Storeys Lodge, Hanbury

Worcester Diocesan Board of Finance Ltd

Flood Risk Assessment

December 2023

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Executive Summary

This Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. It has been produced on behalf of Worcester Diocesan Board of Finance Ltd in respect of a planning application for a proposed residential development at Storeys Lodge, Holmes Lane.

This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented.

The site is located in Flood Zone 1 on the Environment Agency Flood Map for Planning and is at low risk of fluvial and tidal flooding.

The site is at low to high risk of pluvial flooding and is at low risk of flooding from all other sources.

Surface water drainage from the site is to be controlled through the use of proposed new surface water sewers to direct runoff to a below-ground geocellular online attenuation crate system. A Hydro-brake chamber would then control the flow of discharge to the watercourse. The discharge rate from site will be restricted to 0.2l/s.

In compliance with the requirements of National Planning Policy Framework, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area as a result of suitable management of surface water runoff discharging from the site.

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1 Introduction

Background

1.1 The purpose of this FRA is to assess the risk of flooding to the proposed development and where possible provide sufficient mitigation to demonstrate that the future users of the development would remain safe throughout its lifetime, that the development would not increase flood risk on site and elsewhere and, where practicable, that the development would reduce flood risk overall.

Site Proposals

1.2 The proposed development consists of the removal of the existing caravan and replacement with a new dwelling with associated access, parking, and landscaping.

1.3 A copy of the proposed development drawings is included within **Appendix A**.

National & Local Planning Policy

1.4 The National Planning Policy Framework (NPPF)[1] sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance (PPG) is also available online[2].

1.5 The PPG sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.

1.6 The NPPF states that a site-specific Flood Risk Assessment will be required for proposals:

a) that are greater than 1 hectare in area within Flood Zone 1
b) for all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3
c) in an area within Flood Zone 1 which has critical drainage problems; and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding
d) in an area within Flood Zone 1 identified in a Strategic Flood Risk Assessment as being at increased flood risk in the future
e) in an area in Flood Zone 1 that may be subject to other sources of flooding, where its development would introduce a more vulnerable use

1.7 This FRA aims to provide sufficient flood risk information to satisfy the requirements of the NPPF, PPG and regional/local government plans and policies.

1.8 This assessment considers the risks of all types of flooding to the site including tidal, fluvial, surface, groundwater, sewer and artificial sources and provides mitigation measures to ensure that the flood risk to the site is minimised and that flood risk off-site is not increased.

[1] https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] https://www.gov.uk/guidance/flood-risk-and-coastal-change

Sources of Information

1.9 This FRA has been based on the following sources of information:

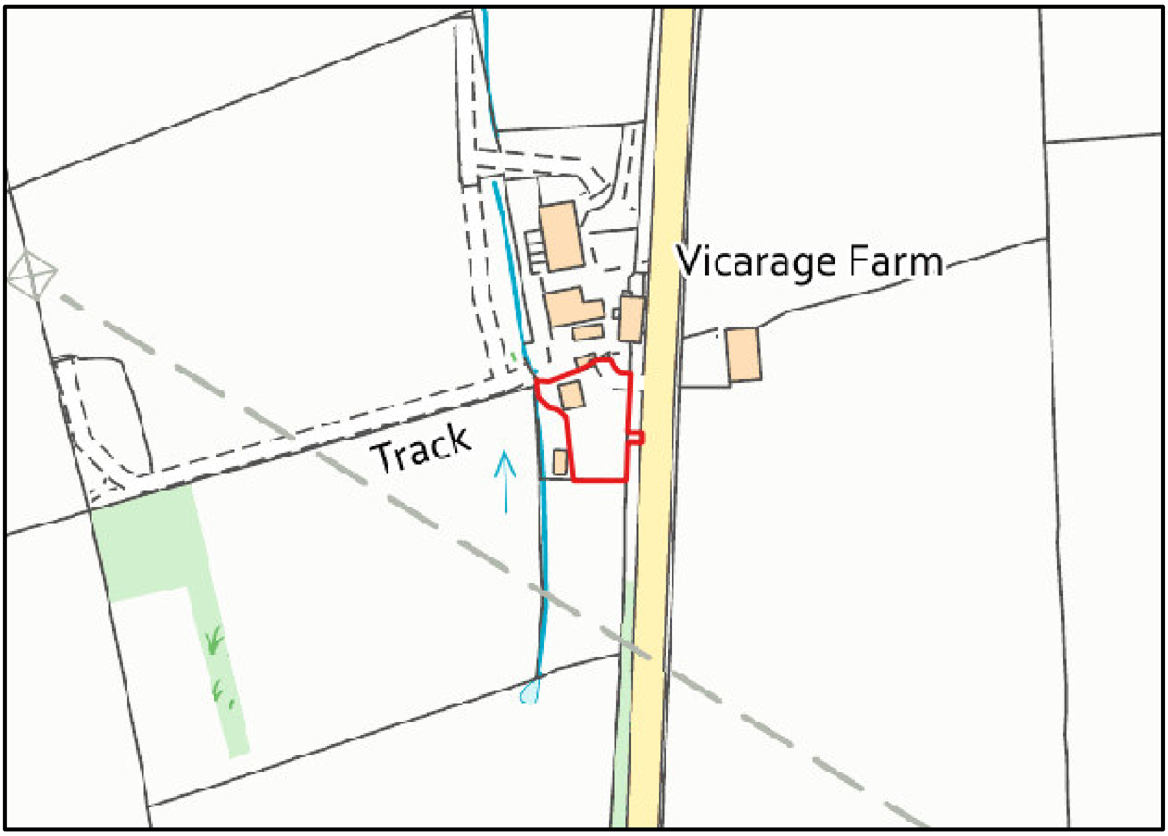
a) NPPF
b) NPPF-PPG
c) Site Layout Plan
d) Ordnance Survey mapping
e) Site Topographical Survey
f) DEFRA Magic mapping
g) Environment Agency mapping
h) Worcestershire Councils Strategic Flood Risk Assessment (2018)
i) Web Based Soil Mapping
j) British Geological Survey Drift & Geology Maps
k) Severn Trent Water Sewer Records
l) Local Press Flood Reports / Anecdotal Evidence

