

Flood Risk Assessment & Drainage Strategy

Van Storage Area, Faraday Road, Knowsley

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Prepared for:
Network Space

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1 INTRODUCTION

Pinnacle Consulting Engineers Ltd have been commissioned to produce a Flood Risk Assessment (FRA) and Drainage Strategy (DS) for a proposed development located off Faraday Road, Knowsley. A plan showing the proposed development layout is enclosed in Appendix A.

Indicative flood maps published by the Environment Agency (EA) reveal the entire site sites within Flood Zone 1. This FRA has been prepared in accordance with the requirements contained within National Planning Policy Framework (NPPF, Feb 2019) and the associated Planning Practice Guidance. The guidance refers to the EA's "standing advice" on flood risk. Based on requirements set by the EA, a FRA is needed to support the planning application.

This report has been prepared in accordance with (i) National Planning Policy Framework (NPPF, July 2021) and the accompanying Planning Practice Guidance (ii) Level 1 and Level 2 Strategic Flood Risk Assessments (SFRA) undertaken on behalf of Knowsley Council (iv) Local Flood Risk Management Strategy undertaken on behalf of Knowsley Council (v) Knowsley Local Plan Core Strategy, and (vi) Other statutory laws and local bylaws and rules.

It is stated in Paragraph 30 of the Flood Risk and Coastal Change chapter within the Planning Practice Guidance that "a site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users".

This report has been prepared to address the requirements of the NPPF and has derived the following data/information from various sources including:

- Information published or explicitly provided by the EA;
- Information published by the Local Planning Authority, including the SFRA;
- A site-specific topographical survey; and
- Specific design works carried out for this report.

2 EXISTING SITE CONDITIONS

2.1 Site description

The proposed 2.38ha site is centred on National Grid Reference (NGR) 342908, 397183 and can be accessed via Faraday Road, Knowsley, L33 7UT. The plot is an irregular shape, assumed to be greenfield and has areas of dense greenery. The proposed development is for a van storage facility for operational vehicles with circulation routes.

The site is bound to the south and east by industrial buildings, to the north by industrial buildings, Faraday Road and open land. It is bounded to the west by Faraday Road and open land.

The nearest watercourse is Knowsley Brook 600m to the east of the site.



Figure 2.1 – Site Location Plan © Google 2020

A copy of the proposed development site can be found in Appendix A.

2.2 Topography

A topographic survey has been completed for the development site.

The site has a general fall from east to west with the levels in the south of the site grading towards the stie boundary. Maximum levels onsite are approximately 34.85m AOD and minimum levels onsite are approximately 31.67m AOD.

A full topographic survey of the site is enclosed in Appendix B.

2.3 Geological ground conditions

Geological conditions at the site are detailed below, information is drawn from the British Geological Survey (BGS) mapping and the online DEFRA Magic Map service.

A summary of the relevant geological information at the site location is summarised in Table 2.1 below.

Formation	Description
Artificial Ground (Made Ground)	Artificial Deposits/ Made ground or Top soil delineated on BGS borehole records near the site appear to span up to depths of approximately 1.6m below ground level (bgl). This top soil became wet at 1.5m.
Bedrock Geology	The proposed site lies within the bedrock zone identified as Chester formation – Sandstone.
Superficial Geology	The proposed site lies within an area where superficial deposits are primarily Devensian Till – Diamicton.
Nitrate Vulnerable Zone	The site is located within a Nitrate Vulnerable Zone (2017 Designation).
Source Protection Zone	The site is within a “Zone III – Total Catchment” Ground Water Source Protection Zone.
Aquifer Designation – Bedrock	The site is within a “Principal” defined Bedrock Aquifer Designation Zone.
Aquifer Designation – Superficial	The site is within a “Secondary (undifferentiated)” Superficial Aquifer Designation zone.
Groundwater Vulnerability	The site is within a ‘Medium-High’ groundwater vulnerability zone.

Table 2.1 – Geological Ground Conditions

2.4 Existing surface water management

The site is assumed to be greenfield and has areas of dense vegetation. The greenfield runoff rate for the site (QBAR), according to HR Wallingford, is 5.55 l/s. Refer to Appendix C for the HR Wallingford calculations.

3 PROPOSED DEVELOPMENT

The development proposals are to construct a van storage area, including resurfacing, amendments to the site access, associated parking and ancillary infrastructure.

The proposed impermeable area for the development site is approximately 1.99ha.

Plans of the proposed development are enclosed in Appendix A.

4 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.

4.1 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 Flood Risk and Coastal Change, Planning Practice Guidance, 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.

4.1.1 Fluvial Flood Risk

An extract from the Environment Agency's online flood map published on their website is shown in Figure 4.1 below, with Flood Zone 3a & 3b denoted by dark blue hatch and Flood Zone 2 a light blue.

The site is located within a Flood Zone 1 'Low Probability' area and therefore lies outside an area at risk of fluvial/tidal flooding.

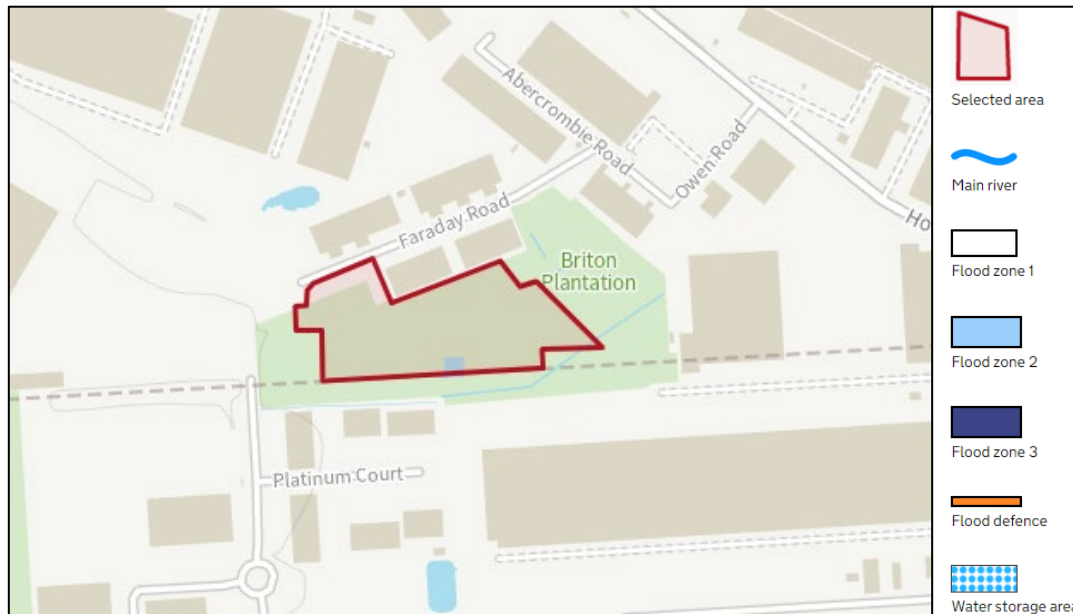


Figure 4.1 – Environment Agency Online Flood Map Extract

4.1.2 Tidal Flood Risk

The site is not at risk of tidally surcharged watercourses.

