T.R. COLLIER & ASSOCIATES LIMITED

Flood Risk Assessment

Graftongate Developments Ltd

Banbury 200 Unit,
Southam Road,
Banbury

CONTENT

1. INTRODUCTION

T.R.Collier & Associates Ltd have been commissioned by Graftongate Developments Ltd to carry out a Flood Risk Assessment report (FRA) for an existing development of a site at Southam Road, Banbury, OX16 2NL. A site location plan is enclosed in Appendix A.

With reference to the indicative flood maps published by the Environment Agency, the site is shown to lie within Flood Zone 1, 2 and 3.

The building is at a level to be in Flood Zone 1 with the external area's, car parking and service yards in Zones 2 and 3.

The proposed development is to renovate an existing building by changing the cladding with the external area's to remain generally as is but replacing the wearing course, all existing drainage is to remain.

There is a marginal increase in external area's which will require new drainage and reduced discharge.

This FRA report has been prepared in accordance with the requirements contained within National Planning Policy Framework (NPPF, March 2012) and the associated Technical Guidance. The guidance refers to the Environment Agency's "standing advice" on flood risk. Based on requirements set by the Environment Agency, a Flood Risk assessment is needed to support the planning application.

This report has been prepared in accordance with (i) National Planning Policy Framework (NPPF), (Department for Communities and Local Government, March 2012) and the accompanying (ii) Technical Guidance to the National Planning Policy Framework (Department for Communities and Local Government, March 2012); and (iii) Strategic Flood Risk Assessment (SFRA) undertaken on behalf of Cherwell District Council and West Oxfordshire County Council (Scott Wilson, 2009) (iv) and other statutory laws and local bylaws and rules.

It is stated in Paragraph 9 of the Technical Guidance to the National Planning Policy Framework that "...local planning authorities should only consider development in flood risk areas appropriate where informed by a site-specific flood risk assessment. This should identify and assess the risks of all forms for flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account".

This report has been based on readily available existing information, as listed below, and the aim is to identify any flood issues and outline a strategy to reduce and mitigate the flood risk to the proposed development and adjacent properties in accordance with the NPPF and its supporting Technical Guidance:

- Information published or explicitly provided by the Environment Agency;
- Information published by the Local Planning Authority, including the SFRA;
- A site specific topographical survey.
- Existing sewer records from Thames Water - June 2017
- Existing and Proposed site plan UMC Architects.

2 EXISTING SITE CONDITIONS

2.1 Site description

The proposed development is located at National Grid Reference (NGR) [444981;241514] at Southam Road, Banbury, OX16 2QU. This 2.20 ha site is bound to the North-West by Ruscote Ave, to the North and East by a Factory and to the South and South-West by houses and Nursery Drive. Refer to Appendix A for the Site Location Plan.

The site is currently occupied by existing buildings, service yard and parking. The northern portion includes a large surface water ditch running West to East which currently drains the site.

Figure 2.1 – Aerial View of the existing development site

2.2 Topography

Based on the topographical survey, the low point of the site is in the western corner at 96.47m AOD. The existing service yards around the building are generally at approximately 96.5 m AOD.

A major feature of the site is a ditch running West to East in the northern portion of the site. This ditch is approximately 2.5m deep with the top of the ditch between 97.9 - 96.9 m AOD and the bottom between 95.3 - 94.8 m AOD. A short section of the ditch has been culverted to facilitate access to the northern most portion of the site.

Details of existing site levels are enclosed in Appendix B. The slab level to the building is at 96.80mAOD and the external levels are generally 95.6m AOD.

2.3 Geological Ground Conditions

Geological conditions at the site are detailed below and are based on the borehole logs from the site investigation report (Hydrock, July 2016). The focus of an FRA study on geology is on the potential movement of water through Made Ground, Drift Geology and Solid Geology.

These strata are depicted in Figure 2.2 & 2.3 and outlined in Table 2.1.

Formation	Description
Artificial ground/ Topsoil (Made ground)	As a result of the site's historic development, the depth of made ground/ topsoil varies between 0.3-0.9m.
Superficial Deposits (Drift Deposits)	Alluvium was encountered across the northern portion of the site at depths between 0.3-2.8m bgl. The remainder of the site is underlain by River Terrace formation, to a depth between 0.3 - 8.0m bgl.
Bedrock	The entire site is underlain by the Charmouth Mudstone Formation. The borehole logs indicate a layer of stiff grey clay transitioning to a weak laminated grey mudstone from a depth of 0.55m bgl to a depth at least 20m bgl.

Table 2.1 - Geological Ground Conditions

Ground water was mostly encountered at the transition from the superficial deposits to the Charmouth Mudstone formation, with water depths in groundwater monitoring pipes varying between 0.36 - 5.00 m bgl.

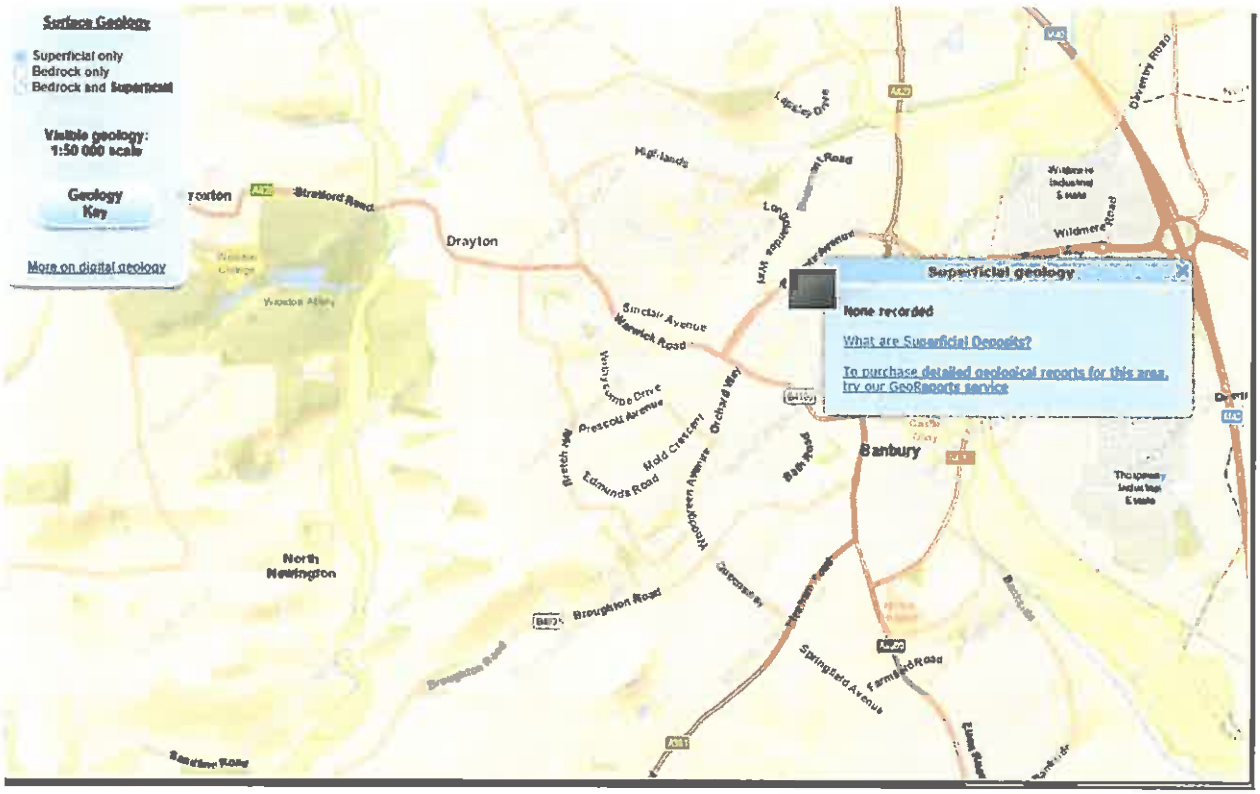


Figure 2.2 - BGS map showing superficial surface geology (approximate site boundary edged red).

