Ford energy from waste

FORD ENERGY RECOVERY FACILITY AND WASTE SORTING AND TRANSFER FACILITY, FORD CIRCULAR TECHNOLOGY PARK

ENVIRONMENTAL STATEMENT
TECHNICAL APPENDIX G: GROUND CONDITIONS AND THE WATER ENVIRONMENT

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FORD ENERGY RECOVERY FACILITY AND WASTE SORTING AND TRANSFER FACILITY, FORD CIRCULAR TECHNOLOGY PARK

FLOOD RISK ASSESSMENT & OUTLINE SURFACE WATER DRAINAGE STRATEGY

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1. INTRODUCTION

1.0 Brief

Ford Energy from Waste (EfW) Limited, a joint venture between Grundon Waste Management Limited (Grundon) and Viridor Waste Management (Viridor) (therein referred to as 'the applicants'), are proposing to build and operate a conventional energy recovery facility (ERF) at the site. Grundon, the sole owner/ operator of the existing waste transfer station (WTS), is proposing to continue this operation in a new, purpose-built waste sorting and transfer facility (WSTF) on site. Ramboll UK Limited (Ramboll) has been appointed by Ford EfW Ltd to undertake a Flood Risk Assessment (FRA) and develop an Outline Surface Water Drainage Strategy to support the full planning application at the site, including the ERF and waste sorting and transfer facility (WSTF) and ancillary uses.

1.1 Scope and Objectives

1.1.1 This document considers the risks of various sources of flooding to the site and the consequent risk of flooding to downstream receptors (such as people, property, habitats, infrastructure and statutory sites) from the proposed development as a result of surface water runoff. A comparison is made between the current situation and the proposed future development.

1.1.2 This FRA has been carried out in accordance with the National Planning Policy Framework (NPPF)[1]. It is to be used to assist the Waste Planning Authority (WPA), the associated Lead Local Flood Authority (LLFA) and Environment Agency (EA) when considering the flooding issues of the proposed development, as part of a planning application. An FRA is required as the developable area is greater than 1 hectare (ha).

1.1.3 This report provides the following information:

i. An assessment of the flood risk to the site based upon flood data and the flood maps provided by the EA and Arun District Council Level 1 and 2 Strategic Flood Risk Assessment (SFRA)[2];
ii. An assessment of the impact of the new development in terms of surface water runoff;
iii. Proposals for measures to mitigate the generation of surface water runoff by the proposed development; and
iv. Recommendations to mitigate any residual flood risks to the development as a result of climate change (CC).

1.1.4 The references for the key source of information used to prepare this document are included in the footnotes section of this report. Ramboll cannot accept liability for the accuracy or otherwise of any information derived from third party sources.

[1] Department of Communities and Local Government (2019). National Planning Policy Framework (online) London: House of Commons. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf [accessed 25/02/2020]

[2] Arun District Council (2016). Level 1 and Level 2 Strategic Flood Risk Assessment Final Report (online) West Sussex. Available at: https://www.arun.gov.uk/flood-risk-planning-policy/ [accessed 25/02/2020]

2. SITE CONTEXT

2.0 Site Description

2.0.1 The site is located at the Ford Circular Technology Park (the former Tarmac blockworks site, approximate National Grid Reference (NGR) 498968 103119) to the west of the village of Ford.

2.0.2 The 7.11 ha site is partially used for existing WTS operations and is partially vacant. The existing WTS building is located towards the centre of the site and portacabins; parking and containers associated with this operation are situated to the west of the WTS. There are two vacant, derelict former hangar buildings towards the north of the site and a large area of hardstanding is situated towards the south and east of the site.

2.0.3 The site location plan and site boundary are provided in Figure 1 and 2 respectively, at the rear of this report.

2.0.4 The site is bound on all sides by agricultural land. Ford Lane Business Park and a number of farmhouses are located approximately 500 m north of the site[3]. A triangular area of sports pitches, with a sewage treatment works located beyond the sports pitches are present approximately 20 m from the southern site boundary. The residential village of Ford and Ford Airfield Industrial Estate are located approximately 300 m east and 500 m west of the site, respectively.

2.1 Site Walkover

2.1.1 A site walkover was undertaken by a Ramboll flood risk consultant on the 11 December 2019. The principal objectives of the walkover survey were to inspect the site and surrounding area, verify information collected as part of the desk-based flood risk and drainage assessment, collect additional information and examine local records concerning the site.

2.1.2 The site walkover features are further described in Section 2.6 and photographs taken are presented in Appendix A.

2.2 Site Topography

2.2.1 Based on the topographic survey undertaken by Mitcham Surveys (2013, Drawing No. 1275-1), the site is generally flat. Topography in the vicinity of the site gently slopes towards the north. Ground elevations within the site boundary range from 6.38 to 7.27 m Above Ordnance Datum (mAOD), with the lowest levels recorded towards the west and northeast sides of the site.

2.2.2 The topographic survey is provided in Figure 3.

2.3 Geological Setting

2.3.1 The British Geological Survey (BGS)[4] map of the area (1:50,000 scale map series), accessed via online digital mapping indicates that the site is underlain by superficial deposits of River Terrace Deposits (sand, silt and clay) which is in turn underlain by bedrock of the Lewes Nodular Chalk Formation (chalk). Made Ground is present across the site.

2.3.2 A review of historical borehole logs in the vicinity of the site was undertaken using the BGS Geology of Britain Viewer. The following borehole logs were reviewed:

[3] Distance references included in this report are taken from the centre of the site.

[4] British Geological Survey (BGS) (2017). Geology of Britain Viewer (online). Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed 25/02/2020]

- SU90SE18 – 85 m south of the rectangular portion of the site boundary at 5.5 m mAOD;
- SU90SE37 – 375 m east of the rectangular portion of the site boundary at 3.4 mAOD; and
- SU90SE16 – 480 m north of the rectangular portion of the site boundary at 4.6 mAOD.

2.3.3 A summary of ground conditions in the area of the site as described within the historical borehole logs is presented as Table 2.1 below.

Table 2.1: Summary of Ground Conditions Identified by BGS Borehole Logs

Stratum	Description	Depth (m below ground level (bgl))	Thickness (m)
Made Ground	'Made Ground' OR Soil OR Brown soil	0.2 to 0.6	0.2 to 0.6
River Terrace Deposits	Sandy clay and gravel OR Clay, silty, reddish brown, with angular to well rounded flint pebbles and gastropod shell fragments	1.1 to 6.4	0.9 to 5.8
Lewes Nodular Chalk Formation	Clay/chalk marl OR Chalk, rubbly, with matrix of olive silt and fine sand and some rounded flint pebbles to 5.5m, greyish white, with nodular flints	>30	>23.6

2.3.4 Historical boreholes recorded groundwater levels ranging from 2.0 mbgl (1.4 mAOD) at SU90SE37, 4.21 mbgl (0.39 mAOD) at SU90SE16 and 5.87 mbgl (-0.37 mAOD) at SU90SE18. Historical groundwater levels in SU90SE16 and SU90SE18 indicate that groundwater is shallower in the southeast than in the northwest. This is consistent with the location of the River Arun to the east of the site.

2.3.5 An intrusive ground investigation followed by a supplementary ground investigation were undertaken by Enzygo in 2015 and 2018, respectively. Ground conditions were generally in line with the anticipated ground conditions detailed in Table 2.4. A summary of ground and groundwater conditions is presented in Table 2.2 and Table 2.3.