The site is not at risk of flooding from the open coast.

4.2 Flooding from land & sewers

Figure 4.2 below identifies areas within the site which are shown to have 'Low' to 'High' risk of flooding from surface water. These are primarily along the northern boundary and along existing drainage features onsite.

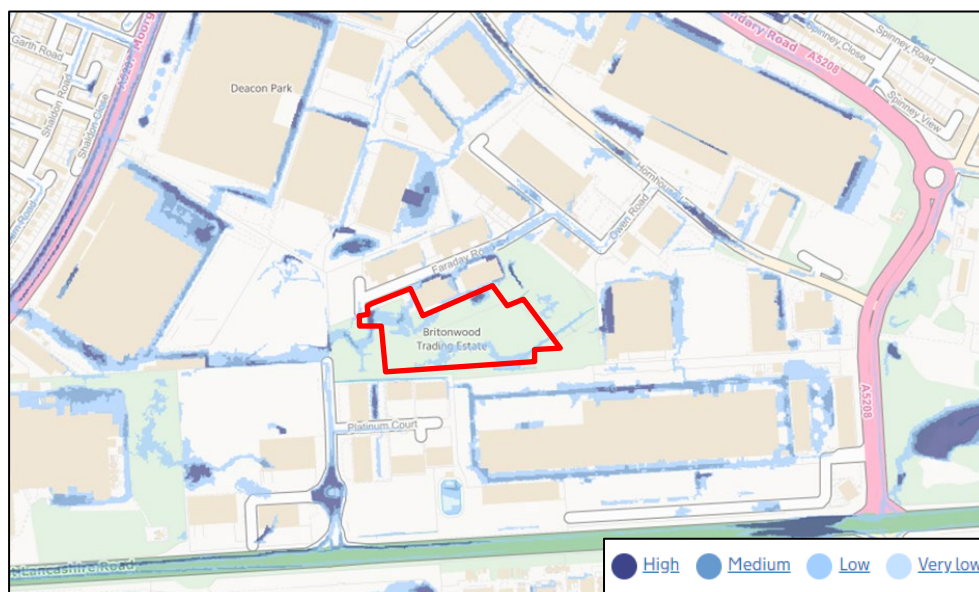


Figure 4.2 – Gov.uk Surface Water Flood Risk Map extract

The Level 2 SFRA shows there are no records of sewer related surface water flooding (between the dates of 01.04.2008 – 03.05.2012).

4.3 Flooding from groundwater

The Level 1 SFRA shows that the site is not within an area categorised as being at risk of groundwater flooding.

4.4 Flooding from reservoirs, canals, and other artificial sources

There are no canals within the immediate vicinity of the development site. Therefore, the risk of flooding from canals is low.

The online Gov.uk reservoir flood maps show the site is not at risk of flooding from reservoirs.

4.5 Flood Risk Summary

A summary of the flood risk posed to the proposed development is provided in 'Table 4.1' below.

Flood Risk Source	Flood Risk Posed by Source
Rivers	Low
Sea	Low
Land	Low-High
Sewers	Low
Groundwater	Low
Reservoirs	Low
Canals	Low

Table 4.1 – Flood Risk Summary

5 POLICY STATUS FOR PROPOSED DEVELOPMENT

5.1 Vulnerability classification

The proposed development complies with the following principles:

- The proposed development lies within Flood Zone 1;
- The proposed development is classified as 'Less Vulnerable' in accordance with Table 2 of the Flood Risk and Coastal Change, Planning Practice Guidance (reproduced as Table 5.1 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 5.1 – 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	✓	✗	Exception Test	✓
	Zone 3b	Exception Test	✓	✗	✗	✗
Key ✓ Development is appropriate ✗ Development should not be permitted						

Table 5.2 – Flood Risk Vulnerability and Flood Zone ‘Compatibility’

The proposed development is appropriate in accordance with Table 3 of the Flood Risk and Coastal Change, Planning Practice Guidance, reproduced in Table 5.2 above.

5.2 Sequential Test & Exception Test

The NPPF requires that all development is subject to the Sequential Test to steer new development towards 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 to

the developer, or promoter of the site. The NPPF 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 Planning Practice Guidance 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 the 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 Flood Risk and Coastal Change, Planning Practice Guidance (reproduced in Table 5.2 above) indicates when the Exception Test is required.

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

5.3 Local Policy

The information provided below is an extract from the Knowsley Development Plan (January 2016) found on the council website (www.knowsley.gov.uk/residents/building-and-planning/local-plan/adopted-documents). Additional information can be found in the Knowsley Council Local Flood Risk Management Strategy (2017) found (knowsley.gov.uk/residents/roads/flood-risk-management).

With respect to flooding, Policy CS24 of the Knowsley Local Core Strategy “Managing Flood Risk” states: “*Climate change has the potential to increase flood risk by raising sea levels and leading to a greater occurrence of extreme rainfall events. The Local Plan is required to take account of these risks and set out policies for managing surface water and promoting the use of Sustainable Drainage Systems (SuDS).*”

- 1) New development that may cause an unacceptable risk of flooding on the site or elsewhere will not be permitted.*
- 2) New development should preferably be located in areas of low probability of flooding. New development in areas of medium or high flood risk will only be permitted if evidence has been submitted demonstrating that the development could not be practicably located in an area of lower flood risk and if applicable the ‘exception test’ has been complied with, in accordance with national guidance.*
- 3) All development which is within or otherwise affects an area of flood risk or is larger than one hectare in size shall be accompanied by a site-specific Flood Risk Assessment (FRA).*
- 4) New development shall include flood mitigation measures, where necessary, to manage flood risk associated with or caused by the development. These measures shall be derived from the Strategic Flood Risk Assessment (SFRA), relevant FRA(s) or a local strategy for flood risk management, and:
 - a) Be designed to contribute to the biodiversity of the borough unless it can be demonstrated that this would not be technically feasible;*
 - b) Incorporate a Sustainable Drainage System;*
 - c) Be fully described in the planning application; and*
 - d) Be funded by the developer, including long term maintenance.**
- 5) The drainage of new development shall be designed to reduce surface water run-off rates to those associated with a green-field site by treating it at its source. The chosen method of implementation should take account of site size, ground contamination or conditions, and potential damage to adjacent buildings or sites.*
- 6) Further guidance on these issues will be provided in a proposed Supplementary Planning Document.*