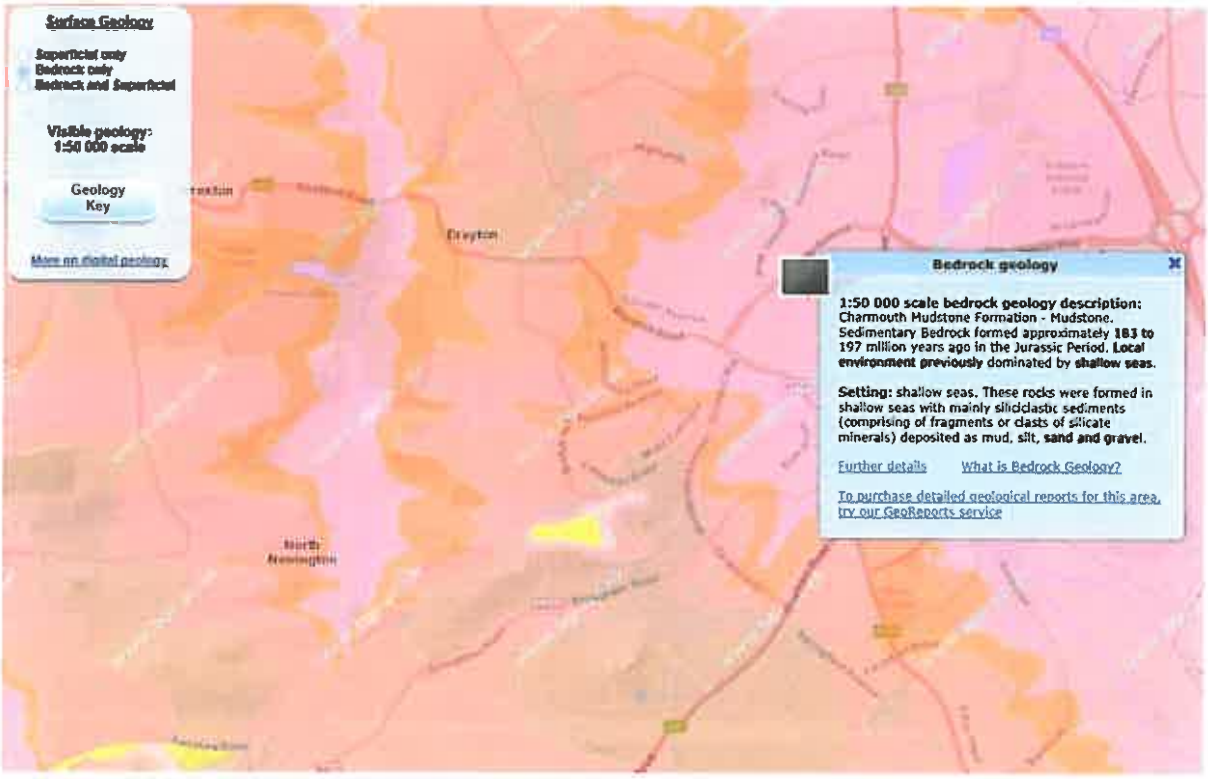


Figure 2.3 - BGS map showing bedrock surface geology (approximate site boundary edged red).

2.4 Hydrology

Groundwater details are depicted in Figure 2.4 & 2.5.

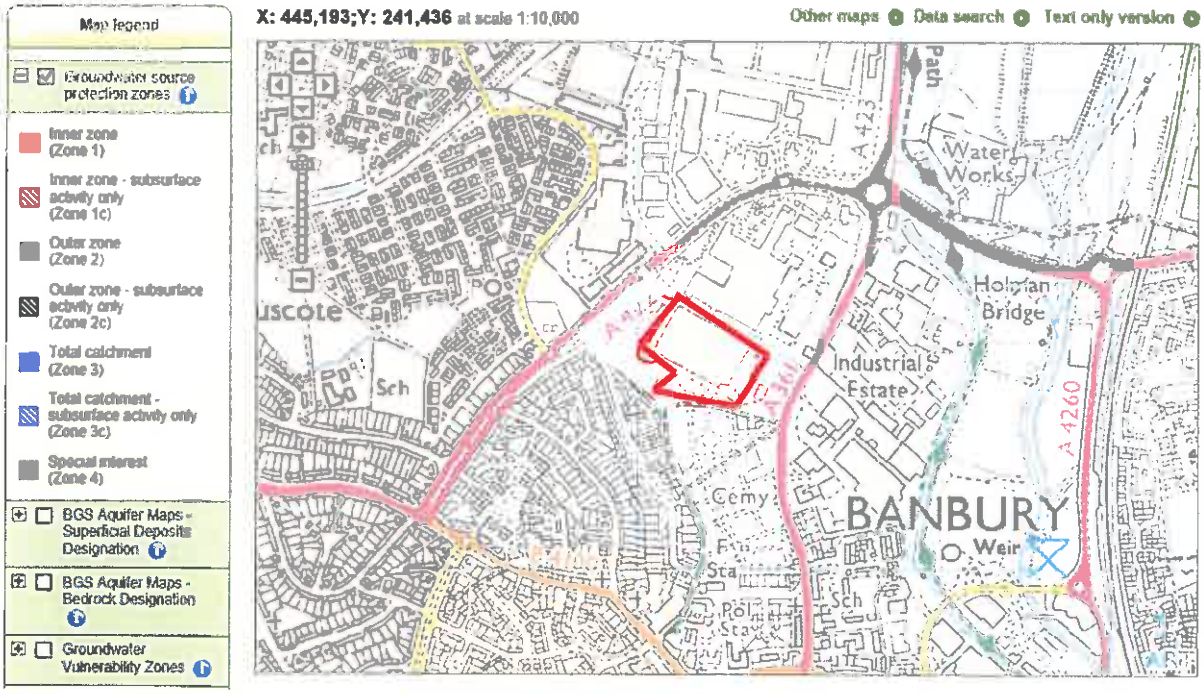


Figure 2.4 - EA Groundwater source protection zone (approximate site boundary edged red).

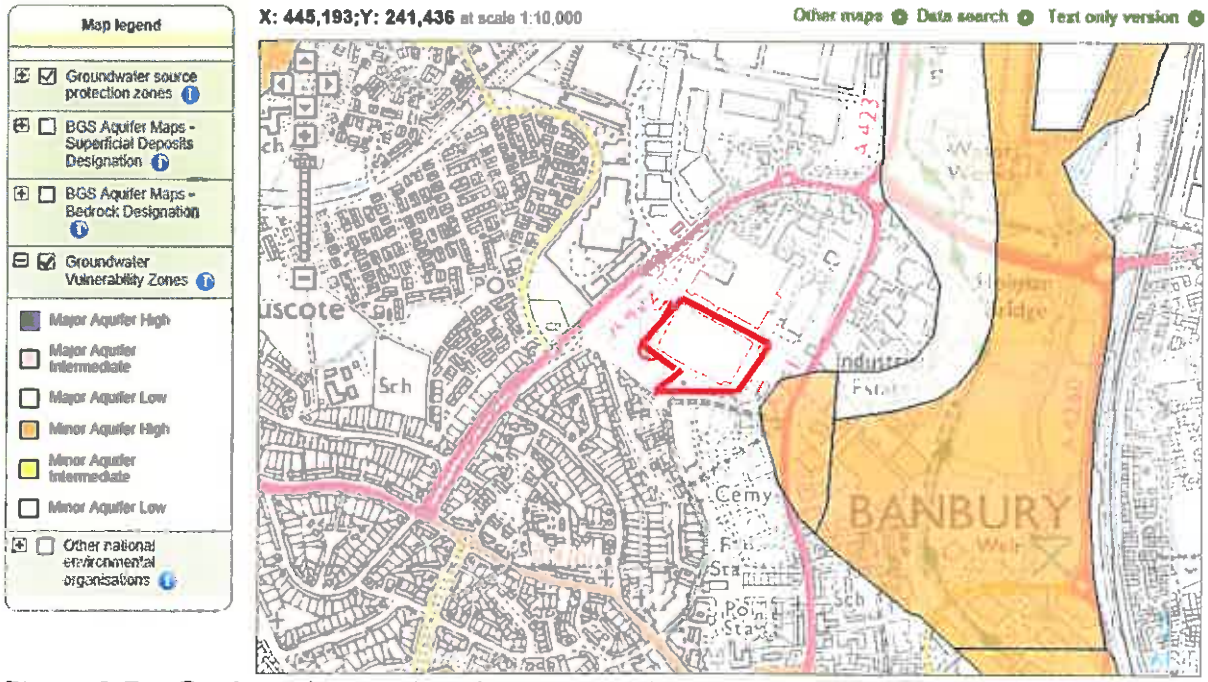


Figure 2.5 - EA Groundwater Map showing groundwater vulnerability zones (approximate site boundary edged red).

2.5 Hydrogeology

The site Hydrogeology is depicted in Figures 2.6, 2.7 and outlined in Table 2.2.

