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History.

Revision	Date	Reason
0	Aug 2022	Original to support planning application.
1	Oct 2022	Update with new Site layout & topo survey.

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Introduction.

Reference:

Reference document & policy requiring a drainage strategy report.

A planning application for development is to be submitted for the erection of 7No detached residential dwellings, refer to Proposed Plan in Appendix.

As part of the planning application, a Drainage Strategy Report is required to address issues regarding sustainable drainage principles for the proposed development.

Purpose of Report:

The primary purpose of this report is to identify specific drainage proposals for parts of the proposed site in accordance with the national drainage hierarchy for surface water disposal & exceedance characteristics, also considering the proposed end adopters and their requirements.

Regarding site assessment, this report will appraise the existing site and local drainage infrastructure, assess the suitability of the proposed development, giving recommendations for drainage design & management, specifically for approval of the LLFA/EA/sewerage undertakers, as applicable.

General principles:

Drainage from new developments is to be designed to follow the national drainage hierarchy for surface water discharge to the following networks in order of preference:

- *infiltration*
- *watercourse*
- *public sewer*

Flow rates (existing & proposed) are to be estimated for approval using the following methodology:

- *Development should aim to deliver greenfield runoff on greenfield sites up to a 100yr rainfall event, considering climate change.*
- *Development should aim for a minimum reduction in surface water runoff rates of 50% for brownfield sites on a 1yr rainfall event.*
- *Development should be designed so that there is no flooding to the development in a 30yr event and so that there is no property flooding in a 100yr event considering climate change.*

Plans.

Location Plan.

Refer to the appended Location Plan.

The Site is within a predominantly residential area with some immediate local amenities, such as shops, public houses, and sports facilities.

It is to the west of Middleton Town Centre, and residential dwellings are located primarily to the east, south and west, with the Middleton Links Golf Club & course immediately to the north.

The closest open watercourse is the within the golf course approximately 200m west.

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Site Plan.

The overall pre-development Site comprises a residential bungalow, nominally central to the plot. The bungalow appears to have been extended over time with various other additional buildings such as garages, annexes, and other outbuildings.

The Site is served by an access drive off Sunny Brow Road to the south.

The external areas are made up of hardstandings comprising macadam finishes to the access road & drive, and pcc pavements to surrounding pathways/patios. The remainder of the Site is vegetated.

The predevelopment areas are:

- *Total area* 3000 sqm
- *Hardstanding area (impermeable)* 1500 sqm
- *Soft landscaped area (permeable)* 1500 sqm.

The proposal is for 7 No. detached residential dwellings. The properties will each have a private double driveway served by the main access road, surrounding private pathways, and the remaining area will comprise soft landscaping garden area.

Desk Surveys & Investigations.

Existing and proposed topography.

The Site is on the top of a small hill, with land elevation falling to the south. A topographic survey of the Site has been undertaken pertinent levels indicate below (m aOD):

GL at north Site corner	97.00
GL at west corner	96.80
GL at east Site corner	95.50
GL at south Site corner/boundary with Sunny Brow Rd	93.30
Inspection chamber at the Site entrance, cover level	93.31

Geology & Site Investigations.

Geological maps of the local area suggest the Site is underlain by Hummocky (moundy) Glacial Deposits, Devensian - Sand and gravel.

Borehole Records.

There were no relevant boreholes within close proximity to the Site.

United Utilities Records.

United Utilities records indicated combined sewers locally.

Assessments.

Flood zone category.

Refer to the .gov flood maps appended. The Site is within Flood Zone 1, ie a LOW probability of flooding.

Watercourses – No risk from watercourses in the local area.

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Surface water – Current maps show there is some minor flooding of surface water outside of the Site on War Office Road.

Canals/Artificial Water Bodies – No risk.

Reservoirs – Not known to be a risk.

Climate change impacts.

Climate change allowances allow for uncertainty in the climate model, and the resultant change assumed through time. Allowances are thus related to the type of development and the potential lifetime expected of such development as per the Environment Agency table below:

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%

Residential developments are classified within the '2080s' timeframe resulting in a 40% climate change allowance to be included on the predicted extreme rainfall models.

Existing surface water system.

The Site comprises approximately 1500 sqm of impermeable area.

It is assumed the Site has a connection to the United Utilities combined sewer and can be considered as a brownfield plot of land for the purposes of this assessment.