Policy 10.24 “Sustainable Drainage Systems” states: “Sustainable Drainage Systems (‘SuDS’) are now the expected way to manage surface water and can be used on any site. These features include green roofs, soft landscaping, permeable surfaces and/or water storage ponds. Policy CS24 will complement Part H of the Building Regulations 2010 and national legislation by requiring the use of SuDS on all sites. Further guidance on the Council’s requirements concerning the use of SuDS will be set out in the ‘Design Quality in New Development’ or other SPD as appropriate.”

The excerpt is from the Knowsley Council Local Flood Risk Management Strategy found under the section titled “Managing our Local Flood Risk”. The following policy is applicable to management of surface water runoff on site:

“Paragraph 103 of the NPPF requires all major developments to use Sustainable Drainage Systems (SuDS) and proposals must not increase flood risk elsewhere. SuDS are a means of managing rainwater, using and mimicking natural processes so that the volume and flow rate of water from developments is similar to that of the land in its natural state. SuDS can have a significant role in managing flooding by regulating the amount of surface water that is discharged.

As well as managing flood risk high quality, landscaped SuDS can provide multiple benefits such as provision of accessible green space, improved amenity value, water quality improvements climate change adaptation and biodiversity enhancement.

In its role as a statutory consultee on all major development proposals, Knowsley Council LLFA will encourage the use of high-quality SuDS on all development proposals to deliver multiple benefits and to contribute towards Green Infrastructure. This will be achieved by effectively implementing national and local SuDS policies and by requiring applicants to submit a sustainable drainage strategy and, where one is required, a site-specific flood risk assessment in support of development proposals.”

6 FLOOD RISK MANAGEMENT AND MITIGATION

6.1 Surface Water Drainage

6.1.1 Drainage Hierarchy

The site is greenfield and drains via overland flow to the southern boundary. The drainage hierarchy has been considered below in the context of the proposed development and is as follows:

- Discharge into the ground;
- Discharge to a surface water body; and
- Discharge to a surface water sewer;

6.1.1.1 “Discharge into the ground”

This FRA & DS report outlines that the site is primarily underlain by clay and sandstone. Additionally, the groundwater vulnerability for the site is indicated as “Medium-High” and the risk of groundwater flooding is likely to rise over the next few years. It is therefore assumed that infiltration for the site is not a suitable solution. This can be confirmed via 3 sets of soakage tests (conducted in accordance with BRE365 guidance).

6.1.1.2 “Discharge to a surface water body”

As infiltration is considered to be unfeasible (subject to BRE365 tests), the next method of discharge in conjunction to Building Regulation H3 would be to discharge into the nearest watercourse. The flood maps show a historic drainage ditch and a pond along the southern boundary. It is assumed that these have been filled in. The next closest waterway is Knowsley Brook, 600m to the east of the site.

6.1.1.3 “Discharge to a surface water sewer”

The following feasible option for drainage management is to establish discharge locations into the existing public sewer network. Discharge into the existing network is deemed most practical, in this case. The practicability of this mode of management however would be subject to a pre-development enquiry to the asset owners confirming that the existing asset has the capacity to accommodate the increased discharge volumes.

6.1.2 Climate Change Impact

It is widely accepted that climate change will increase the severity of flood events in the future. To ensure that the proposed development is future-proofed an allowance for climate change has been made in the design of flood risk management measures. The climate change allowance is based on the expected lifetime of the development, which for industrial developments is approximately 80-years, and guidance on climate change allowances from the UK Government.

The development site is located within the ‘Alt and Crossens Management Catchment’. An extract of the DEFRA Climate Change Allowances for this catchment is provided below in Figure 6.1.

Alt and Crossens Management Catchment peak rainfall allowances			✕
3.3% annual exceedance rainfall event			
Epoch	Central allowance	Upper end allowance	
2050s	25%	35%	
2070s	30%	40%	
1% annual exceedance rainfall event			
Epoch	Central allowance	Upper end allowance	
2050s	25%	40%	
2070s	30%	45%	
*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.			

Figure 6.1 – Alt and Crossens Management Catchment Climate Change Allowances

As outlined in Figure 6.1 above, for the 2070s EPOCH, the upper end allowance that will be used in all hydraulic calculations is 40% for the 1:30-year return period and 45% for the 1:100-year return period.

6.1.3 Surface Water Modelling Considerations

FEH rainfall data will be used in all hydraulic calculations for the development plot. The design storms that will be considered are:

- 1:1-year return period scenario
- 1:30-year return period +40% climate change scenario
- 1:100-year return period +40% climate change scenario

The site will restrict flows to the greenfield runoff rate. The greenfield runoff rates for the site are outlined in Table 6.1 below and a copy of the calculations are included in Appendix C.

Return Period	Runoff Rate per hectare 1ha	Runoff Rate for Site area (2.38ha)
QBAR	2.33 l/s	5.55 l/s
Q1	2.03 l/s	4.83 l/s
Q30	3.96 l/s	9.42 l/s
Q100	4.84 l/s	11.52 l/s
Design Rate		5.55 l/s

Table 6.1 – Greenfield Runoff Rates and Proposed Surface Water Design Rate

The runoff rate from the proposed site will match the greenfield run-off rate for the site, with a 40% Climate Change allowance. This discharge rate should be sufficient to ensure that there will be no adverse effects to the existing infrastructure. Additionally, it is worth reaffirming that this management programme is subject to an investigation ruling out infiltrations a viable method of drainage.

6.1.4 Ground Level Strategy

The proposed development will set finished floor levels (hereinafter referred to as FFLs) above the 1:100-year plus 45% climate change scenario levels plus an additional minimum 150mm to provide a freeboard. The ground level strategy will aim to achieve an optimal earthworks solution, with a neutral cut-fill if possible.