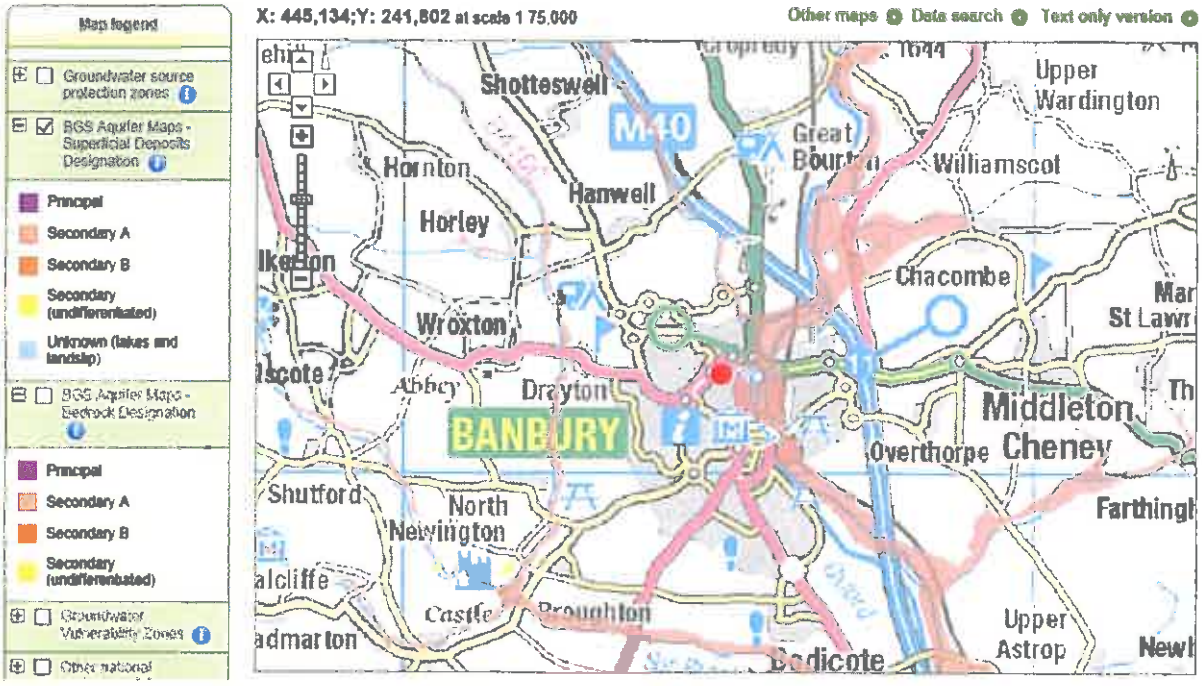


Figure 2.6 - EA Groundwater Map showing superficial deposit designations (approximate site location identified as a red dot).

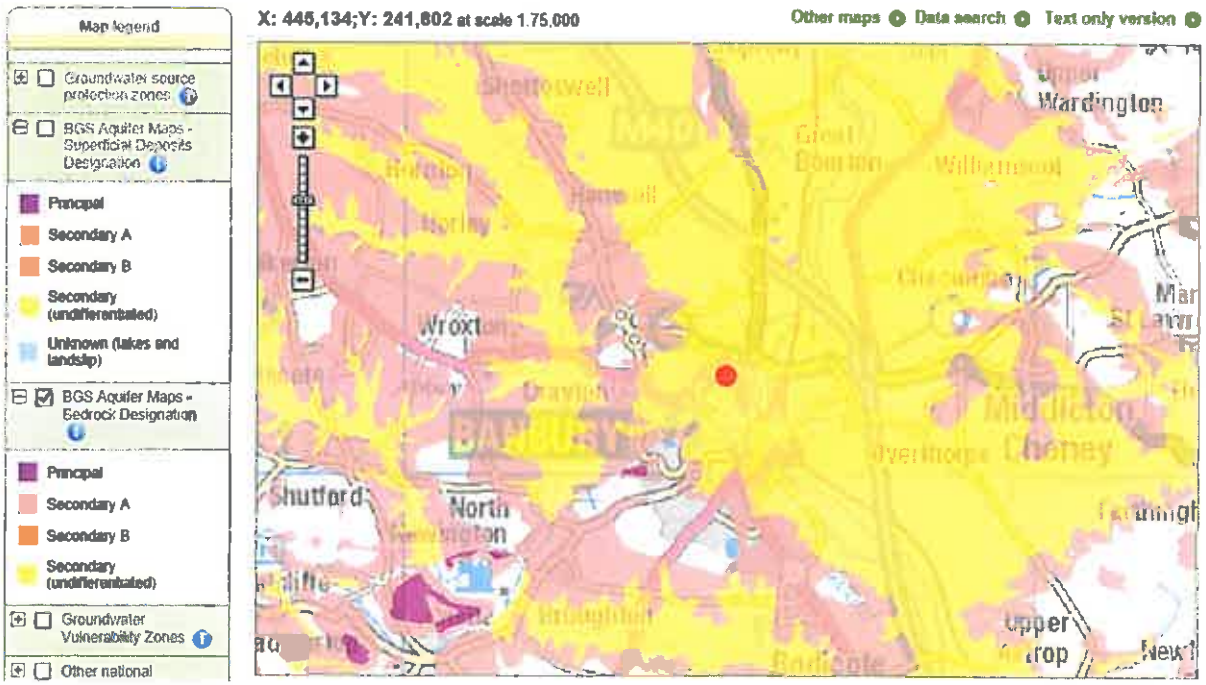


Figure 2.7 - EA Groundwater Map showing groundwater bedrock designations (approximate site location identified as a red dot).

Map Dataset	Designation	Comment
Groundwater source protection zone	None	These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. No designation means: no groundwater source zone is present.
Aquifer Maps: Superficial deposits designation	None	This identifies the type of aquifer present in the permeable unconsolidated (loose) deposits. None is defined as: unproductive strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
Aquifer Maps: Bedrock deposits designation	Secondary (undifferentiated)	This identifies the type of aquifer present in solid permeable formations. Secondary (undifferentiated) is defined as: unproductive strata. It is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Groundwater vulnerability zone	None	This describes the vulnerability of the underlying groundwater body from activities carried out on the surface. A none designation indicate that groundwater will be affected by activities on the surface.

Table 2.2 – Hydrology Conditions

2.6 Existing water management

Subject to detailed CCTV survey, the site's existing drainage system discharges surface water runoff to a ditch running across the northern portion of the site. Evidence of existing drainage is shown on Thames Water's Sewer Record Plan enclosed as Appendix C. Two surface water sewers run into the site from the West under Ruscote Avenue, before combining and discharge into the ditch. The ditch then flows eastward into a series of ditches and culverts to the East of the site. It is unknown if the site has existing attenuation structures or Sustainable Drainage Systems (SuDS). Details of the existing drainage system will need to be identified by a CCTV survey.

Existing impermeable area's already drained = 29611m^2. Proposed impermeable area's = 34482m^2.

An assessment of the existing impermeable areas has been conducted (refer to Appendix D) which shows a total increase in impermeable area of 0.4871 ha.

Peak existing flows from the site have been established using the existing catchment areas and the Modified Rational Method.

The existing impermeable area is drained adequately.

Modified Rational Method:

$Q = 2.78xCxIxA$

$Q = 2.78x1x50x2.9611$ $Q = 411.6$ l/s

Assuming no attenuation, the above indicates that the existing site contributes a maximum of l/s to the existing ditch.

Thames Water's Sewer Record Plan indicates a 300mm diameter public foul water sewer running parallel to the ditch within the site boundary, with a manhole 9501 (CL: 25.3m, IL: 22.84m AOD, depth: 2.46m) in the West of the site and manhole 0501 (CL: 24.79m, IL: 22.26m AOD, depth: 2.53 m) to the East.

3 PROPOSED DEVELOPMENT

3.1 Proposed Scheme

The proposed scheme comprises the re-cladding of the existing building and extending the hardstanding area.

The proposed development plans are enclosed as Appendix E.

The proposed permeable catchment is approximately 29611m^2 and it is proposed to increase this to 34482m^2.

This increase in impermeable area will be restricted to Greenfield run-off rate of 5l/s/ha which for the increase of 0.487ha will restrict the discharge to 2.3l/s.

The attenuation required for the increase in impermeable area will be 328m^3 for the 100yr event + 30% for c.c. Discharge from the attenuation will be a hydrobrake into the existing drainage system restricted to 2.3l/s.

4 POLICY STATUS FOR PROPOSED DEVELOPMENT

4.1 Vulnerability classification

The proposed development can be classified as follows:

- The proposed development lies within Flood Zone.
- The proposed development is classified as 'Less Vulnerable' in accordance with Table 2 of the NPPF (reproduced as Table 4.1 below).

Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood Wind Turbines
Highly Vulnerable	Police stations, Ambulance stations, Fire stations, Command Centres and telecommunications installations required to be operational during flooding Emergency dispersal points Basement dwellings Caravans, mobile homes and park homes intended for permanent residential use Installations requiring hazardous substances consent
More Vulnerable	Hospitals Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels Buildings used for dwelling houses; student halls of residence, drinking establishments, nightclubs and hotels. Non-residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste.

	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	Police, ambulance and fire stations which are not required to be operational during flooding. Buildings used for shops; financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place). Sewage treatment works (if adequate measures to control pollution and manage sewage during flood events are in place).
Water-compatible Development	Flood control infrastructure. Water transmission infrastructure, pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Docks, marinas, wharves Navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for

	staff required by uses in this category, subject to a specific warning and evacuation plan.

Notes

1 - This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)21 and also on the need of some uses to keep functioning during flooding.

2 - Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

3 - The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Table 4.1 - Flood Risk Vulnerability Classification

Vulnerability Classification		Essential Infrastructure	Water-compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test	✓	✓
	Zone 3a	Exception Test	✓	x	Exception Test	✓
	Zone 3b	Exception Test	✓	x	x	x

Key

✓ Development **is appropriate**

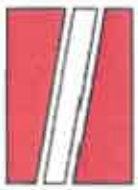
x Development should not be permitted

Table 4.2 - Flood Risk Vulnerability and Flood Zone 'Compatibility'

The proposed development is appropriate in accordance with Table 3 of the NPPF, reproduced in Table 4.2 above.

4.2 Sequential Test & Exception Test

The NPPF requires that all development is sequential tested to steer new development to areas at the lowest probability of flooding (Flood Zone 1). The Sequential Test would normally be completed by the Local Planning



Authority (LPA) to inform the preparation of the Local Development Framework (LDF), where one exists. However, where this process has not

yet been completed the onus for the provision of evidence demonstrating successful application of the Sequential Test falls on the developer, or promoter of the site. The NFFP also requires the layout of a site to be sequentially tested to locate the most vulnerable land uses in the areas at lowest risk of flooding.

The NPPF acknowledges that in some circumstances it may not be possible to locate development in areas of low or appropriate (considering development vulnerability) flood risk, or that there may be other valid reasons for a development to take place within a floodplain. In these circumstances, it is necessary to apply the Exception Test to clearly demonstrate that the benefits for development of a site outweigh the flood risks to the development and its occupants. Table 3 of the NPPF (reproduced in Table 4.2 above) indicates when the Exception Test is required.

The proposed development site falls entirely within Flood Zone 1, and therefore the Sequential Test is deemed to be passed and the Exception Test is not required.

4.3 Local Policy

Oxfordshire County Council and Cherwell District Council have produced the following Flood Risk Management documents:

Preliminary Flood Risk Assessment

As the Lead Local Flood Authority (LLFA) the Oxfordshire County Council was required to undertake a preliminary flood risk assessment as the first part of the Flood Risk Regulations (2009). The aim of this document was to provide a high-level overview of all potential sources of flood risk.

Surface Water Management Plan

This document from the Oxfordshire County Council outlines the strategy for managing surface water within the borough. Surface Water flooding refers to flooding caused by rivers, sewers, groundwater and any runoff which is caused by heavy rainfall.

Strategic Flood Risk Assessment

The SFRA from Cherwell District Council builds upon the findings made in previous reports, and offers a general assessment of flood risk across the whole borough. Appendix B of this report provides a detailed analysis of areas where there is a significant risk of flooding.

Local Flood Risk Management Strategy

This document from Oxfordshire County Council aims to provide guidance and information for residents, business and developers within the borough. It outlines the responsibilities of the LLFA, evaluates the risk of flooding and then reviews flood management measures within the borough.

5 PROBABILITY OF FLOODING

The NPPF identifies six potential sources of flooding:

- Flooding from rivers (fluvial flooding);
- Flooding from the sea (tidal flooding);
- Flooding from land;
- Flooding from sewers;
- Flooding from groundwater; and
- Flooding from reservoirs, canals, and other artificial sources.

These are considered below.

5.1 Flooding from rivers (fluvial flooding) & sea (tidal flooding)

The assessment of flood risk in this report is based on the definitions in Table 1 of the Technical Guidance to the National Planning Policy Framework, which recognises the following Flood Zones:

- Flood Zone 1 - little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000-year)
- Flood Zone 2 - low to medium risk, with annual probability of flooding between 0.1% and 1.0% from rivers and between 0.1% and 0.5% from the sea
- Flood Zone 3a - high risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.
- Flood Zone 3b – the 'Functional Floodplain' with an annual probability of flooding of 5% or greater.

An extract from the Environment Agency's online flood map published on their website is shown in Figure 5.1 below, with Flood Zone 3a & 3b denoted by a dark blue hatch and Flood Zone 2 by a light blue hatch. The site is located within a Flood Zone 1 'Low Probability' area and therefore lies outside an area at risk of fluvial/tidal flooding.

Figure 5.1 – Environment Agency Online Flood Map Extract (Approximate Site Extents Edged Red) – Flood Risk from rivers or the sea.

5.2 Flooding from land & sewers

From the environmental agency's online flood map in Figure 5.2 below, the site has a low risk of flooding across to the building although there is a medium risk to flooding to the car park and service yard around the building area. However, there is a medium to high risk of flooding in the landscaped area in the North of the site, in the vicinity of the existing ditch. A high risk of flooding is also noted along the western boundary around the Kraft factory, as well as in Southam Road.

Figure 5.2 – Environment Agency Online Flood Map Extract (Approximate Site Extents Edged Red) – Flood Risk from surface water.

The external flood area's achieves an approximate level of 95.8m AOD against a building slab level of 96.8m AOD.

5.3 Flooding from groundwater

With reference to Figure 5.3 below, there is a long history of groundwater flooding in the surrounding area due to the Charmouth Mudstone Formation, the most recent of these being in July 2007. The groundwater monitoring pipes installed to a depth of 5 m below ground level (bgl) indicate that the groundwater levels vary between 1 and 5 m bgl.