Hydrological characteristics for the site were obtained from the HR Wallingford mapping database:

SAAR (mm) ⓘ	1009
M5-60 rainfall depth (mm) ⓘ	17 ▾
'r' ratio M5-60 / M5-2day ⓘ	0.3 ▾
FEH/FSR conversion factor ⓘ	1.11
Hydrological region ⓘ	10

Existing Brownfield Runoff (The Wallingford Procedure)

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Other
Storm duration	D = 10 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.300
5-year return period rainfall of 60 minutes duration	M5_60min = 17.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.49
Rainfall for 10min storm with 5 year return period	M5_10min _i = Z1 * M5_60min = 8.3 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 10min storm with 1 year return period	M1_10min = Z2 * M5_10min _i = 5.1 mm

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Design rainfall intensity

$$I_{\max} = M1_{10\min} / D = 30.7 \text{ mm/hr}$$

Maximum surface water runoff

Catchment area

$$A_{\text{catch}} = 3000 \text{ m}^2$$

Percentage of area that is impermeable

$$p = 50 \%$$

Maximum surface water runoff

$$Q_{\max} = A_{\text{catch}} * p * I_{\max} = 12.8 \text{ l/s}$$

Pass Forward Flow Rates:

The existing greenfield flow rate is c12.8l/s. It is normal practice to limit brownfield flows to 50% of their predeveloped state, subject to a minimum flow rate of 5l/s to avoid blockages at unnecessarily low flow rates.

Due to the above, the pass forward flow rate from the Site should it be required (ie infiltration is not suitable), should be restricted to max 6.4l/s for surface water discharge only.

Proposed Surface Water System.

Following the guidance of hierarchy for disposal of surface water (SUDS):

- **INFILTRATION:** BGS maps suggest the subsoils comprise glacial Devensian sand and gravel. Sand & gravel deposits are generally highly permeable & are thus suitable for infiltration techniques such as permeable paving & soakaways.
- Site investigations should be undertaken to confirm whether infiltration will be a suitable method of surface water management at the Site.
- It should be noted that the boundaries & soil types identified on the geological maps do not always reflect the reality of the soil profile on Site. If Site investigation prove that infiltration is not suitable, another method of surface water disposal will be required.
- **WATERCOURSE:** There are no suitable watercourses for the discharge and connection of Site surface water. All are distant and through multiple 3rd party land which would be cost prohibitive.
- **SEWER:** The Site is expected to have an existing connection to the combined sewer. Should infiltration not prove to be suitable, the combined connection should be reused with attenuation and flow control to ensure the 100yr+cc rainfall event is stored on Site discharging at no more than 6.4l/s.

Proposed Foul Water System.

Foul water flows from the proposed development will need to be kept separate from surface water flows, and combined in the last manhole on Site and discharging to public combined sewer.

Additional Recommendations.

Site investigations should be undertaken to assess the on-Site geology. Should it be underlain by a permeable material then soakaway tests should be undertaken to BRE 365 to obtain infiltration rates for design.

Prior to demolition, a survey of the existing Site drainage, and its connection to the UU combined sewer should be undertaken to feed into the detailed design process. Any survey should include a detailed plan of drainage connectivity, pipe size, manhole depths, point of connection & suitability for reuse.

Should a new connection be required, an S106 connection application to United Utilities will need to be submitted & approved.

A topographic survey should be undertaken to feed into the design process.

This report should be submitted to the LPA, and approved before detailed design can be undertaken.

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Appendix.

Location Plan.



Station

Station	Easting	Northing	Level
4059400	386239.243	405956.814	99.114
4059400	386239.242	405956.814	99.114
4059400	386239.242	405956.814	99.114
4059400	386239.242	405956.814	99.114
4059400	386239.242	405956.814	99.114

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Proposed Site Plans



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Existing Impermeable Area Plan



Proposed Impermeable Area Plan

N/A, none available.