6.1.5 Proposed Drainage Regime

Stormwater will be managed onsite via a combination of traditional drainage and SuDS. Stormwater will be collected on the surface by channel drainage and gullies. Stormwater will be conveyed via a piped network towards a flow control manhole which will restrict flows to the QBAR rate of 5.55 l/s. Cellular storage will be provided onsite to attenuate stormwater at the restricted rate. Stormwater pollution will be treated through the inclusion of a petrol interceptor. The stormwater network will tie into an existing offsite sewer network.

No stormwater flooding will be modelled during the 1:30-year return period, plus climate change, scenarios. Any stormwater flooding that is modelled within the 1:100-year return period, plus climate change, will be contained within the site boundary and will not pose a risk to site occupants or to third parties.

An indicative drainage layout is included in Appendix D. Hydraulic calculations included in Appendix E support the proposal for 1,726-2,408m³ of stormwater attenuation.

6.1.6 Surface Water Pollution Management

Pollution treatment has been provided within the proposed drainage network and the Simple Index Approach, as outlined in 'Section 26' the SuDS manual (C753), has been summarised in Table 6.2 below.

Land Use (As Defined in the CIRIA SuDS Manual)	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Non-residential car parking with frequent change	Medium	0.7	0.6	0.7
SuDS Type	Treatment			
SPEL Stormceptor ESR Range	-	0.8	0.6	0.9
Suitable Level of Treatment?	-	Yes	Yes	Yes

Table 6.2 – Simple Index Approach Summary for the Proposed Development

As shown in Table 6.2 above, the surface water associated with the proposed development will be suitably treated prior to it discharging from the development site.

6.1.7 Surface Water Drainage Maintenance

It is proposed that the site owner or a maintenance company operating on their behalf will maintain all drainage elements on the site, including the proposed SuDS.

6.1.7.1 Attenuation Tank

The proposed Geolight (or equivalent) attenuation tank includes a perforated/ slotted distribution pipe surrounded by granular material providing filtration and treatment for surface water flows. This in conjunction with the proposed catch pit manhole (silt trap) is considered appropriate for the scale and nature of the development.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks			
Maintenance schedule	Required action	Typical frequency	
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually	
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly	
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually	
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required	
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required	
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually	
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required	

6.1.7.2 Proprietary System

Proprietary systems will require routine maintenance by the owner to ensure continuing operation to design performance standards. A typical maintenance schedule is detailed below in table 14.2 from the CIRIA SuDS manual.

TABLE 14.2 An example of operation and maintenance requirements for a proprietary treatment system		
Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

6.1.7.3 Gullies/Channels/Pipes/Manholes

All components are to be periodically cleaned of foreign particles and silt accumulation, on a quarterly basis. Components located in unadopted areas will be maintained by the landowner. Those located in adopted areas will be maintained by the adopting authority.

6.2 Foul Water Drainage

Foul water will be managed via a piped connection into an existing sewer north of the site, located in Faraday Road. A plan showing the proposed foul water drainage arrangement is included in Appendix D.

7 CONCLUSION

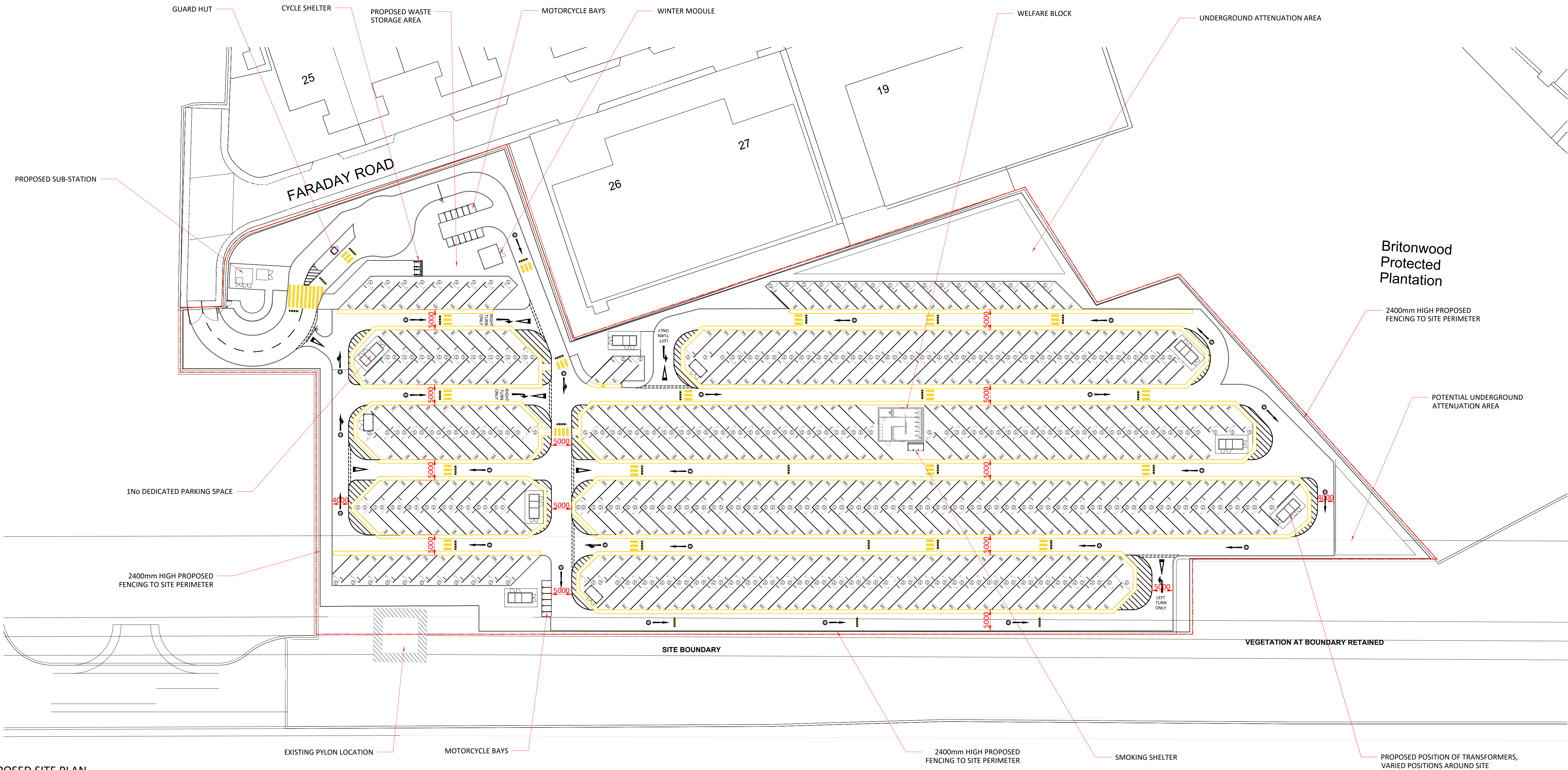
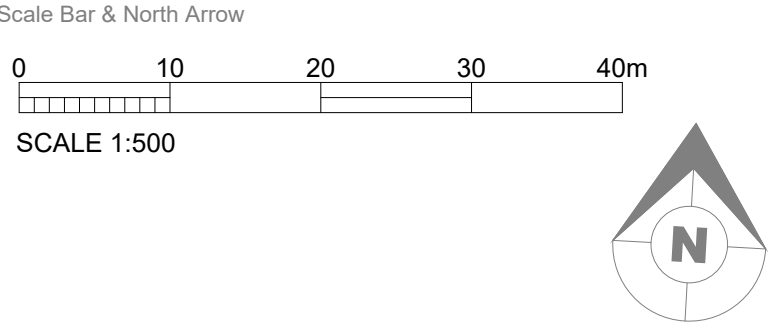
The development proposals are for a van storage area on an existing greenfield plot.