2 Existing Site & Hydrology Characteristics

Site Location & Composition

2.1 The site is located off Holmes Lane, approximately 2km north of Hanbury. The approximate co-ordinates for the centre of the site are E: 396584; N: 265723, with the nearest post code of B60 4HQ. The site location is approximately shown outlined in red in **Figure 2.1**.

2.2 The current site comprises of greenfield land, with a caravan located in the northwest of the site. Holmes Lane bounds the east of the site and Vicarage Farm is located to the north of the site. Greenfield land is located to the west and south of the site.



(Source: Promap)

Figure 2.1 Site Location

Topography

2.3 A detailed topographic survey was carried out during July 2023, a copy of which is included within **Appendix B**. Ground levels on the site fall in a westerly direction from 78.53 metres Above Ordnance Datum (mAOD) to 77.05mAOD located in the west of the site.

Ground Conditions

2.4 Geological data held by the British Geological Survey (BGS)[3] shows that the bedrock geology underlying the site is Branscombe Mudstone Formation (mudstone). No superficial deposits are recorded at the site.

2.5 Soilscapes mapping[4] indicates the underlying soil as slowly permeable, seasonally wet, slightly acidic but base rich, loamy and clayey soils with impeded drainage.

2.6 Department for Environment, Food & Rural Affairs (DEFRA) Magic Service Mapping[5] shows the site is not located in a groundwater Source Protection Zone (SPZ).

Existing Drainage & Hydrology

2.7 An unnamed ordinary watercourse runs along the west of the site, and continues north to the Worcester and Birmingham Canal, located approximately 1.7km northwest of the site. This waterbody issues from the pond located to the south of the site as shown on **Figure 2.1**.

2.8 The River Salwarpe (main river) is located approximately 2.5km northwest of the site. There are no other major watercourses located within the vicinity of the site.

2.9 Severn Trent Water asset plans show that there are no public sewer assets located within the vicinity of the site.

2.10 Severn Trent Water sewer records are contained in **Appendix C**.

2.11 The DEFRA Magic Map (England and Wales) shows there are no designated sites (SSSIs) in or close to the site including downstream (from a flood risk and drainage perspective).

3 https://geologyviewer.bgs.ac.uk/
4 http://www.landis.org.uk/soilscapes/
5 https://magic.defra.gov.uk/MagicMap.aspx

3 Development Vulnerability & Flood Zone Classification

National Planning Policy Framework

3.1 Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency, (EA) on all applications in flood risk zones. The EA will consider the effects of flood risk in accordance with the NPPF.

3.2 NPPF requires that, as part of the planning process:

a) A 'site specific' Flood Risk Assessment will be undertaken for any site that has a flood risk potential.
b) Flood risk potential is minimised by applying a 'sequential approach' to locating 'vulnerable' land uses.
c) Sustainable drainage systems are used for surface water disposal where practical.
d) Flood risk is managed through the use of flood resilient and resistant techniques.
e) Residual risk is identified and safely managed.