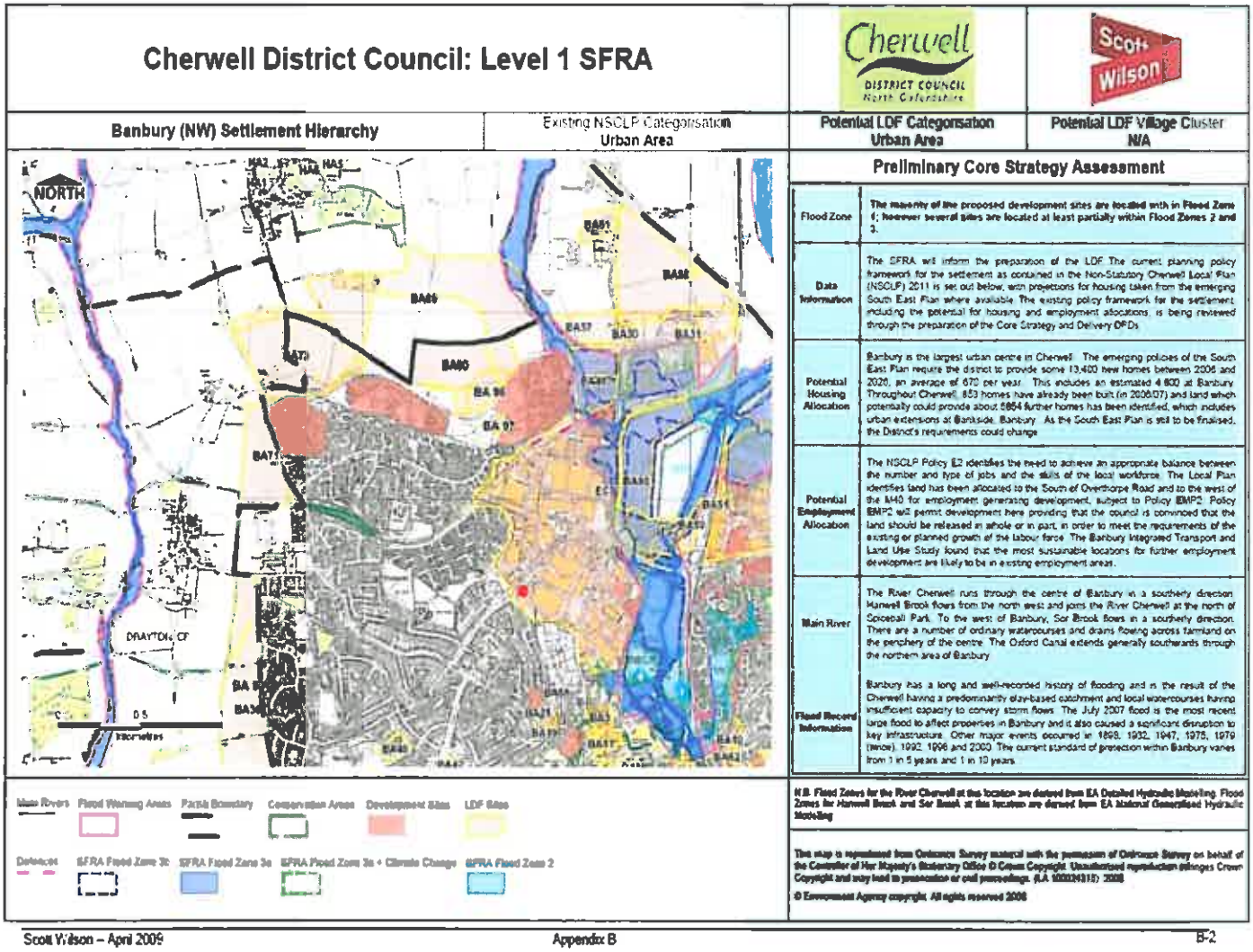


Figure 5.3 – Chernwell District Council SFRA, Appendix B, Figure B-2 (Approximate Site Location represented by red dot) – Flood Risk from groundwater.

5.4 Flooding from reservoirs, canals, and other artificial sources

Based on the information from the environmental agency's online flood maps in Figure 5.4, the site and the area around it is not at risk of flooding due to reservoirs, canals or other artificial sources.

Figure 5.4 - Environment Agency Online Flood Map Extract (Approximate Site Extents Edged Red) - Flood Risk from reservoirs.

6 FLOOD RISK MANAGEMENT STRATEGY

6.1 Flood mitigation measures

NPPF guidance advises that an FRA should take into account the flood risk to people in terms of 'public safety issues', access/egress to/from and evacuation/rescue from the site.

The building itself has a low flood risk as it lies within Flood Zone 1. However, as evidenced in Figure 5.2, the exit onto Southam Road has a low to medium flood risk due to surface water.

Additionally, the flood risk across the North of the site will be directed away from the buildings into the landscaped areas to minimise the impact of flood water on the development. There will be no change in external levels consequently there will be no increase in risk off site.

6.1.1 Public Safety Issues

The SuDS design criteria control onsite flood risk arising from the surface water runoff management system.

Given the relatively low/medium risk of flooding across the entire site, it is not deemed appropriate to develop a Flood Evacuation Plan to address public safety issues, nor are flood resilient construction methods deemed necessary.

6.1.2 Safe Access/Egress

The access/ egress from the site will be through the exit onto Southam Road. As mentioned above, to minimise the risk of surface water flooding in this area, the discharge from the increased area will be limited and associated storage will be provided within the site.

However, to ensure pedestrian access/egress to the site, alternative exit routes are required. This can be guaranteed by a footpath along the southern boundary of the site leading to Nursery Drive.

6.1.3 Flood risk elsewhere

Currently the site does not pose a flood risk to its surroundings, as it is considered that all rainfall falling onto the site is already being collected by the local sewer system or into the ditch onsite. Mitigation measures for the proposed development to prevent any impact to neighbouring property should be implemented. It is therefore recommended:

- To restrict the flow to the increase in impermeable area a certain discharge rate and provide an appropriate attenuation to control runoff from increased area during a 100 year, with 30% Climate change, event.
- Ensure managed surface water and exceedance flood flows are diverted away from the surrounding buildings.
- Exceedance flood flows should be guided into the existing car park area's and service yards. No change in levels will be required.

6.2 Surface water management strategy

The NPPF guidance states that developers and local authorities should not increase flood risk elsewhere due to site development. Additionally, developers should aim to reduce the overall risk of flooding for the area with the appropriate application of SUDS.

This can be achieved by using tanks to attenuate the flows and a Hydro-brake, or other flow control device, to restrict the discharge rate.

6.2.1 Discharge strategy

Given the history of groundwater flooding in the area, as well as the information in the site investigation report regarding soil strata & groundwater levels, the site is deemed to be unsuitable for infiltration systems (soakaways).

The nearest watercourse is an unnamed ditch running through the North of the site. To facilitate the redevelopment of the site, it is proposed to fill in the ditch and divert the public surface and foul sewers around the proposed B&M store as shown in Appendix F.

6.2.2 Drainage Strategy design

The buildings' roof water runoff is collected around the buildings at various points. Runoff from the remaining impermeable areas is collected using existing gullies, draining into this same network.

The existing drainage includes appropriate petrol interceptors, deep silt trapped gullies and silt boxes to all channel drains.

As mentioned in section 3.1 the existing discharge rate, for the existing impermeable area of 29.6 ha, is 411.6 l/s and this discharge rate is to remain.

The increase in impermeable area of 0.487 ha will be attenuated to 2.3l/s.

6.3 Foul water management strategy

It is proposed to collect all foul flows from the buildings into existing network before discharging into existing public sewer manhole 0501 in the North East of the site. The existing connections will remain within a similar discharge rate.

7 FUTURE FLOOD RISK

By the 2080s, the latest UK Climate Impacts Programme (UKCP09) predict around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance or rarer) could increase locally by 40%.

7.1 Key climate change projections

The UK Climate Projections science report: Climate change projections. Version 3 (DRFRA & DECC, December 2010) summarises the central estimate of change in climate likely to be experienced in the region based on UKCP09 data for the thirty year 2050 time period under the medium emissions scenarios, compared to the baseline time period (1961 to 1990).

Generally, for precipitation this indicates drier summers, heavy rainfall being more common, significant decrease in snowfall, and greater contrast between summer and winter seasons. Extreme river and coastal flooding events are expected to be more severe and frequent.

7.2 Effects of climate change

The detailed design of the drainage system will make an appropriate allowance for climate change as agreed with the LLFA. With an appropriate climate change allowance and given that the site is entirely within Flood Zone 1, no increased flood risk to the site should be expected due to climate change.

8 CONCLUSION

With reference to the indicative flood map published by the Environmental Agency, the development site is located entirely within Flood Zone 1 "Low Probability". This has been confirmed by a site-specific flood risk assessment in section 4 of this report.

The site is non-tidal and has no record of flood history. However, the northern portion of the site in and surrounding the existing ditch is shown to be at a medium to high risk of flooding due to surface water. This localised surface water flooding within the site will be addressed as a part of the detailed sustainable design for the site.

From Table 4.1, the development is classified as 'Less Vulnerable' (Flood Risk Vulnerability Classification) and therefore, from Table 4.2 classified as 'appropriate'.

The ground investigation reports indicate that the soil strata under the site are inadequate for infiltration. Additionally, the report indicates high groundwater levels. This is confirmed by the history of groundwater flooding in the area indicated in the Cherwell District Council SFRA. Therefore, the preferred method of discharge of surface water from the site is into the watercourse running across the North of the site.