The flood risk on the development site has been assessed and the site is considered to be at a low risk of flooding from all sources considered within this report, with the exception of surface water. Surface water flood risk varies from low-high across the site however, the risk will be mitigated by the new stormwater drainage network.

It has been outlined how the proposed development will manage both storm water and foul water. Stormwater will be managed via a piped connection into an existing sewer, where flows are restricted to QBAR and attenuation is provided through below ground crates. An indicative stormwater layout demonstrating how storm water will be contained on the site for all scenarios up to and including the 1:100-year plus 45% climate change scenario is included in Appendix D.

Overall, it is considered that the site has passed the sequential test and the proposals are suitable from the sequential test perspective. It has been demonstrated that an appropriate solution is available to the development to manage storm water and foul water flows.

Appendix A – Proposed Development Layout



PROPOSED SITE PLAN
1:500

LOCATION PLAN:

NOTES:

- SITE AREA (Acres/Hectares) 5.88 Acres/2.38 Ha
- VAN STORAGE BAYS (6.5 x 3.1m) - 359
- LV DUCT ENTRY TO FUTURE CHARGING LOCATION
- 1m HIGH BOLLARD PROTECTION
- WHEEL STOP

REV	DATE	DESCRIPTION
P1	30/01/2023	INITIAL ISSUE

LF	KN
DRAWN BY	CHECK BY

PROJECT TITLE

VAN STORAGE AREA
FARADAY ROAD, KNOWSLEY

DRAWING TITLE

PROPOSED SITE PLAN

RIBA STAGE	STATUS		DRAWN BY	CHECKED BY
N/A	PLANNING		LF	KN
SHEET	SCALE	DATE	SUITABILITY	REVISION
A1	1 : 500	24/01/2023	S2	P1

DRAWING NO.

23013 - ASA - 00 - EX - SI - D - A - P03 _ (S2 - P1)

CLIENT

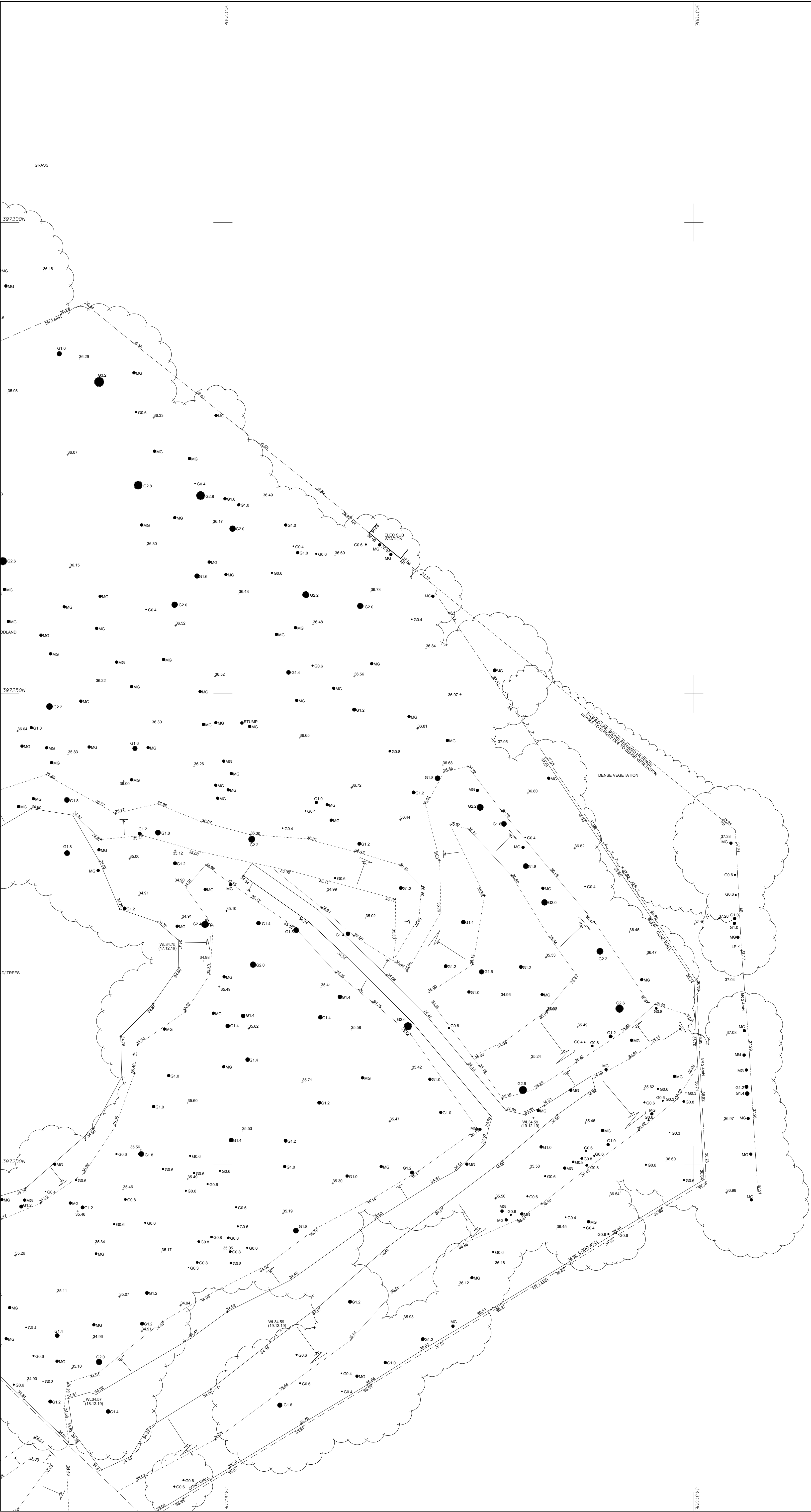
network
space

AshtonSmith
Beyond Design

Ashton Smith, Belvedere House, 2 Victoria Avenue, Harrogate, North Yorkshire, HG1 1EL
Tel: 01423 522882 Fax: 01423 565104
www.ashtonsmith.co.uk