Table 2.2: Summary of Ground conditions (Enzygo, 2015; 2018)

Strata	Summary Description	Depth to top of Strata (mbgl)	Thickness (m)
General Made Ground	Made Ground (concrete 120 mm to 250 mm thick) over lean concrete (150 mm to 200 mm) over black ashy sandy fine angular gravel.	0.0	0.15 to 2.0
Made Ground Backfilled slurry pit (TP12, TP13 and TP14)	Large concrete blocks (300 mm + square), rebar, cable in a sandy gravel matrix over large concrete blocks with abundant 6 mm rebar in grey sandy gravelly size concrete matrix black sandy gravelly clay with brick fragments	0.0	0.65 to 1.2
Made Ground backfilled pit (TP15)	Dark grey sandy gravelly topsoil with brick and concrete fragments over large concrete blocks with rebar, metal pipe, brick in a topsoil matrix	0.0	In excess of 1.5
Made Ground (demolished autoclaves (TP9, TP10 and TP11))	Large concrete blocks (300 mm + square), rebar, pieces of plastic, wire metal roots, wood fragments in a sandy matrix. Slight discernible hydrocarbon odour over firm brown, grey and black sandy gravelly clay over concrete lean mix.	0.0	2.1 to 3.0

Strata	Summary Description	Depth to top of Strata (mbgl)	Thickness (m)
Superficial materials (River Terrace Deposits)	Firm locally soft orange brown sandy clay over medium dense orange brown and yellow brown slightly clayey slightly gravelly medium sand and gravel. Gravel is medium to coarse rounded flint.	0.15 to 2.0	0.9 to 4.35
Chalk	Structureless chalk composed of sub-angular to rounded medium to coarse gravel size light brown highly weathered weak fragments with subrounded cobble size weathered weak fragments . Some matrix of soft light brown clayey sand size fragments	2.3 to 4.5	In excess of 18.2
Groundwater	Seepages within Made Ground at 1.4 mbgl. Water strike at depths between 5.5 mbgl and 9.0 mbgl during ground investigations. Hydraulic gradient generally appears to be towards the east to southeast.	N/A	N/A

2.3.6 In addition to the groundwater monitoring visits undertaken by Enzygo, Grundon Waste Management Ltd carried out 24 groundwater level monitoring visits between March 2018 and December 2019. Ramboll also carried out a groundwater monitoring visit on 18 February 2020 to investigate groundwater levels at the site during a winter period. This visit took place immediately following Storm Dennis (15 February 2020). The details of the groundwater level monitoring are presented in the Ramboll Water Quality Assessment (Ref 1620007830-RAM-XX-XX-RP-YE-00006) and provided as a summary of average, minimum and maximum groundwater levels in Table 2.3. The shallowest recorded depth to groundwater at the site was 2.45 mbgl (4.27 mAOD) recorded by Ramboll in February 2020.

2.3.7 The location of the boreholes presented in Table 2.3 is presented in Figure 4.

Table 2.3: Summary of Groundwater Level Monitoring 2018 to 2020

Location	2018-2019 Groundwater Levels (mbgl) [mAOD]			February 2020 Groundwater Levels (mbgl) [mAOD]
	Average	Maximum	Minimum	
BH1	Not Measured (N/M)	N/M	N/M	N/M
BH2	4.49 [2.18]	5.32 [4.26]	3.62 [1.4]	2.45 [4.27]
BH6A	5.19 [1.48]	6.02 [3.01]	4.34 [0.65]	3.66 [3.01]
BH7	5.19 [1.42]	7.84** [3.05]	4.5 [-1.24]	3.55 [3.05]
BH8	5.14 [1.35]	5.83 [2.83]	4.34 [0.66]	3.66 [2.83]
BH101	4.55 [2.2]	5.49 [4.3]	3.62 [1.26]	2.66 [4.3]
BH102	5.06 [1.67]	5.82 [3.07]	4.41 [0.91]	3.66 [3.07]
BH103	5.04 [1.45]	5.68 [2.71]	4.48 [0.81]	3.78 [2.71]
BH104	4.97	5.75	4.27	3.27

Location	2018-2019 Groundwater Levels (mbgl) [mAOD]			February 2020 Groundwater Levels (mbgl) [mAOD]
	Average	Maximum	Minimum	
	[1.97]	[3.67]	[1.19]	[3.67]
BH105	4.7 [2.03]	5.69 [6.45]	4.15 [1.04]	0.28* [6.45]
BH106	0.63* [5.7]	0.73* [5.8]	0.52* [5.59]	Flooded
BH107	4.11 [2.89]	5.71 [6.83]	0.17* [1.29]	Lost
BH108	4.53 [2.13]	5.36 [3.82]	3.77 [1.3]	2.84 [3.82]

*These values are considered to be anomalous due to flooding of the relevant locations and are not considered to be representative of the groundwater table
**This value is significantly lower than groundwater levels recorded at this location on other visits or at other locations during the same visit and is anticipated to be anomalous. As such it is not considered to be representative of the groundwater table

2.3.8 For further details on the geological features at the development site, please refer to the Geoenvironmental Desk Study for the site (Report No. 1620007830-RAM-XX-XX-RP-YE-00002).

2.4 Hydrological Setting

2.4.1 The proposed development site is located within the Arun Lower Operational Catchment and is located approximately 900m west of the River Arun. The River Arun (Transitional Water) is a heavily modified watercourse and its current ecological and chemical state is classified as moderate and good respectively by the EA[5].

2.4.2 There are no watercourses or other hydrological features within the site boundary. Approximately 350 m east of the site and adjacent to the new access road and Ford Road, a narrow drainage ditch flows in an easterly direction prior to discharging into the River Arun.

2.5 Hydrogeological Setting

2.5.1 The EA has developed Groundwater Source Protection Zones (SPZ) to assist in the assessment of risk to groundwater supplies taken from an abstraction point. According to MAGiC[6] interactive mapping, the site does not lie within a Groundwater SPZ.

2.5.2 In addition, the site is not located within a Nitrate Vulnerable Zone (NVZ) or Drinking Water Protected Area (DWPA), however the River Arun is classified as a DWPA and is linked to a Special Protected Area (SPA) and a Special Area of Conservation (SAC). The SPA and SAC are 10 km upstream of the site and are not anticipated to be relevant to this study.

2.5.3 The EA website shows aquifers and provides designations which are in line with the Water Framework Directive and are based on maps produced by the BGS. According to the EA aquifer mapping, the underlying superficial deposits (River Terrace Deposits) and bedrock geology (Lewes Nodular Chalk Formation) are designated as Secondary A and Principal aquifers, respectively.

[5] Environment Agency (2020). Catchment Data Explorer – Arun Lower Summary (online). Available at: https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3266/Summary [accessed 25/02/2020]
[6] Natural England (2020). MAGiC (online). Available at: https://magic.defra.gov.uk/home.htm [accessed 25/02/2020]

2.5.4 In terms of groundwater vulnerability, the site is located within a medium vulnerability zone for the River Terrace Deposits and a high vulnerability zone for the Principal aquifer indicating that the area is able to easily transmit pollution to groundwater.

2.6 Existing Drainage Regime and Surface Water Runoff

2.6.1 For context, greenfield runoff rates were calculated for the site (7.12 ha) using the Interim Code of Practice for Sustainable Drainage Systems (ICP SuDS) method in MicroDrainage 2018. The results of the calculations are shown in Table 2.4 below. The outputs from MicroDrainage are provided in Appendix B.