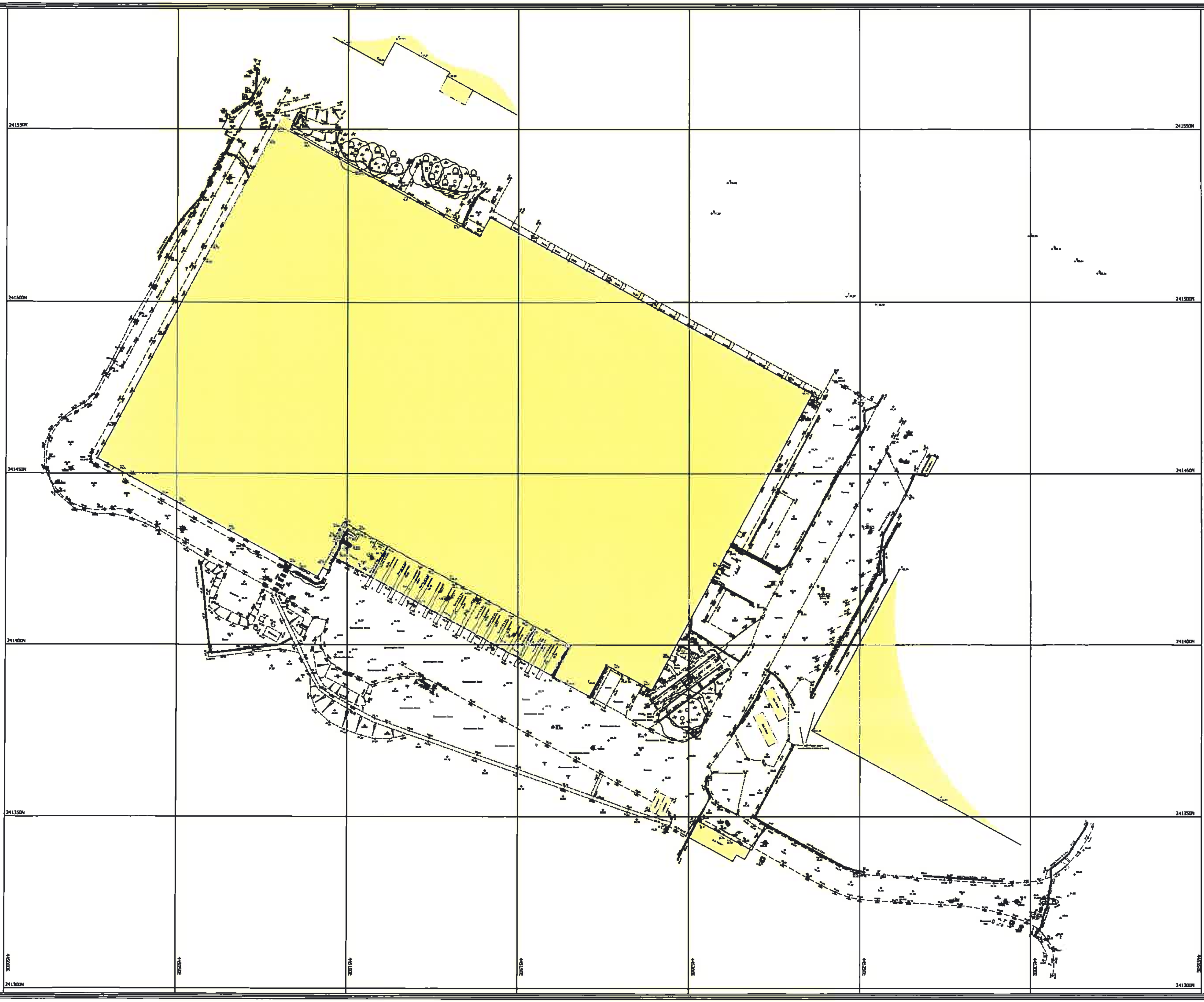
The increase in impermeable is 0.487 ha. The increased run-off from impermeable areas will be collected and controlled using attenuation tanks and Hydrobrakes prior to being discharged into the existing culvert in the North-east corner of the site via the existing drainage network.

To allow the detailed drainage design for the site to be completed, the following is recommended:

- Finalised development layout, with confirmed permeable and impermeable areas.
- Consulting with Thames Water with regards to the existing public foul sewer and ditch across the North of the site.
- A CCTV survey of the site drainage for sizes and falls

Appendix A – Site Location Plan

Appendix B – Existing Site Layout and Topographical survey



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Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	445243.026	241476.821	96.045
GH2	445190.899	241379.812	95.817
GH3	445180.311	241376.093	95.726
GH4	445089.635	241428.956	96.480
GH5	445024.707	241454.194	96.619
GH6	445077.913	241552.866	96.869
GH7	445115.224	241533.004	96.841
GH8	445261.870	241325.069	94.866
GH9	445303.469	241326.160	94.304
S6	445222.226	241410.468	95.441

OS Note.

Legend:

greenhatch group

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR

CLIENT

Graftongate

PROJECT

Banbury 200
Banbury
OX16 2QU

TITLE

Topographical Survey

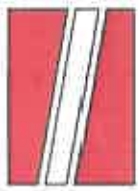
SCALE	DATE
A1@ 1: 500	20.10.17
DRAWN	**QUALITY REF**
CQ	GH1830

Drawing No.: 28419_T

Rev: 0

Comments

Notes:



Appendix C – Sewer Record Plan

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9451	103.66	102.03
9401	104.23	102.4
8451	103.67	101.14
2501	96.93	91.58
1501	96.79	92.39
9554	100.44	95.39
9503	100.35	95.54
8551	100.66	95.46
9551	99.82	95.42
0501	97.04	93.23
8504	100.41	95.74
9502	98.53	94.97
8502	101.31	95.74
9504	99.79	95.19
9501	97.89	95.44
8503	100.62	95.92
9553	98.11	96.55
9651	98.39	96.51
0602	99.03	97.18
0652	99.04	97.49
0651	100.65	98.86
0601	100.78	98.61
2401	95.85	90.83

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8354	106.56	105.52
8352	n/a	n/a
8353	111.01	110.12
831A	n/a	n/a
8258	107.98	103.7
8356	105.68	103.89
8260	n/a	n/a
8351	105.72	104.74
9254	106.66	103.73
931D	n/a	n/a
9206	106.68	104.06
9253	106.58	104.97
921B	n/a	n/a
921A	n/a	n/a
931C	n/a	n/a
931B	n/a	n/a
921C	n/a	n/a
931A	n/a	n/a
9452	103.14	102.4
9402	103.01	101.58
9453	102.78	101
9301	102.36	101.08
9403	102.51	101.7
9302	102.08	100.7
9307	102.57	101.75
9353	102.09	100.3
9404	102.51	101.97
9203	102.5	101.64
9306	101.91	101.11
9351	102.25	100.64
9303	101.94	100.17
9202	102.72	101.38
9304	101.52	100.71

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9309	101.41	100.76
9305	101.56	100.86
9352	101.82	99.8
9308	101.42	100.41
9310	n/a	n/a
9204	101.69	99.89
9252	101.72	99.53
9311	n/a	n/a
9251	101.43	99.19
9205	101.46	99.43
9312	n/a	n/a
9313	n/a	n/a
8253	109.15	107.57
8201	108.59	105.16
821B	n/a	n/a
921E	n/a	n/a
9201	102.71	102.18
921D	n/a	n/a
821A	n/a	n/a
8202	109.21	103.39
8252	106.34	104.8
8259	108.25	103.66
0252	98.37	97.5
0202	98.31	97.2
1352	n/a	n/a
1301	96.68	94.87
1302	95.52	93.66
1351	95.55	94.31
2351	94.48	93.56
2301	94.23	93.08
2302	93.93	92.5
2352	94.45	91.1
2303	94.07	90.7

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3301	94.47	90.56
3353	94.17	92.71
3351	95.15	91.77
3302	95.03	90.43
3253	n/a	n/a
3251	93.89	90.1
3352	93.99	93.16
3201	93.41	91.14
3202	93.27	91.15
0251	101.17	99.62
0354	99.09	98.61
0201	101.09	98.74
0297	n/a	n/a
0356	99.17	98.49
0353	99.12	97.97
0301	99.31	97.85
0352	99.21	97.71
0296	n/a	n/a
0351	98.93	97.29
0203	98.53	97.17
0294	n/a	n/a
0295	n/a	n/a
0358	n/a	n/a
0355	97.77	96.75
0303	97.58	96.18
0302	97.77	96.53

Appendix D – Existing & Proposed Impermeable Areas

Dimensions are in millimeters, unless noted otherwise
Scaling of this drawing is not recommended
It is the recipient's responsibility to print this document to the correct scale
All relevant drawings and specification should be read in conjunction with this drawing.

N

1) Full height over-clad façade. Existing glazing to warehouse will be replaced with translucent panels. Guarantee to be confirmed. Engineer to assess the capacity of existing structure.
2) Existing offices to be refurbished. (hatched area to be made good only)
3) External Cat ladder to be replaced (roof access strategy to be reviewed)
4) Existing Loading Doors & dock levellers to be removed & replaced.
5) Existing Canopy to be over-clad & made good
6) External concrete hardstanding to be extended Existing landscape bund to be repositioned
7) External yard to be made good. Hatched area denoted extent of concrete yard to be cut back and replaced. (Jockey Wheel damage)
8) Existing wheel guides to be removed. Not to be replaced.
9) Existing Vehicle wash and housing to be removed. Adjacent landscaping to be removed and replaced with hardstanding.
10) Gatehouse island only to be installed Services to gatehouse to be reviewed.
11) Remove existing landscape and replace with hardstanding to 2 no. new Level Access Doors.
12) Existing internal slab to be made good.
13) Existing windows to the pod to be removed and over-clad
14) Extend hard surfacing and alter levels to create car park area..
15) Temporary construction traffic entrance.
16) Option for white masonry paint to internal blockwork walls
17) Roof to be assessed to ensure a watertight facility. Eastern warehouse roof to have Receive a new layer of membrane & bitumen. Contractor to provide options for guarantees.
18) Western Warehouse Roof to be over-clad to provide a guarantee.
19) Sprinkler tank and pump house to be installed if required.
20) Existing Offices to be demolished. New first floor offices to be installed.
21) Existing dock levelers to be removed and over clad, external levels adjusted to suit new car park.