JOB NO. 23013

Appendix B – Topographic Survey



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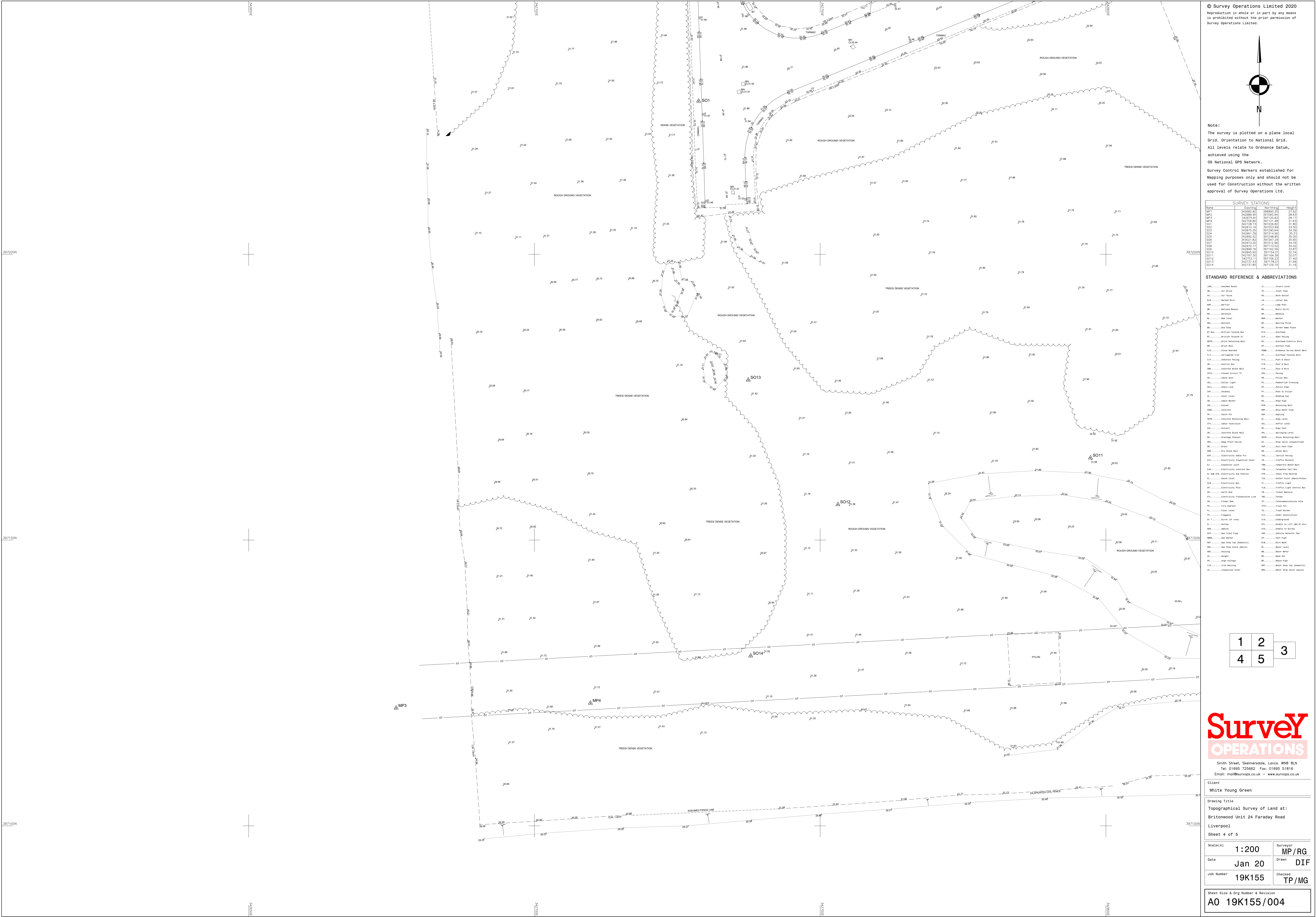


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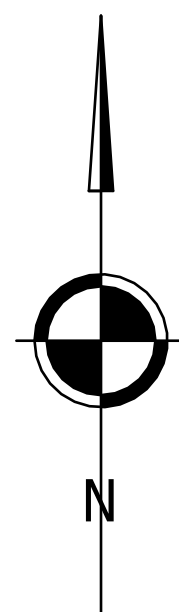
The survey is plotted on a plane local
Grid. Orientation to National Grid.
All levels relate to Ordnance Datum,
achieved using the
OS National GPS Network.

Survey Control Markers established for
Mapping purposes only and should not be
used for Construction without the written
approval of Survey Operations Ltd.

SURVEY STATIONS			
Name	Easting	Northing	Height
MP1	342682.82	396890.30	27.92
MP2	342689.95	397060.04	28.63
MP3	342675.81	397120.62	29.17
MP4	342709.80	397163.48	31.63
S01	342872.73	397226.82	31.80
S02	342810.16	397253.99	33.30
S03	342675.05	397280.64	34.59
S04	342661.39	397307.06	35.06
S05	342992.52	397348.85	35.05
S06	343021.82	397267.29	35.65
S07	397273.20	397212.96	34.87
S08	342970.17	397252.52	35.52
S09	342899.76	397162.56	33.76
S010	342645.90	397154.01	32.74
S011	342797.30	397167.34	32.07
S012	342753.11	397156.23	31.40
S013	342737.43	397178.01	31.56
S014	342737.85	397129.74	31.16



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Note:
The survey is plotted on a plane local Grid. Orientation to National Grid.
All levels relate to Ordnance Datum, achieved using the OS National GPS Network.
Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.