2.6.2 Approximately 93% of the site (6.64 ha) is occupied by existing buildings and hard landscaping and is considered to be brownfield and 100% impermeable. The existing (pre-development) runoff rates from the site in its current configuration have been calculated using Tekla Tedds (Version 2.0.00, 2017) and are presented in Appendix C[7]. The critical storm duration is 15 minutes. The results of the calculations are shown in Table 2.4.

Table 2.4: Greenfield and Pre-development Runoff Rate Calculations

Return Period (years)	1-in-1	1-in-2	1-in-10	1-in-30	1-in-100
Greenfield runoff rates (l/s)	22.5	23	43	60	84
Pre-development runoff rates (l/s)	559	723	1,119	1,371	1,772

2.6.3 During the walkover survey, it was noted that surface water runoff from the existing buildings (Unit 1, Unit 2 and the WTS) is collected by a number of plastic rainwater downpipes, discharging at ground level and draining (gravitational flow) into the nearest gully which comprises part of the existing private surface water drainage network. A number of these rainwater pipes were noted to be cracked, broken and dislocated (Photo A.9, Appendix A). The majority of the gullies observed were completely blocked by soil and debris, causing ponding of surface water around them (Photo A.7, Appendix A).

2.6.4 Surface water runoff from the external yard area (concrete hard standing with vegetation noted to be growing in between the cracks) is also discharging into existing gullies. Based on the Drainage Assessment undertaken by Enzygo Ltd[8], the private surface water sewer carries stormwater in an easterly direction with an outfall to an unnamed land drain located approximately 350 m east of the site at NGR 500095 103414[9].

2.6.5 A detailed description of the proposed outline surface water drainage strategy is provided in Section 4.

2.6.6 Southern Water asset records are provided in Appendix D. These records indicate that there is an adopted foul rising main passing close to the southern site boundary, conveying foul water flows to the Ford Sewage Treatment Works (STW). No foul, surface or combined sewers are shown in close proximity to the site. Once the location and condition of the existing connections to the foul sewer network are proven, it may be possible to reuse or upgrade these connections for the proposed development.

[7] The design rainfall intensity is calculated in accordance with the Wallingford Procedure and BRE Digest 365 by defining the appropriate storm length and return period and the ratio(r) of a 60 minute to two-day rainfalls of five-year return period appropriate for the geographic location. The entire catchment (site area), and the percentage of that area that is impermeable, are considered in order to calculate the surface water runoff rate from the site

[8] Drainage survey and associated report by Enzygo Ltd, titled "Ford CTP, Arundel – Drainage Assessment", dated 2015.

[9] Drawing No.100.A and 102.A, form Enzygo Ltd Drainage Survey Report "Ford CTP, Arundel – Drainage Assessment", 2015.

2.7 Existing Flood Risk

Fluvial and Tidal Flood Risk

2.7.1 The EA floodplain maps identify areas in England and Wales at risk of flooding by allocating them into flood risk zones. The flood risk zones shown on the flood maps are defined in Table 1 (Flood Zones) of the National Planning Policy Guidance (NPPG)[10].

2.7.2 The flood zones' spatial variation within the site boundary, based on the EA indicative flood map, is provided in Figure 5.

2.7.3 The EA indicative flood risk mapping shows that the site is entirely located in Flood Zone 1, at low risk of fluvial flooding.

2.7.4 Considering the above, the site is presently at low risk of fluvial flooding. The effects of climate change (CC) are considered in Section 3.

Surface Water and Sewer Drainage Flood Risk

2.7.5 The Flood and Water Management Act 2010 defines surface water flooding as flooding that takes place when surface water runoff generated by rainwater falls on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer.

2.7.6 The EA's flood risk map for surface water flooding is provided in Figure 6.

2.7.7 The EA surface water flood mapping indicates low risk of flooding from surface water in the external yard area surrounding by Unit 1 (Hangar 1), Unit 2 (Hangar 2) and the WTS with the predicted depth from EA data as up to 0.30 m. Furthermore, the area adjacent to the west of the site office and weighbridge is shown to be at medium to low risk of surface water flooding. Associated depth of flooding is predicted to be between 0.15 m and 0.30 m. The northwest part of the site is also shown to be at low risk of surface water flooding with the predicted depth as up to 0.30 m.

2.7.8 The above described surface water flooding is created primarily due to natural ground depressions in certain parts of the site covered with concrete. Surface water ponding in these areas was also confirmed from surface water maps provided by Arun District Council (Level 1 SFRA: Appendix E Surface Water Flood Risk, p.34) and during the site walkover (Photos A.10 and A.11, Appendix A). In addition, during the site walkover, surface water ponding was also observed in the area along the south of the WTS (Photos A.12 and A.13, Appendix A). It is understood that this is primarily due to blockages in the existing surface water drainage system which do not allow surface water to freely drain off the site.

2.7.9 Considering the above, the overall risk of flooding from surface water within the site boundary is considered to be low. Low risk of flooding from surface water means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).

2.7.10 According to Arun District Council SFRA, there are no incidents of sewer flooding within the site boundary or in the vicinity of the site (within 1 km radius).

Groundwater Flood Risk

[10] Department for Communities and Local Government (2014). National Planning Practice Guidance (NPPG) – Flood risk and coastal change. Part of Planning practice and Planning system (online) London: House of Commons. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones [accessed 25/02/2020]

2.7.11 Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods may emerge from either point or diffuse locations. They tend to be long in duration developing over weeks or months and prevailing for days or weeks.

2.7.12 Arun District Council SFRA (Level 1 SFRA: Appendix F Areas Susceptible to Groundwater, p.34) indicates that the area in general is highly susceptible to groundwater flooding. In addition, it is mentioned that 'significant groundwater flood events have been recorded across the Arun District. This risk is supported by the Areas Susceptible to Groundwater Flooding mapping and suggests that susceptibility to groundwater flooding is generally high through the district' (Arun District Council, 2016).

2.7.13 From review of groundwater level monitoring data at the site, the shallowest depth of groundwater (recorded during the recent prolonged wet winter period) during the visit on 20 February 2020 (refer to Table 2.3 and Figure 4) is 2.45 mbgl recorded in the southwestern corner of the site. Groundwater levels recorded on 20 February 2020 in the vicinity of the proposed bunker are generally slightly deeper than 2.45 mbgl.

2.7.14 Based on the available ground investigation data, the shallowest depth to Lewes Nodular Chalk (Principal Aquifer) has been recorded at 2.3 mbgl in the southern half of the site and is generally slightly deeper in the vicinity of the proposed bunker.

2.7.15 Considering the above and taking a precautionary approach, the overall risk of flooding from groundwater within and in the vicinity of the site is considered to be high. A depth of 2.3 mbgl to the top of Lewes Nodular Chalk and 2.45 mbgl to groundwater are representative of the worst-case recorded data available for the site to date (as of February 2020)[11].

Risk from Reservoirs, Canal and Other Artificial Sources

2.7.16 There are two reservoirs, namely Swanbourne Lake and Bisham Farm Reservoir within the Arun District and in close proximity to the site (within 5 km radius). Nevertheless, the UK Government indicative mapping database[12] shows that there is no risk of flooding from reservoirs within the site boundary and therefore, the associated risk is considered low.