Local BGS Borehole Records

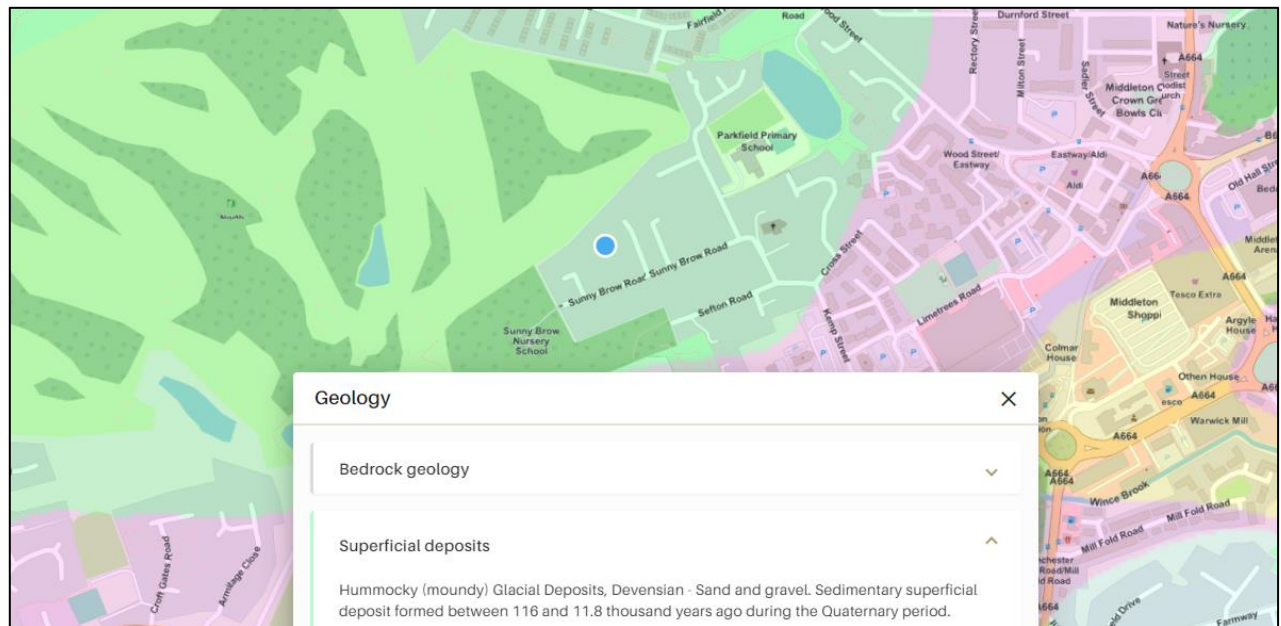
N/A, none available.

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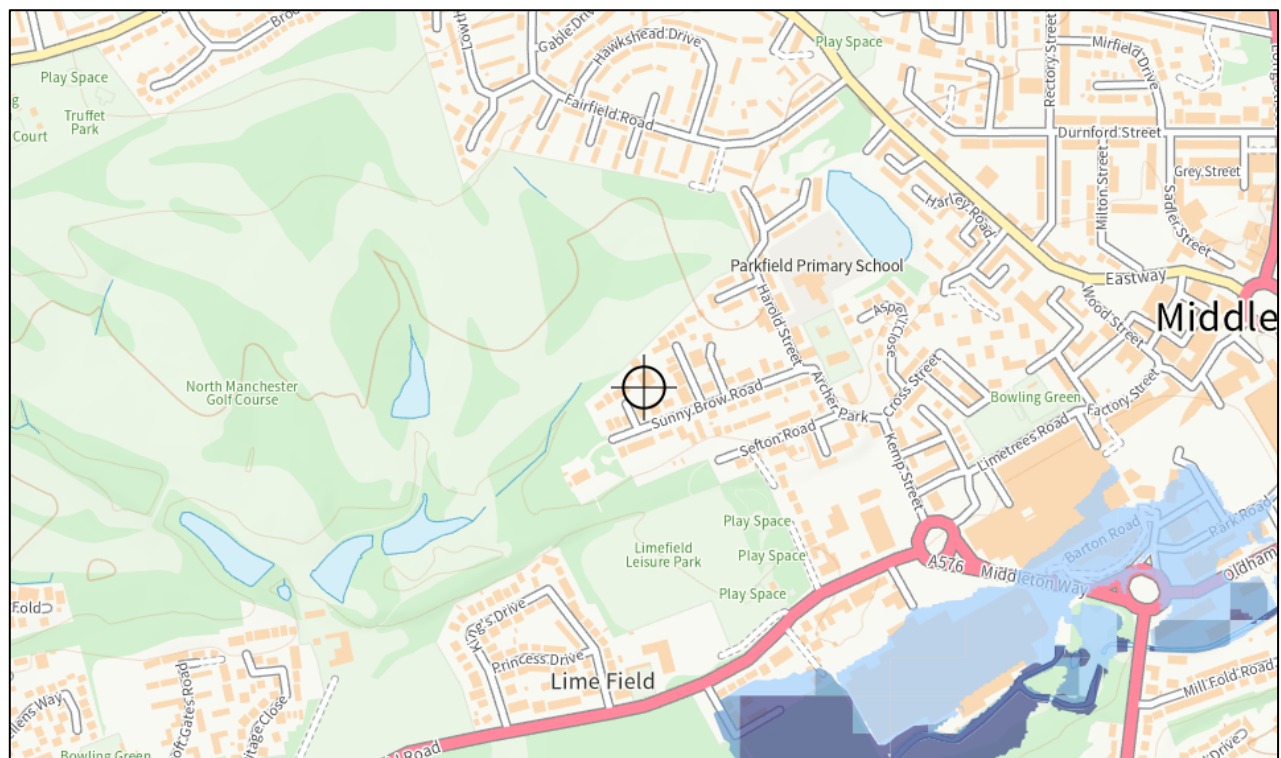
Landmark Watercourse Map