Surfaces Key

- Concrete
- Tarmac
- Soft Landscaping

Existing Unit
Existing Level Access Door
2nd New Level Access Door
50000
1st Floor Office
186 No. Car Parking
13 No. HGV Parking Spaces
22 No. HGV Parking Spaces
Sprinkler Tank & Pumphouse

10m SCALE 1:500

rev	amendment	by	chd	date
E	Entrance hatching clarified	DG	GH	26.03.18
D	Yard area changed to concrete	DG	GH	02.03.18
C	SW red line boundary amended. Parking and yard updated to suit	AS	GH	22.02.18
B	Revised road, footway added as required and HGV parking spaces updated to suit	DG	GH	13.02.18
A	Proposed surfacing types amended to allow consistency	DG	GH	30/01/18

Banbury 200 Unit, Southam Road, Banbury

Proposed Site Plan

E:\JMC Marketing\Logos\Client Logos\Gratkorn.jpg

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Drawing Status	Planning
Drawn / Checked	AS / GH
Date	13/10/17
Scale	1:500 A1
Drawing no.	Revision
16083 P003	E

Appendix E – Proposed Development Plans

Dimensions are in millimeters unless stated otherwise
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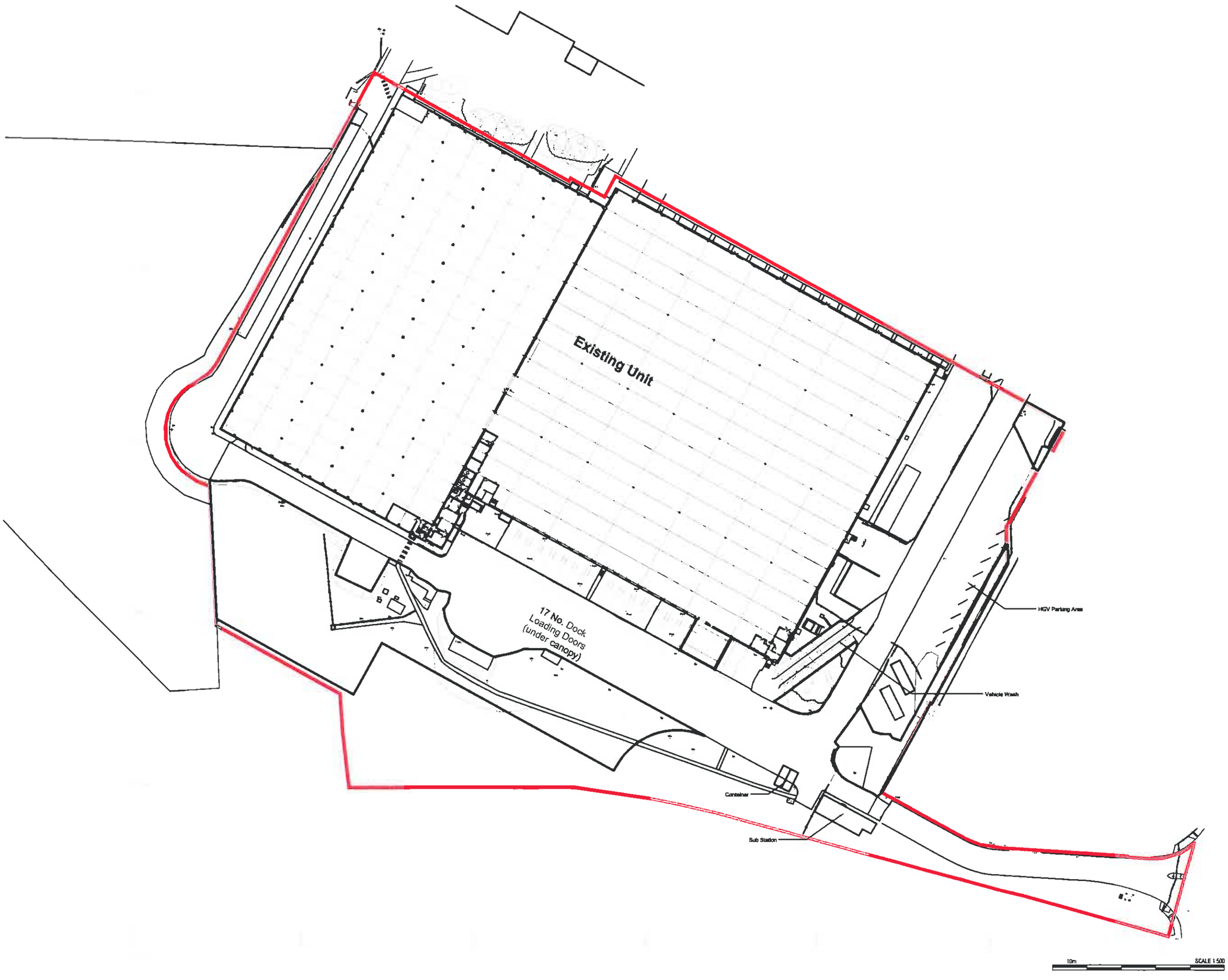
All relevant drawings and specification should be read in conjunction with this drawing



rev	amendments	by	chkd	date
A	Redline boundary adjustments suit	DG	GH	26.03.18

Banbury 200 Unit, Southam Road, Banbury

Existing Site Plan

X:\UMC Marketing\Logos\Client Logos\Grafton.jpg

umc architects

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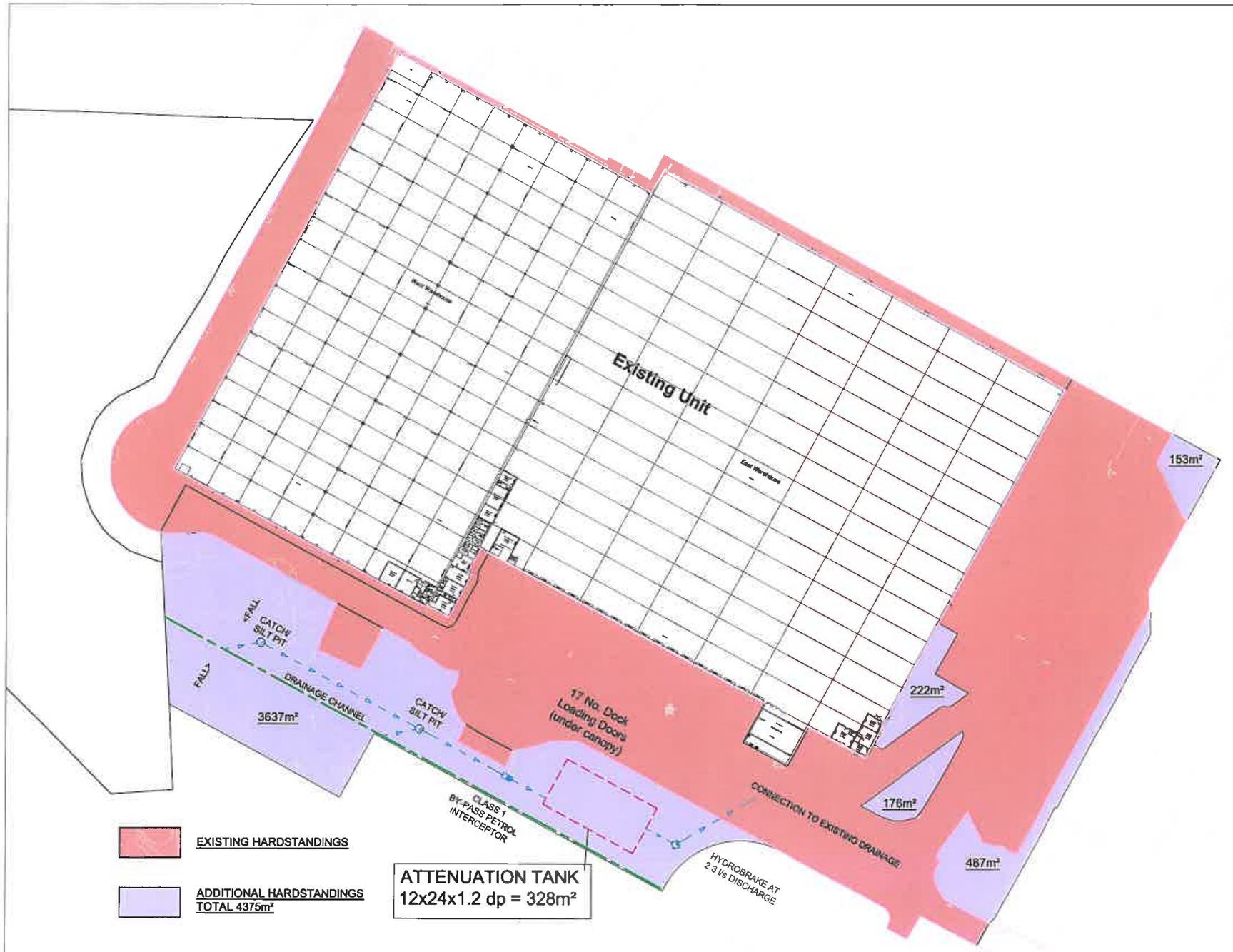
Drawing Status	Planning
Drawn / Checked	AS / GH
Date	13/10/17
Scale	1:500 A1
Drawing no.	Revision
16083 P002	A