Flood Risk Summary

Table 2.5: Flooding Sources at the Proposed Development Site

Sources of Flooding	High	Medium	Low	Comments
Tidal and Fluvial			√	The entire site is located within Flood Zone 1, at low risk of fluvial and tidal flooding
Surface water			√	EA surface water flood map indicates low risk of flooding within the site boundary. No incidents of sewer flooding within or in the vicinity of the site have been reported.
Groundwater	√			The overall risk of groundwater flooding within and in the vicinity of the site is considered to be high.

[11] As stated previously, this is based exclusively on the ground investigation and groundwater level monitoring data available to date which does not provide full coverage in the vicinity of the proposed bunker.

[12] UK Government (2020). Learn more about flood risk (online) Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map [accessed 25/02/2020]

Sources of Flooding	High	Medium	Low	Comments
Reservoirs, canals and other artificial sources			√	The site is not shown to be at risk of flooding from reservoirs, canals and other artificial sources

3. ASSESSMENT OF NEW DEVELOPMENT

3.1 Development Proposal

3.1.1 Ford EfW Ltd, Grundon and Viridor propose to redevelop the site as a waste management facility comprising an ERF and WSTF. The buildings and ancillary structures to be constructed as part of the waste management facility are anticipated to occupy 40% of the site. The remaining 60% of the site will be occupied by external areas, predominantly comprising hardstanding. External areas of the site will include access roads and operational transport routes within the site, car and heavy goods vehicle (HGV) parking spaces, HGV washing areas ramps and pedestrian routes.

3.1.2 The proposed architectural layout drawings are presented in Appendix E.

3.2 Flood Risk Vulnerability

3.2.1 According to Table 2 (Flood Risk Vulnerability Classification) in the Planning Practice Guidance to NPPF, buildings used for services and industrial purposes are classified as 'Less Vulnerable'.

3.3 Sequential Test

3.3.1 The Sequential Test aims to steer development to areas with the lowest probability of flooding. The proposed development is classified as 'Less Vulnerable' in Flood Zone 1 and therefore, the sequential test is deemed to have been passed and the Exception Test is not required for the proposed development.

3.4 Surface Water Runoff

3.4.1 The NPPF identifies that rainfall intensities will increase in the future as a result of CC, thereby increasing surface water runoff rates and volumes. The EA CC allowance guidance (2016)[13] shows the recommended national precautionary sensitivity ranges for various parameters including peak rainfall intensity. The design life of the new development is considered to be 60 years; the recommended allowance for CC has a range between 20% (central) and 40% (upper end). Due to the development site being located in a wider urban environment, a 40% CC allowance has been applied and should be accounted for when designing the new surface water drainage systems.

3.4.2 The existing site is 93% impermeable (6.64 ha), as it is occupied by existing buildings and hard landscaping. The footprint of the proposed development will result in a 9% decrease of the impermeable site area (6.02 ha) due to the inclusion of landscaping around the eastern, northern and western edges of the site.

3.4.3 Table 3.1 summarises the predicted change in peak flows as a result of CC (considering 40% allowance). The critical storm duration for runoff is 15 minutes. Calculations are provided in Appendices C and F.

Table 3.1: Surface Water Runoff Rate Calculations

Return Period (years)	1-in-1	1-in-2	1-in-10	1-in-30	1-in-100
Pre-development runoff rates (l/s)	559	723	1,119	1,371	1,772
Post-development runoff rates (l/s) including 40% CC	724	926	1,427	1,765	2,311
Post-development increase (when allowing for CC)	165	203	308	394	539

[13] National Planning Policy Framework (NPPF) dated February 2016, and updated March 2020.

3.4.4 To ensure that flood risk to downstream receptors does not increase following development, attenuation of surface water runoff will need to be incorporated into the proposed drainage strategy for the site. The attenuation requirements for the proposed development were agreed with the West Sussex County Council LLFA (refer to Appendix H and sections 3.4.5 and 3.4.6) and calculated using the Wallingford procedure. The footprint of the proposed development in conjunction with a 40% allowance for CC were considered for the storage volume calculations. Table 3.2 presents the calculated storage volumes for different critical storm events. The detailed calculations are provided in Appendix G.

3.4.5 According to the West Sussex LLFA Policy for the Management of Surface Water[14], redevelopment on brownfield land has the potential to rectify or reduce flood risk. Proposed brownfield developments are required to manage their surface water runoff in order to achieve a 50% reduction in the rates of surface water drainage compared to the existing ones at peak times.

3.4.6 Following direct liaison with WSCC (refer to Consultation and Scoping response, Appendix H), it is required to restrict post-development runoff rates to 60 l/s (1-in-30 year rainfall event at greenfield runoff rates) and attenuate the 1-in-30 year critical storm event including 40% allowance for CC below ground, equating to 2,900 m^3.

Table 3.2: Storage Volume Calculations

Storm Event	M1-120	M2-240	M10-240	M30-240	M100-240
Storage Volume (m^3)	882	1,206	2,173	2,895	4,038

NB. The "M" value refers to the return period (M1 is the 1-in-1 year rainfall event). The "120" or "240" value refers to the time period of the rainfall event in minutes. This duration is assessed as being the critical storm duration whereby the maximum amount of storage is required based upon the allowable discharge.

3.5 Groundwater Flood Risk

Whilst the overall risk of groundwater flooding within and in the vicinity of the site is considered to be high there are limited areas of the development that have the potential to interact with groundwater. The main below ground excavation will be for the construction of a waste bunker with a floor level of approximately 2 mbgl. Based on existing groundwater level data at the site (shallowest depth recorded at 2.45 mbgl), the potential for the bunker excavation to interact with groundwater is anticipated to be minimal. As such elements of the design that could interact with groundwater is limited to the installation of supporting structural piles. As is standard practice, potential impacts can be mitigated, for example, by the provision of granular conveyance routes and drainage blankets on and surrounding below ground structures where necessary to maintain groundwater flow rates to be approximately equivalent to that pre-development (although unlikely to be required). In addition, and as discussed in Section 4 below local surface ponding of water will be allowed to occur in extreme events in managed external hardstanding areas. These areas will be at marginally lower elevations and would also allow for the ponding of groundwater should levels rise in a groundwater flood event, prior to that water being conveyed as a managed overland flow path within the site boundary and subsequently following the existing flow path towards the local watercourse .

4. OUTLINE SURFACE WATER DRAINAGE STRATEGY

4.0.1 The indicative surface water drainage strategy layout for the proposed development is provided in Figure 7.

[14] West Sussex County Council (2018). West Sussex LLFA Policy for the Management of Surface Water (online) West Sussex. Available at: https://www.westsussex.gov.uk/media/12230/ws_llfa_policy_for_management_of_surface_water.pdf [accessed 18/03/2020]

4.0.2 The surface water drainage strategy takes into consideration the topography, geological, hydrological and hydrogeological setting and investigates how surface water runoff from the development site can be managed to comply with the requirements of the NPPF, EA and WSCC.

4.0.3 A range of SuDS options were considered in order to identify the most suitable options for attenuating surface water runoff on the proposed development site. Table I.1 in Appendix I presents the different SuDS approaches that are available and were considered for this site and describes their advantages, disadvantages and appropriateness for use on the proposed site.

4.0.4 Although a wide range of SuDS techniques were considered, there are very few methods that would be practically feasible and suitable due to the extensive built footprint within the site boundary and its geological and hydrogeological setting. Specifically, considering the high potential groundwater levels and contamination at the site in conjunction with its location within a high vulnerability zone on Principal aquifer (Sections 2.3 and 2.5), infiltration is not considered to be a viable option for the site.

