away from the sources or alter ground gas pathways which may cause a temporary worsening in groundwater quality or increased ground gas risk compared to baseline.
5. The area of the source sites which lie within the footprint of the application boundary may require remediation. The majority of the source sites lie outside of the application boundary and so it is assumed that these parts will not be remediated.
6. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely to low likelihood	Medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely to low likelihood	Medium	Low to moderate/low risk
Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polyaromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.	Off-site Employees at the substation/ converter station	Inhalation of ground gases.	Unlikely to low likelihood	Medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Medium	Low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Medium	Low risk
	Off-site Residential Farm buildings and school	Inhalation of ground gases.	Unlikely	Medium	Low risk
		Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Likely	Mild	Moderate/low risk
			Likely	Mild	Moderate/low risk
Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk	

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
	Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buildings, foundations, services (on-site and off-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure and associated off-site post-development receptors have been considered in this CSM. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Low to moderate/low risk	Neutral	Neutral to minor beneficial effect
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Low to moderate/low risk	Neutral	Neutral to minor beneficial effect
Inhalation of ground gases (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low to moderate risk	Low to moderate/low risk	Neutral to minor adverse	Neutral to minor beneficial effect
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (off-site employees at the substation/ converter station)	N/A	N/A	Low risk	N/A	N/A
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (off -site employees at the substation/converter station)	N/A	N/A	Low risk	N/A	N/A
Inhalation of ground gases (off-site employees at the substation/ converter station)	N/A	N/A	Low risk	N/A	N/A
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Inhalation of ground gases (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low to moderate	Moderate/low risk	Neutral to minor adverse	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Moderate/low risk	Moderate/low to moderate	Moderate/low risk	Neutral to minor adverse	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses: Ponds	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses: Thames Estuary	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Impact on property receptors, on-site and off-site (exposure to explosive gases)	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors, on-site and off-site (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral to minor adverse	Neutral to minor beneficial effect
Notes/assumptions					
<ol style="list-style-type: none"> The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that up to only temporary minor adverse effects during the construction period may occur from ground disturbance. The post-construction impact column assumes remediation required has been undertaken and the benefits of remediation realised. Assumes construction works are complete. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Risk and Impact Assessment – Buried disused oil pipeline (within and extending outside of the application boundary)

Table 11.B4.1: Risk and impact risk assessment for buried disused oil pipeline located within and extending outside of the application boundary.

Site ID (IDS)	CL12
Site group	Buried disused oil pipeline (within and extending outside of the application boundary)
Site title (Site ID) and land use class	Current buried disused oil pipeline (CL12) – Class 3

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current buried disused oil pipeline (CL12) – Class 3	<u>On-site:</u> agricultural workers, potential landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Environmentally Sensitive Area (ESA) (North Kent Marshes)	<u>On-site:</u> disused buried oil pipeline	None

Post-construction development description

CL12 – Located within and extending outside of the footprint of the application boundary, where earthworks (cut) are proposed.

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, potential landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
Aggressive ground conditions		Low likelihood	Mild	Low risk	

Notes/assumptions

1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
Aggressive ground conditions		Low likelihood	Mild	Low risk	
Notes/assumptions					
<ol style="list-style-type: none"> 1. It is assumed that ground investigations will be undertaken specific to the application boundary prior to construction. 2. During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management. 					

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
<ol style="list-style-type: none"> 3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline. 4. The area of the source site which lies within the footprint of the application boundary may require remediation. 5. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Post-construction CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases. Aggressive ground conditions	Low likelihood Low likelihood	Mild Mild	Low risk Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
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3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Buried disused oil pipeline located in the application boundary

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Inhalation of ground gases (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Impact on property receptors, on-site (exposure to explosive gases)	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors, on-site (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral

Notes/assumptions

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that up to only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Former ponds (assumed infilled) (outside of the application boundary)

Table 11.B5.1: Risk and impact assessment for former ponds (assumed infilled) located outside of the application boundary.

Site ID (IDS)	CL09 and CL10
Site group	Former ponds (assumed infilled) (outside of the application boundary)
Site title (Site ID) and land use class	Current pond / former pond (assumed infilled) (CL09) – Class 1 Current undeveloped land / former pond (assumed infilled) (CL10) – Class 2

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current pond / former pond (assumed infilled) (CL09) – Class 1	<u>Off-site:</u> agricultural workers, landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Current on-site pond Drain/stream to the west	ESA (North Kent Marshes)	None	None
Current undeveloped land / former pond (assumed infilled) (CL10) – Class 2	<u>Off-site:</u> agricultural workers, landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Drain to the south	None	None	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas.		Direct contact, ingestion, inhalation of dust/ vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk

Notes/assumptions

1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground gas. Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
		Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild
Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk	

Notes/assumptions

- As these sites are outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on these sites. However, these sites may have the potential to influence conditions on the application boundary site during construction.
- During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management.
- Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
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4. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas. Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk	

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Inhalation of ground gases. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions					
<ol style="list-style-type: none"> The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Risk and Impact Assessment – Former Kent Oil Refinery (outside of the application boundary)

Table 11.B6.1: Risk and impact risk assessment for former Kent Oil Refinery located outside of the application boundary.