Appendix F - Proposed Drainage Strategy



SURFACE WATER DESIGN CRITERIA

DISCHARGE RATE = 2.3 l/s)
BASED ON 5 l/s/Ha(Greenfield Run-off)
Soakaway designed for 1:100 year return storm + 30% climate change
using FEH Rainfall Figures

DRAINAGE STRATEGY DRAWING

Scale 1:750

REV	DATE	DESCRIPTION	CHK	DRN
P1	11.06.18	PRELIMINARY ISSUE	TC	CE

NOTE: Where a 'P' revision applies, this drawing is NOT to be used for construction

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PROJECT
UNIT 200
RUSCOTE AVENUE, BANBURY

TITLE
DRAINAGE STRATEGY

ARCHITECT
UMC

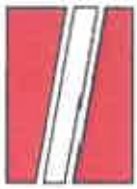
DRAWN	DESIGNED	CHECKED
CE	TC	TC

DATE	SCALE	STATUS
July 2018	1:750	Preliminary

3852-02 P1

ISO 9001 REGISTERED FIRM
Certificate No: GB2000800
INTERNATIONAL ACCREDITATION BOARD
Registration No. 1044/1

A2 SHEET



Appendix G – Quick Storage Estimate

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

Half Drain Time : 1361 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.449	0.449	0.0	2.0	2.0	122.8	O K
30 min Summer	8.585	0.585	0.0	2.0	2.0	160.1	O K
60 min Summer	8.724	0.724	0.0	2.0	2.0	198.0	O K
120 min Summer	8.833	0.833	0.0	2.0	2.0	228.0	O K
180 min Summer	8.899	0.899	0.0	2.0	2.0	245.9	O K
240 min Summer	8.943	0.943	0.0	2.1	2.1	257.9	O K
360 min Summer	8.995	0.995	0.0	2.1	2.1	272.2	O K
480 min Summer	9.018	1.018	0.0	2.1	2.1	278.6	O K
600 min Summer	9.024	1.024	0.0	2.1	2.1	280.3	O K
720 min Summer	9.020	1.020	0.0	2.1	2.1	279.1	O K
960 min Summer	8.992	0.992	0.0	2.1	2.1	271.3	O K
1440 min Summer	8.920	0.920	0.0	2.0	2.0	251.8	O K
2160 min Summer	8.828	0.828	0.0	2.0	2.0	226.5	O K
2880 min Summer	8.755	0.755	0.0	2.0	2.0	206.6	O K
4320 min Summer	8.639	0.639	0.0	2.0	2.0	174.7	O K
5760 min Summer	8.531	0.531	0.0	2.0	2.0	145.2	O K
7200 min Summer	8.446	0.446	0.0	2.0	2.0	122.0	O K
8640 min Summer	8.383	0.383	0.0	2.0	2.0	104.8	O K
10080 min Summer	8.335	0.335	0.0	2.0	2.0	91.7	O K
15 min Winter	8.504	0.504	0.0	2.0	2.0	137.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.617	0.0	125.0	23
30 min Summer	93.363	0.0	161.6	38
60 min Summer	58.389	0.0	204.9	68
120 min Summer	34.403	0.0	241.3	126
180 min Summer	25.279	0.0	266.0	186
240 min Summer	20.302	0.0	284.9	246
360 min Summer	14.863	0.0	312.8	364
480 min Summer	11.861	0.0	328.2	484
600 min Summer	9.922	0.0	330.9	602
720 min Summer	8.556	0.0	330.8	722
960 min Summer	6.737	0.0	327.6	956
1440 min Summer	4.768	0.0	316.3	1174
2160 min Summer	3.348	0.0	422.8	1560
2880 min Summer	2.607	0.0	439.2	1964
4320 min Summer	1.845	0.0	466.1	2808
5760 min Summer	1.457	0.0	491.0	3584
7200 min Summer	1.231	0.0	518.3	4320
8640 min Summer	1.082	0.0	547.0	5024
10080 min Summer	0.978	0.0	576.9	5752
15 min Winter	142.617	0.0	140.0	23

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	8.657	0.657	0.0	2.0	2.0	179.8	O K
60 min Winter	8.814	0.814	0.0	2.0	2.0	222.6	O K
120 min Winter	8.939	0.939	0.0	2.1	2.1	256.9	O K
180 min Winter	9.015	1.015	0.0	2.1	2.1	277.8	O K
240 min Winter	9.067	1.067	0.0	2.2	2.2	292.1	O K
360 min Winter	9.132	1.132	0.0	2.2	2.2	309.6	O K
480 min Winter	9.163	1.163	0.0	2.3	2.3	318.3	O K
600 min Winter	9.176	1.176	0.0	2.3	2.3	321.7	O K
720 min Winter	9.176	1.176	0.0	2.3	2.3	321.8	O K
960 min Winter	9.155	1.155	0.0	2.3	2.3	316.0	O K
1440 min Winter	9.075	1.075	0.0	2.2	2.2	294.2	O K
2160 min Winter	8.962	0.962	0.0	2.1	2.1	263.1	O K
2880 min Winter	8.865	0.865	0.0	2.0	2.0	236.7	O K
4320 min Winter	8.701	0.701	0.0	2.0	2.0	191.9	O K
5760 min Winter	8.544	0.544	0.0	2.0	2.0	148.9	O K
7200 min Winter	8.407	0.407	0.0	2.0	2.0	111.4	O K
8640 min Winter	8.314	0.314	0.0	2.0	2.0	85.8	O K
10080 min Winter	8.245	0.245	0.0	2.0	2.0	67.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	93.363	0.0	164.2	37
60 min Winter	58.389	0.0	229.4	66
120 min Winter	34.403	0.0	270.3	124
180 min Winter	25.279	0.0	297.9	182
240 min Winter	20.302	0.0	319.1	242
360 min Winter	14.863	0.0	335.4	358
480 min Winter	11.861	0.0	337.6	474
600 min Winter	9.922	0.0	337.5	588
720 min Winter	8.556	0.0	336.6	702
960 min Winter	6.737	0.0	333.5	924
1440 min Winter	4.768	0.0	324.8	1330
2160 min Winter	3.348	0.0	473.6	1652
2880 min Winter	2.607	0.0	491.9	2112
4320 min Winter	1.845	0.0	522.1	3028
5760 min Winter	1.457	0.0	550.0	3920
7200 min Winter	1.231	0.0	580.7	4608
8640 min Winter	1.082	0.0	612.6	5272
10080 min Winter	0.978	0.0	646.1	5952

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 445145 241449	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.468

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.234	4	8	0.234

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	288.0	288.0	1.300	0.0	374.4
1.200	288.0	374.4			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0068-2300-1250-2300
Design Head (m)	1.250
Design Flow (l/s)	2.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	68
Invert Level (m)	7.950
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.3
Flush-Flo™	0.301	2.0
Kick-Flo®	0.610	1.7
Mean Flow over Head Range	-	1.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	2.3	3.000	3.4	7.000	5.1
0.200	2.0	1.400	2.4	3.500	3.7	7.500	5.3
0.300	2.0	1.600	2.6	4.000	3.9	8.000	5.4
0.400	2.0	1.800	2.7	4.500	4.2	8.500	5.6
0.500	1.9	2.000	2.9	5.000	4.4	9.000	5.8
0.600	1.7	2.200	3.0	5.500	4.6	9.500	5.9
0.800	1.9	2.400	3.1	6.000	4.8		
1.000	2.1	2.600	3.2	6.500	4.9		