4.0.5 The existing surface water drainage system on site will be abandoned. The off-site surface water drainage connection with the unnamed land drain will be surveyed and cleaned out to the outfall to ensure that the new surface water drainage system will function appropriately.

4.0.6 It is proposed that surface water runoff is attenuated in lined below ground cellular storage tanks (impermeable membrane to avoid potential groundwater ingress) prior to discharging at 1-in-30 year greenfield runoff rates into the unnamed land drain using the existing outfall (NGR 500095 103414). The proposed attenuation storage systems are located beneath areas allocated for car parking in the southwestern, northern and north-eastern parts of the site will collect surface water from rainwater pipes and external hardstanding areas (Figure 7).

4.0.7 It has been calculated that the proposed attenuation system will require 2,900 m^3 of attenuation storage volume designed to contain the 1-in-30 year critical storm event including 40% allowance for CC without causing any flooding to the site. As advised by WSCC, exceedance flows beyond the 1-in-30 year critical storm event can be discharged uncontrolled to the drainage system (Appendix H). However, it is considered appropriate to manage surface water volumes in excess of the 1-in-30 year event (including 40% CC allowance) on site by allowing shallow ponding (~ 150 mm average depth) of managed external hardstanding areas thereby not increasing flood risk downstream as a result of the proposed development.

4.0.8 Some rainwater harvesting is proposed for the development and will be further detailed in future design stages. However, the impact of this option on the required attenuation volumes has not been considered in the current attenuation and discharge calculations, especially as during extreme events the rainwater harvesting system may already be at capacity.

4.0.9 To aid in minimising the impact to the surrounding environment in terms of water quality as well as water quantity it is proposed to install "light liquid" separators as required as part of the proposed formal surface water drainage system. The specific locations for their installation can be finalised at detailed design stage but at present options exist to either locate one separator immediately downstream of each attenuation system, or alternatively one larger separator built on the existing surface water drainage pipe, immediately before surface water discharges off-site.

4.0.10 The surface water drainage strategy will need to be further developed at the detailed design stage. The size of the pipe connecting the surface water system on site with the unnamed drain may need to be adjusted to carry the expected flow for the different return periods.

5. SUMMARY

i. The site is located at the Ford Circular Technology Park (the former Tarmac blockworks site, approximate NGR 499586 103315) to the west of the village of Ford. The site covers an area of approximately 7.11 ha, part of which is used for existing WTS operations with the rest of it being vacant.

ii. It is proposed to redevelop the site as a waste management facility comprising an ERF and WSTF. The buildings and ancillary structures to be constructed as part of the waste management facility are anticipated to occupy 40% of the site. The remaining 60% of the site will be occupied by external areas, including access roads and operational transport routes within the site, car and HGV parking spaces, HGV washing areas ramps and pedestrian routes.

iii. There are no watercourses or other hydrological features within the site boundary. Approximately 350 m east of the site and adjacent to the new access road and Ford Road, a narrow drainage ditch flows in an easterly direction prior to discharging into the River Arun, approximately 1 km east of the site.

iv. The EA indicative flood risk mapping shows that the site is entirely located in Flood Zone 1, at low risk of fluvial flooding.

v. The risk of flooding from surface water within the site boundary is considered to be low.

vi. Taking a precautionary approach, the risk of flooding from groundwater within and in the vicinity of the site is considered to be high. A depth of 2.3 mbgl to the top of Lewes Nodular Chalk and 2.45 mbgl to groundwater are representative of the worst-case data available for the site to date (as of February 2020). Whilst being considered as high, this risk is capable of being mitigated by standard design measures.

vii. There is no risk of flooding from reservoirs within the site boundary and therefore, the associated risk is considered low.

viii. The proposed development is classified as 'Less Vulnerable' in the Planning Practice Guidance to NPPF and therefore, the sequential test is deemed to have been passed and the Exception Test is not required for the proposed development.

ix. The existing surface water drainage system on site will be abandoned apart from the existing outfall and pipework leaving the site. The off-site surface water drainage connection with the unnamed land drain will be surveyed and cleaned out to outfall to ensure that the new surface water drainage system will function appropriately.

x. It is proposed that surface water runoff is attenuated in impermeable-lined below ground cellular storage tanks prior to discharging at 1-in-30 year greenfield runoff rates into the unnamed land drain using the existing outfall. The proposed attenuation storage systems located at the southwestern, northern and north-eastern parts of the site will collect surface water from rainwater pipes and external hardstanding areas.

xi. Considering the high groundwater levels of the site and its location within a high vulnerability zone on Principal aquifer, infiltration is not considered to be a viable option for the site.

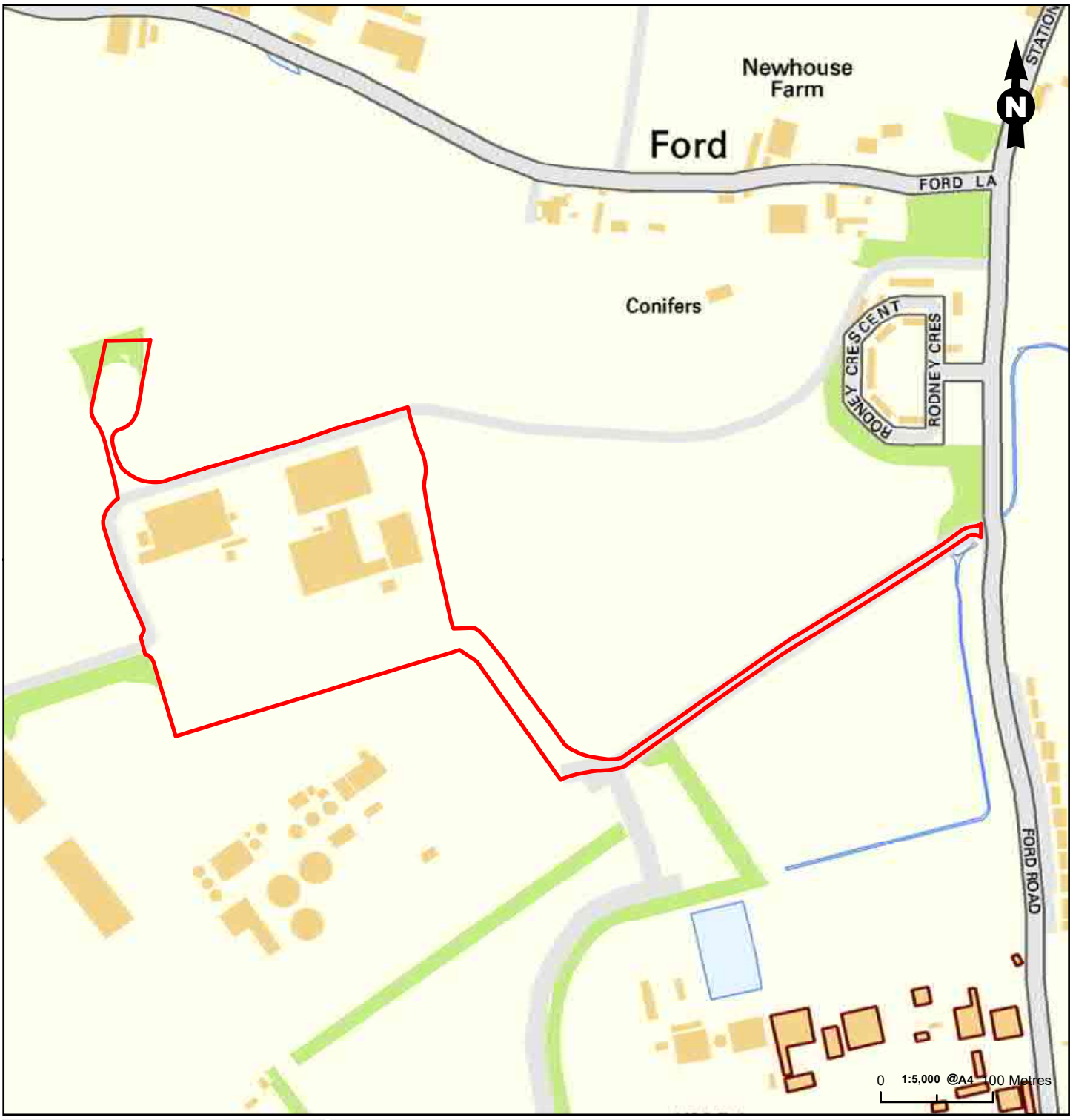
xii. It has been calculated that the proposed attenuation system will require 2,900 m^3 of attenuation storage volume designed to contain the 1-in-30 year critical storm event including 40% allowance for CC without causing any flooding to the site. As advised by WSCC, exceedance flows beyond the 1-in-30 year critical storm event can be discharged uncontrolled to the drainage system.