Site ID (IDS)	CL07					
Site group	Former Kent Oil Refinery (outside of the application boundary)					
Site title (Site ID) and land use class	Current unoccupied land / former Kent Oil Refinery (CL07) – Class 3					
Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current unoccupied land / former Kent Oil Refinery (CL07) – Class 3	<u>Off-site:</u> industrial land users to the south east	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Drains on site and off site to the east and south	None	On-site: Derelict structures	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

<i>Source</i>	<i>Receptor</i>	<i>Pathway</i>	<i>Probability</i>	<i>Consequence</i>	<i>Risk at baseline</i>
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos	Off-site Industrial land users to the south east	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases.	Low likelihood	Minor	Very low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos		Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
	Off-site users	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
	Industrial land users to the south east	Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases.	Low likelihood	Minor	Very low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. As this site is outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on this site. However, this site may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
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4. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.
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Post-construction CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos	Off-site Industrial land users to the south east	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases. Aggressive ground conditions	Low likelihood Low likelihood	Minor Mild	Very low risk Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction.
3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Former Kent Oil Refinery located outside of the application boundary

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Inhalation of ground gases. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors (exposure to explosive gases)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Impact on property receptors (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions					
<ol style="list-style-type: none"> The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Risk and Impact Assessment – Former military land use (outside of the application boundary)

Table 11.B7.1: Risk and impact assessment for former military land use located outside of the application boundary.

Site ID (IDS)	CL06					
Site group	Former military land use (outside of the application boundary)					
Site title (Site ID) and land use class	Current undeveloped land / former military land use (CL06)- Class 3					
Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current undeveloped land / former military land use (CL06)- Class 3	None	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Pond to the south east	None	None	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
Notes/assumptions					
<ol style="list-style-type: none"> 1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure. 2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Construction CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk

Notes/assumptions

1. As this site is outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on this site. However, this site may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
Notes/assumptions					
<ol style="list-style-type: none"> 1. Assumes remediation required has been undertaken and construction works are complete. 2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction. 3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Impact Assessment: Former military land use located outside of the application boundary

Contaminant linkage	Baseline risk	Construction Risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface water	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions:					
<ol style="list-style-type: none"> 1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance. 2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered. 					

Risk and Impact Assessment – Farm land (outside of the application boundary)

Table 11.B8.1: Risk and impact assessment for farm land located outside of the application boundary.

Site ID (IDS)	CL01 and CL03
Site group	Current and former farm land (outside of the application boundary)
Site title (Site ID) and land use class	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)– (CL01) Class 1 Current Farm – (CL03) Class 1

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
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Current residential land use / former Perry's Farm (including current storage of farm activity related materials)– (CL01) Class 1	<u>On-site:</u> residential/ farm users <u>Off-site:</u> agricultural workers, landfill management operatives <u>Off-site (post-construction only):</u> Employees at the substation/ converter station	Superficial deposits: Secondary A aquifer	Pond to the southeast	None	<u>On-site:</u> residential/ farm buildings	None
Current Farm – (CL03) Class 1	<u>On-site:</u> residential/ farm buildings <u>Off-site:</u> residential	Superficial deposits: Secondary A aquifer	None	None	<u>On-site:</u> residential/ farm buildings <u>Off-site:</u> residential	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline	
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk	
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk	
	Off-site residential, agricultural workers, landfill management operatives	Inhalation of ground gases.	Inhalation of ground gases.	Unlikely	Mild	Very low risk
			Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
			Inhalation of ground gases.	Unlikely	Mild	Very low risk
		Controlled waters- Superficial deposits: Secondary A aquifer	Vertical and lateral migration.	Low likelihood	Mild	Low risk
		Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
	Property receptors – Buildings, foundations and services (on-site and off-site).	Exposure to explosive gases.	Unlikely	Mild	Very low risk	
		Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk	

Notes/assumptions

1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase	
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk	
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk	
	Off-site residential, agricultural workers, landfill management operatives		Inhalation of ground gases.	Unlikely	Mild	Very low risk
			Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
			Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
			Inhalation of ground gases.	Unlikely	Mild	Very low risk
		Controlled waters- Superficial deposits: Secondary A aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
		Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
	Property receptors – Buildings, foundations and services (on-site and off-site).		Exposure to explosive gases.	Unlikely	Mild	Very low risk
			Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk

Notes/assumptions

1. As these sites are outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on these sites. However, these sites may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
<p>3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.</p> <p>4. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.</p>					

Post-construction CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction	
Soil, leachate and groundwater contamination.		Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk	
Possible ground gas.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk	
Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.		Inhalation of ground gases.	Unlikely	Mild	Very low risk	
	Off-site residential, agricultural workers, landfill management operatives, employees at the substation/ converter Station	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk	
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk	
		Inhalation of ground gases.	Unlikely	Mild	Very low risk	
		Controlled waters- Superficial deposits: Secondary A aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
		Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
Property receptors – Buildings, foundations and services (on-site and off-site).	Exposure to explosive gases.	Unlikely	Mild	Very low risk		
	Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk		

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure and associated off-site post-development receptors have been considered in this CSM. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Farm land located outside of the application boundary

Contaminant linkage	Baseline Risk	Construction risk	Post-construction Risk	Construction impact significance	Post-construction impact significance
Exposure to soil contamination – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to groundwater contamination – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to ground gas – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to soil contamination – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to groundwater contamination – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to ground gas – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors – on-site and off-site (exposure to explosive gases)	Very low to low risk	Very low to low risk	Very low to low risk	Neutral	Neutral
Impact on property receptors – on-site and off-site (aggressive ground conditions)	Very low to low risk	Very low to low risk	Very low to low risk	Neutral	Neutral

Contaminant linkage	Baseline	Construction	Post-construction	Construction impact	Post-construction impact
	Risk	risk	Risk	significance	significance
Overall significance				Neutral	Neutral

Notes/assumptions:

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