SURVEY STATIONS		
Name	Easting	Northing
MP1	342055.43	397050.20
MP2	342059.95	397050.94
MP3	342075.81	397120.62
MP4	342070.80	397121.48
SO1	342075.73	397228.82
SO2	342010.16	397255.99
SO3	342070.00	397256.64
SO4	342070.00	397256.64
SO5	342070.00	397256.64
SO6	342070.00	397256.64
SO7	342070.00	397256.64
SO8	342070.00	397256.64
SO9	342070.00	397256.64
SO10	342070.00	397256.64
SO11	342070.00	397256.64
SO12	342070.00	397256.64
SO13	342070.00	397256.64
SO14	342070.00	397256.64

STANDARD REFERENCE & ABBREVIATIONS	
AB	Assured Route
AC	Accident
AD	Accident
AE	Accident
AF	Accident
AG	Accident
AH	Accident
AI	Accident
AJ	Accident
AK	Accident
AL	Accident
AM	Accident
AN	Accident
AO	Accident
AP	Accident
AQ	Accident
AR	Accident
AS	Accident
AT	Accident
AV	Accident
AW	Accident
AX	Accident
AY	Accident
AZ	Accident
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BK	Accident
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BM	Accident
BN	Accident
BO	Accident
BP	Accident
BQ	Accident
BR	Accident
BS	Accident
BT	Accident
BU	Accident
BV	Accident
BW	Accident
BX	Accident
BY	Accident
BZ	Accident
CA	Accident
CB	Accident
CC	Accident
CD	Accident
CE	Accident
CF	Accident
CG	Accident
CH	Accident
CI	Accident
CJ	Accident
CK	Accident
CL	Accident
CM	Accident
CN	Accident
CO	Accident
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CT	Accident
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CW	Accident
CX	Accident
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DA	Accident
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WY	Accident
WZ	Accident
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XB	Accident
XC	Accident
XD	Accident
XE	Accident
XF	Accident
XG	Accident
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YU	Accident
YV	Accident
YW	Accident
YX	Accident
YZ	Accident
ZA	Accident
ZB	Accident
ZC	Accident
ZD	Accident
ZE	Accident
ZF	Accident
ZG	Accident
ZH	Accident
ZI	Accident

Appendix C – Greenfield Runoff Rate Calculations

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.ukstds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	2	2

HOST class:	N/A	N/A
-------------	----------------------------------	----------------------------------

SPR/SPRHOST:	0.3	0.3
--------------	----------------------------------	----------------------------------

Hydrological characteristics

	Default	Edited
SAAR (mm):	863	863

Hydrological region:	10	10
----------------------	---------------------------------	---------------------------------

Growth curve factor 1 year:	0.87	0.87
-----------------------------	-----------------------------------	-----------------------------------

Growth curve factor 30 years:	1.7	1.7
-------------------------------	----------------------------------	----------------------------------

Growth curve factor 100 years:	2.08	2.08
--------------------------------	-----------------------------------	-----------------------------------

Growth curve factor 200 years:	2.37	2.37
--------------------------------	-----------------------------------	-----------------------------------

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

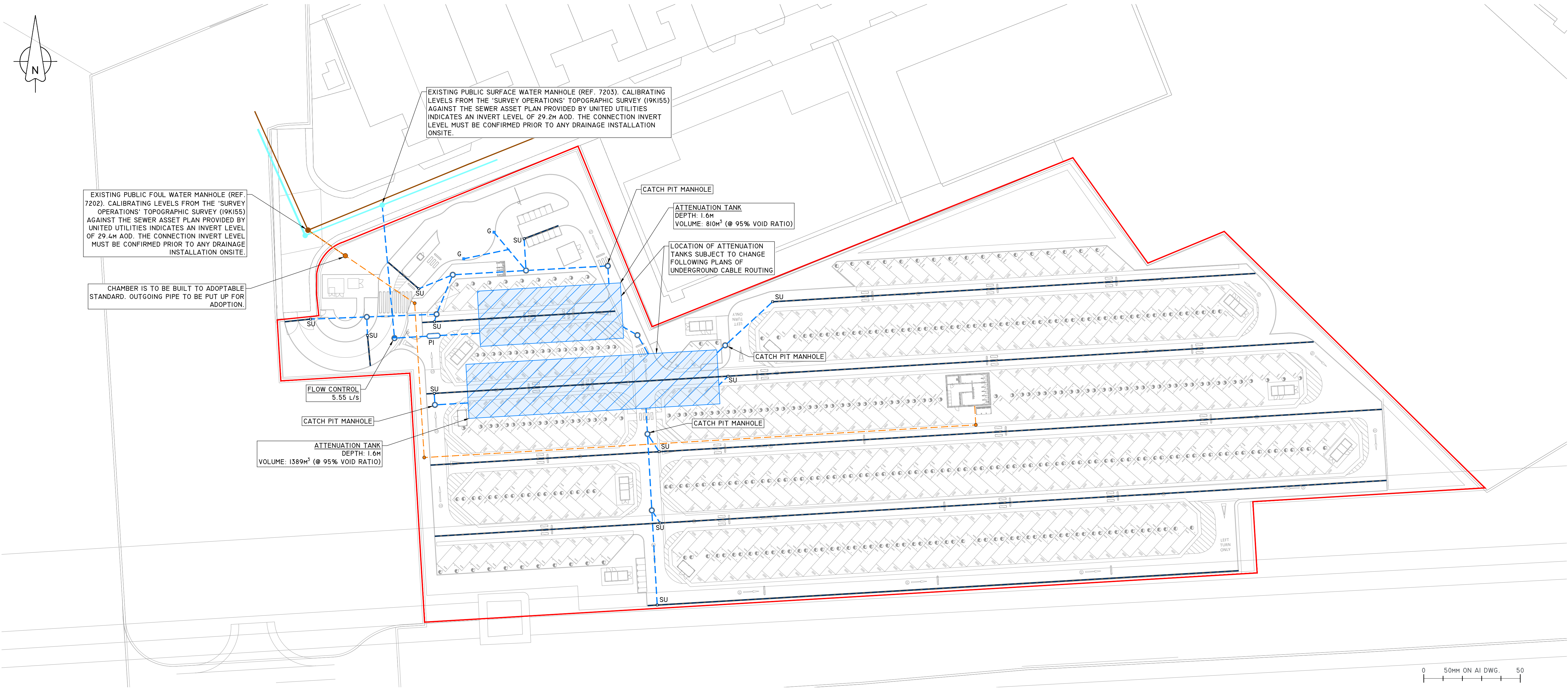
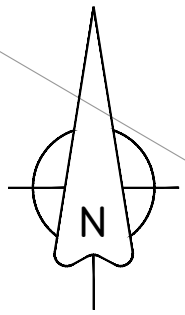
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	2.33	2.33
1 in 1 year (l/s):	2.03	2.03
1 in 30 years (l/s):	3.96	3.96
1 in 100 year (l/s):	4.84	4.84
1 in 200 years (l/s):	5.52	5.52