xiii. However, it is considered appropriate to manage surface water volumes in excess of the 1-in-30 year event (including 40% CC allowance) on site by allowing shallow ponding (~ 150 mm average depth) of managed external hardstanding areas thereby not increasing flood risk downstream as a result of the proposed development.

xiv. Rainwater harvesting is proposed for the development and will be further detailed in future design stages. However, the impact of this option on the required attenuation volumes has not been considered in the current attenuation and discharge calculations, especially as during extreme events the rainwater harvesting system may already be at capacity.

xv. To aid in minimising the impact to the surrounding environment in terms of water quality as well as water quantity it is proposed to install "light liquid" separators as required as part of the proposed formal surface water drainage system.

FIGURES



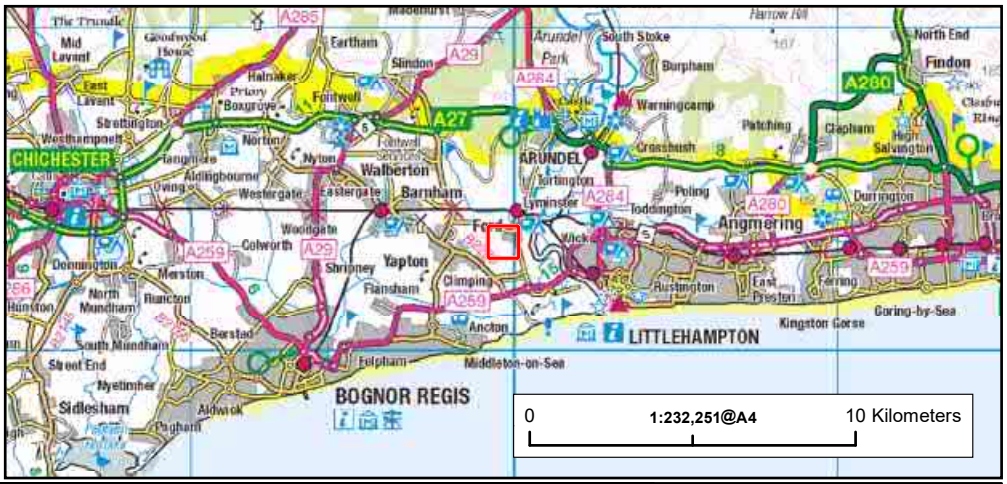
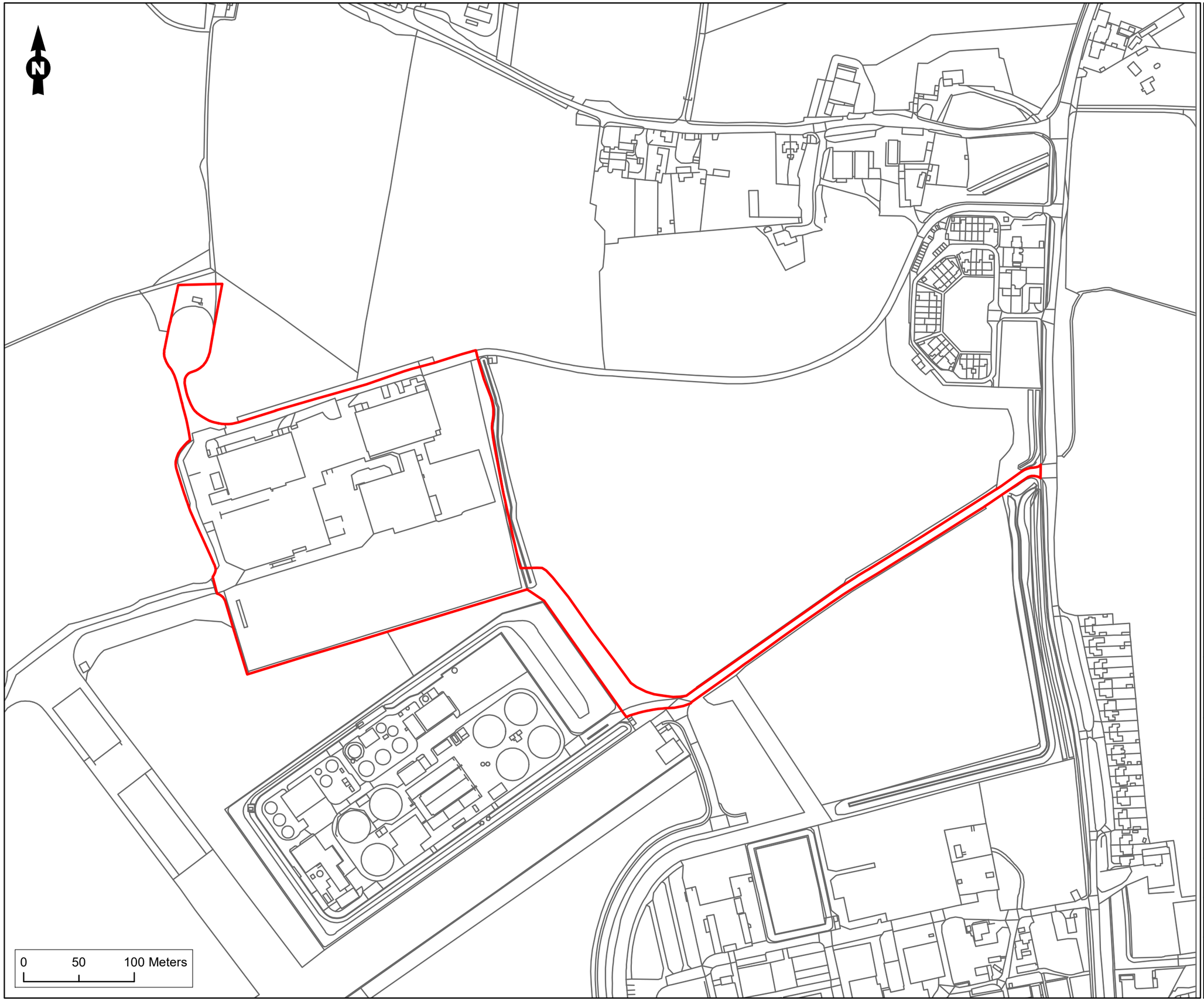