N/A, none available.

BGS Superficial Geology Maps



Gov River Flood Map (Flood Zones).



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Gov Surface Water Flood Map.



Drainage Calculations

N/A.

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Soil Permeability values.

Typical values of soil permeability

Some typical values of permeability coefficient are given below for different soil types. It refers to normally consolidated condition unless otherwise mentioned. These values should be used only as guideline for geotechnical problems; however, specific condition of each engineering problem often needs to be considered for an appropriate choice of geotechnical parameters.

Description	USCS	min (m/s)	max (m/s)	Specific value (m/s)	Reference
Well graded gravel, sandy gravel, with little or no fines	GW	5.00E-04	5.00E-02		[1].
Poorly graded gravel, sandy gravel, with little or no fines	GP	5.00E-04	5.00E-02		[1].
Silty gravels, silty sandy gravels	GM	5.00E-08	5.00E-06		[1].
Alluvial sand and gravel	(GM)	4.00E-04	4.00E-03		[2&3 in 4]
Clayey gravels, clayey sandy gravels	GC	5.00E-09	5.00E-06		[1].
Well graded sands, gravelly sands, with little or no fines	SW	1.00E-08	1.00E-06		[1].
Very fine sand, very well sorted	(SW)			8.40E-05	[5].
Medium sand, very well sorted	(SW)			2.23E-03	[5].
Coarse sand, very well sorted	(SW)			3.69E-01	[5].
Poorly graded sands, gravelly sands, with little or no fines	SP	2.55E-05	5.35E-04		[1]. [2&3 in 4]
Clean sands (good aquifers)	(SP-SW)	1.00E-05	1.00E-02		[5].
Uniform sand and gravel	(SP-GP)	4.00E-03	4.00E-01		[2&3 in 4]
Well graded sand and gravel without fines	(GW-SW)	4.00E-05	4.00E-03		[2&3 in 4]
Silty sands	SM	1.00E-08	5.00E-06		[1].
Clayey sands	SC	5.50E-09	5.50E-06		[1]. [5]
Inorganic silts, silty or clayey fine sands, with slight plasticity	ML	5.00E-09	1.00E-06		[1].
Inorganic clays, silty clays, sandy clays of low plasticity	CL	5.00E-10	5.00E-08		[1].
Organic silts and organic silty clays of low plasticity	OL	5.00E-09	1.00E-07		[1].
Inorganic silts of high plasticity	MH	1.00E-10	5.00E-08		[1].
Inorganic clays of high plasticity	CH	1.00E-10	1.00E-07		[1].
Compacted silt	(ML-MH)	7.00E-10	7.00E-08		[2&3 in 4]
Compacted clay	(CL-CH)	-	1.00E-09		[2&3 in 4]
Organic clays of high plasticity	OH	5.00E-10	1.00E-07		[1].
Peat and other highly organic soils	Pt	-	-		

Site Photographs.

Not used.

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Drainage Utilities Maps.