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix D – Proposed Drainage Layout



DRAINAGE NOTES

1. ALL PRECAST CONCRETE UNITS ARE TO BE TO BS 5911 (CLASS 3 SULPHATE RESISTANT CEMENT)
2. ALL PROPOSED MANHOLE COVERS AND FRAMES ARE TO BE DUCTILE IRON COMPLYING WITH BS EN 124.
3. ALL PRIVATE DRAINAGE WORKS TO BE IN ACCORDANCE WITH PART H OF THE CURRENT BUILDING REGULATIONS AND BS EN 752
4. THE CONTRACTOR MUST CHECK THE LEVELS AND CONDITION OF ALL EXISTING DRAINAGE OUTFALLS PRIOR TO CONSTRUCTION OF ANY DRAINAGE. TO ENSURE THE PROPOSED DESIGN MAY BE ACHIEVED. ANY DISCREPANCIES MUST BE REPORTED TO PINNACLE CONSULTING ENGINEERS LTD AND WORK HALTED IMMEDIATELY.
5. ALL RWP, SVP AND FOUL DRAINAGE POSITIONS, INCLUDING UNDERSLAB GULLIES, ARE TO BE CONFIRMED BY THE ARCHITECT.
6. ALL FOUL CONNECTION POINTS HAVE BEEN ASSUMED, SUBJECT TO ARCHITECT INFORMATION.
7. WHERE RWPs, STUB STACKS AND SVP'S ARE CONNECTED DIRECT TO THE DRAIN, RODDING ACCESS PLATES ARE TO BE PROVIDED.
8. PETROL INTERCEPTORS TO BE FITTED WITH OIL LEVEL ALARMS, TERMINATING AT LOCATION AGREED WITH CLIENT. INTERCEPTORS TO BE VENTED. VENT PIPES TERMINATION TO BE AGREED BY ARCHITECT. CONTRACTOR TO ALLOW FOR POWER SUPPLY AND DUCTING AS NECESSARY.
9. ALL DRAINAGE CHANNEL AND GULLY GRATINGS TO BE CAST IRON 'HEELGUARD'
10. PRIOR TO COMMENCING WORKS THE CONTRACTOR IS TO REVIEW THE ENVIRONMENTAL ASSESSMENT REPORT AND GROUND INVESTIGATION REPORT.

DESIGN NOTES

1. PROPOSED SITE LAYOUT IS BASED ON THE 'ASHTONSMITH' ARCHITECT DRAWING '20048_ASA-VS-SI-DR-A-P03-S4'.
2. SHALLOW DRAINAGE WITH LESS THAN 0.9m COVER ARE TO BE PROTECTED. REFER TO DRAINAGE DETAILS FOR MORE INFORMATION.
3. REFER TO THE ARCHITECTURAL LAYOUT FOR THE SITE BOUNDARY.
4. ALL STUB STACK LOCATIONS ARE SHOWN INDICATIVELY TO DEMONSTRATE DESIGN INTENT. FINAL STUB STACK LOCATION AND CONNECTION REGIME TO BE CONFIRMED WITH ARCHITECT AND MEP.
5. THE CONNECTION LOCATIONS FOR INTERNAL FOUL DRAINAGE TO EXTERNAL FOUL DRAINAGE ARE BASED ON INTERNAL ARCHITECTURAL LAYOUTS. CONNECTIONS TO BE CONFIRMED ONCE STUB-STACK LOCATIONS ARE CONFIRMED BY SPECIALIST.

GENERAL NOTES

1. DO NOT SCALE THIS DRAWING. WORK ONLY TO FIGURED DIMENSIONS.
2. FOR ALL RELEVANT NOTES, REFER TO STRUCTURAL AND CIVIL ENGINEERING PERFORMANCE SPECIFICATION.
3. ANY DISCREPANCIES ARE TO BE REPORTED TO PINNACLE CONSULTING ENGINEERS IMMEDIATELY. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SUB-CONTRACTORS DRAWINGS AND DETAILS.

LEGEND

- PROPOSED PRIVATE SURFACE WATER SEWER
- PROPOSED PRIVATE FOUL SEWER
- PROPOSED ADOPTABLE FOUL SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING PUBLIC FOUL WATER SEWER
- PROPOSED SURFACE WATER CHANNEL
- PROPOSED FLOW CONTROL CHAMBER
- PROPOSED SURFACE WATER ROAD GULLY
- SUMP UNIT
- PETROL INTERCEPTOR
- PROPOSED ATTENUATION TANK
- INDICATIVE SITE BOUNDARY



POI	ISSUED FOR INFORMATION	RB	ST	06.02.23
REV	DESCRIPTION	BY	CHK	DATE

CLIENT
NETWORK SPACE

PROJECT
KNOWSLEY
VAN STORAGE

DRAWING TITLE
DRAINAGE GENERAL
ARRANGEMENT

PINNACLE
CONSULTING ENGINEERS

PINNACLE HOUSE,
3 MERIDIAN WAY,
NORWICH,
NORFOLK
NR7 0TA. TELEPHONE: 01603 327 170
WELWYN GARDEN CITY | LONDON | DUBLIN | THE HAGUE

DRAWING STATUS			
INFORMATION			
SCALE @ A1	DATE	DRAWN BY	CHECKED
1:500	JAN '23	RB	ST
DRG NO.	REVISION		
230100315-PIN-XX-ZZ-DR-C-02300-P01			

COPYRIGHT PINNACLE

REF: 23000315

Appendix E – Drainage Calculations

Quick Storage Estimate

Micro Drainage

Variables

FEH Rainfall

Return Period (years) 100

Version 1999

Site GB 342350 397000 SJ 42350 97000

C (1km) -0.022 D3 (1km) 0.321

D1 (1km) 0.318 E (1km) 0.286

D2 (1km) 0.314 F (1km) 2.503

Cv (Summer) 0.750

Cv (Winter) 0.840

Impemeable Area (ha) 2.000

Maximum Allowable Discharge (l/s) 5.6

Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 45

Analyse OK Cancel Help

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 1726 m³ and 2408 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

NORWICH

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