Figure Title: Figure 1: Site Location Plan	Project Name: Ford Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF)	Date: April 2020	RAMBOLL
		Scale: As shown	
Project Number: 1620007830	Client: Ford EfW Ltd, Grundon & Viridor	Issue: -	Prepared By: CS



Legend

Site Boundary

OS Mastermap (2019)

Figure Title

Site Boundary

Project Name

Ford Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF)

Project Number	Figure No.
1620007830	02
Date	**Prepared By**
April 2020	CS
Scale	**Issue**
1:3,250 @A3	1

Client

Ford EfW Ltd, Grundon & Viridor

RAMBOLL

MITCHAM SURVEYS

Note;-

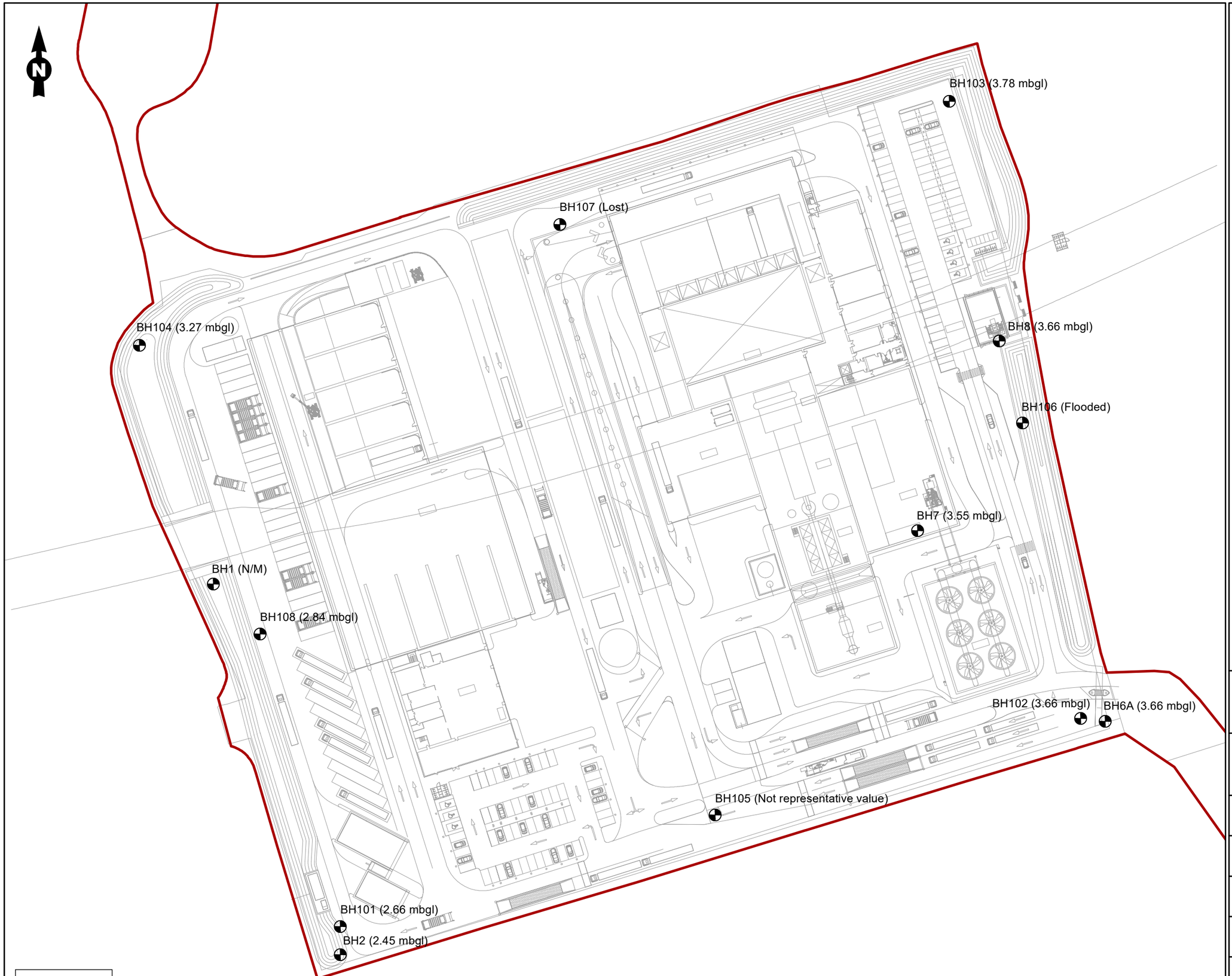
Contour Interval: 0.5m
This survey is orientated to OSGB36 using GPS methods and the OSTN02-OSGM02 transformation.

GRUNDON

Ford Works

Site Survey
August 2013

Drawn By. TJP	Job No. 1275
Date. 15-AUG-13	Surveyed By. TJP
Scale. 1 : 500	Drg No. 1



Legend

- Site Boundary
- Borehole
- Architectural Layout

Figure Title

Borehole Location Plan

Project Name

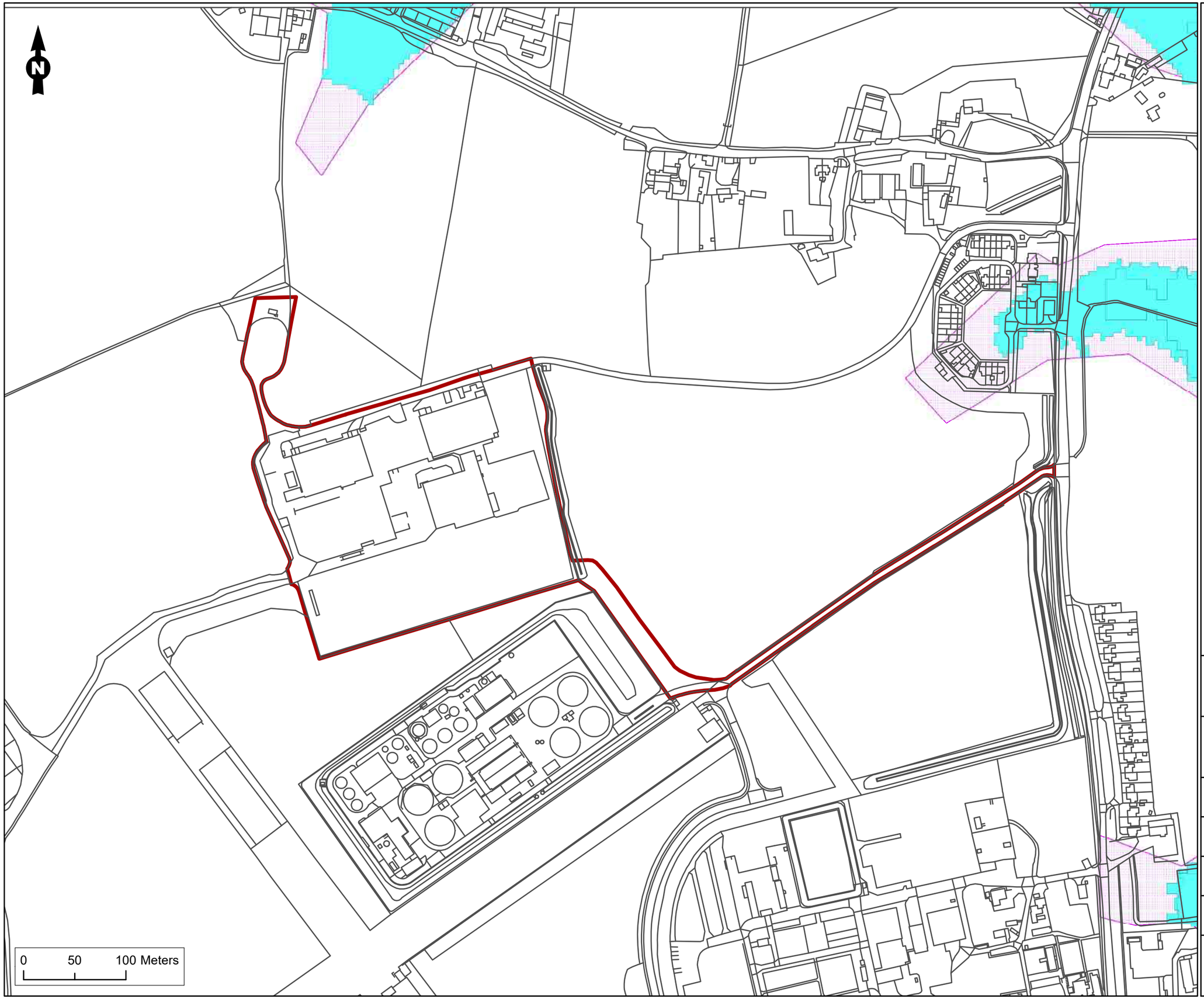
Ford Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF)

Project Number	Figure No.
1620007830	04
Date	**Prepared By**
August 2019	CS
Scale	**Issue**
1:1,150 @A3	1

Client

Ford EfW Ltd, Grundon and Viridor

RAMBOLL



Legend

- Site Boundary
- Flood Zone 2
- Flood Alert Areas
- Flood Warning Areas
- OS Mastermap

Figure Title

Environment Agency - Risk of Flooding from Rivers and Sea

Project Name

Ford Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF)

Project Number	Figure No.
1620007830	03
Date	**Prepared By**
February 2020	CS
Scale	**Issue**
1:3,500 @A3	1

Client

Ford EfW Ltd, Grundon & Viridor

RAMBOLL

N

0 50 100 Meters

Legend

Site Boundary

OS Mastermap

Risk of Flooding from Surface Water (0.1% annual probability)

Depth (Six bands)

- < 150 mm
- 150 - 300 mm
- 300 - 600 mm
- 600 - 900 mm
- 900 - 1200 mm
- > 1200 mm

Figure Title
Environment Agency - Risk of Flooding from Surface Water (0.1% annual probability)

Project Name
Ford Energy Recovery Facility (ERF) and Waste Sorting and Transfer Facility (WSTF)

Project Number	Figure No.
1620007830	4b
Date	**Prepared By**
February 2020	CS
Scale	**Issue**
1:3,000 @A3	1

Client
Ford EfW Ltd, Grundon & Viridor

RAMBOLL

Legend

- Site boundary
- Flow Control Manhole
- Rainwater Pipe
- Existing Surface Water Manhole
- Proposed Surface Water Manhole
- Carrier Drain
- Existing Surface Water Drainage Pipe
- Proposed Surface Water
- Below Ground Cellular Storage Tank (Lined)
- Surface water ponding (for storm events in excess of the 1 in 30 year event +CC, avg. 150mm)
- Main Building

Light-liquid separators to be installed as required as part of new SW drainage network.

Drawn at A3

1:1,200

N

Note
Please refer to Figure 08 'Surface Water Drainage - Indicative Long Section' for Long Section A-A.

Client

Ford EfW Ltd, Grundon & Viridor

Project Title

Ford Energy Recovery Facility and Waste Sorting and Transfer Facility, Ford Circular Technology Park

Project Number

1620007830

Figure Title

Outline Surface Water Drainage Strategy

RAMBOLL

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www.ramboll.co.uk

Date	Prepared By
April 2020	CS/BH
Figure No.	**Revision**
Figure 7	01

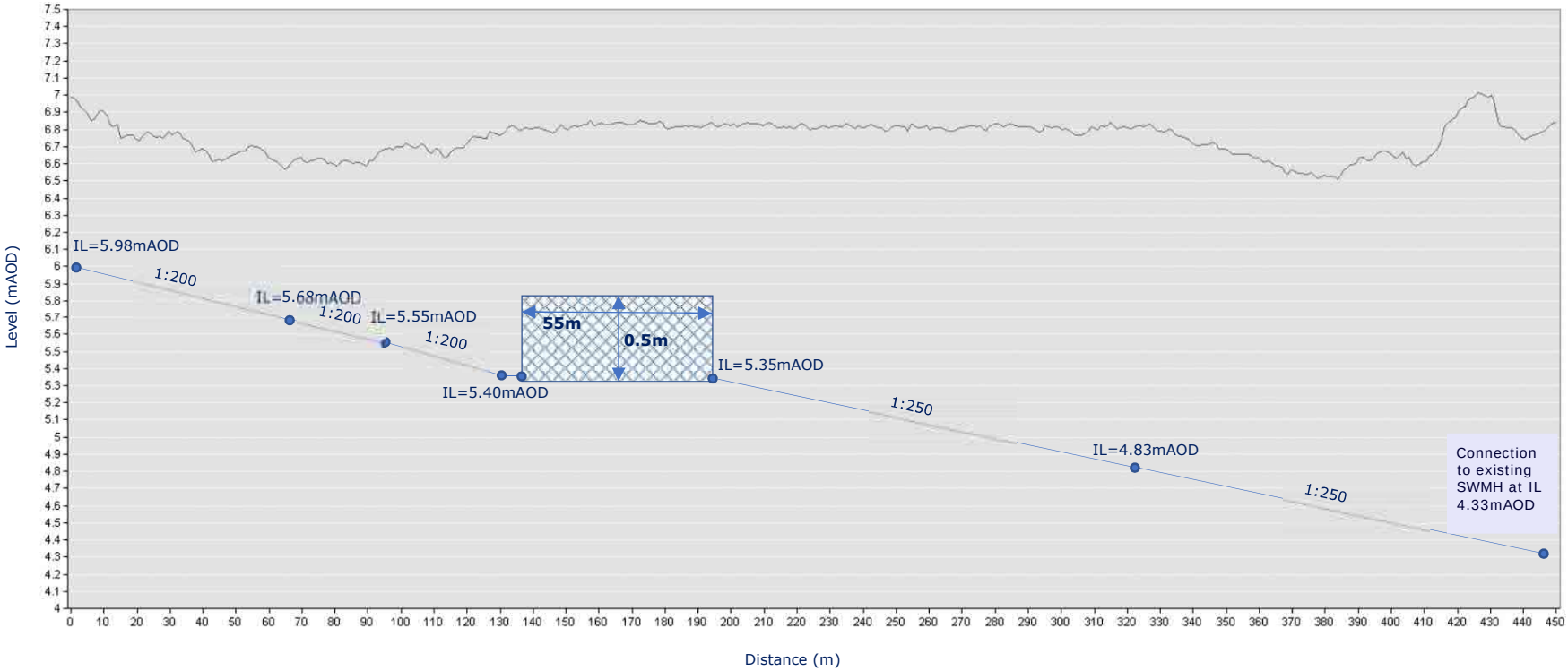

Figure 08: Surface Water Drainage – Indicative Long Section (Long Section A-A)

Note
Please refer to Figure 07 'Outline Surface Water Drainage Strategy' for the long section's location.

Light-liquid separators to be installed as required as part of new SW drainage network