3.3 Table 1 of NPPF, categorises flood zones into:

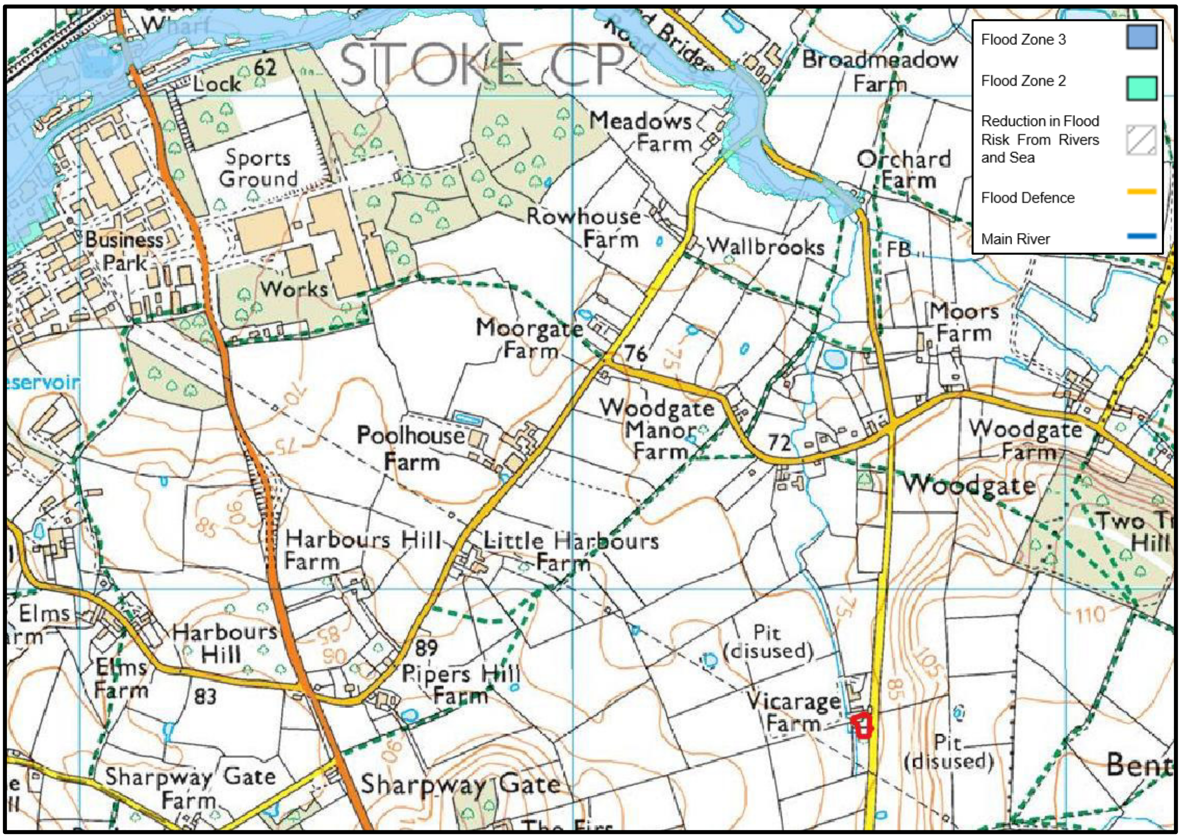
a) Zone 1- Low risk, less than 0.1% Annual Event Probability (AEP) (< 1 in 1000 years)
b) Zone 2- Medium risk, 0.1% AEP (1 in 1000 - 1 in 100 years)
c) Zone 3a- High risk, 1% AEP (> 1 in 100 years)
d) Zone 3b- High risk - Functional Floodplain, 3.33% AEP (>1 in 30 years)

Environment Agency Flood Map for Planning

3.4 The Environment Agency Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, since these can be breached, overtopped and may not be in existence for the lifetime of a development.

3.5 The site is located within Flood Zone 1 as shown on the Environment Agency Flood Map for Planning[6] and **Figure 3.1**. This is the area shown to be at low risk of river flooding.

[6] https://flood-map-for-planning.service.gov.uk/



(Source: Environment Agency)

Figure 3.1 Environment Agency Flood Map for Planning

Flood Risk Vulnerability

3.6 The proposed development is considered to be 'more vulnerable' in terms of its land use type flood risk vulnerability as shown in Annex 3 of the PPG[7].

3.7 The NPPF sets out a matrix indicating the flood risk vulnerability types of development that are acceptable in different flood zones based upon the Flood Map for Planning as shown in Table 2 of the PPG. All forms of development are considered acceptable in Flood Zone 1. An exception test is not required.

[7] https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables

4 Site Specific Flooding

National Planning Policy Framework (NPPF)

4.1 In accordance with the National Planning Policy Framework, this Flood Risk Assessment considers all sources of flooding including:

a) Tidal flooding – from sea;
b) Fluvial flooding – from rivers and streams;
c) Pluvial flooding – overland surface water flow and exceedance;
d) Groundwater flooding – from elevated groundwater levels or springs;
e) Flooding from sewers – exceedance flows from existing sewer systems; and
f) Artificial sources – reservoirs, canals etc.

Historic Flooding

4.2 The Worcestershire Councils SFRA (2018)[8] states that there are two properties at risk of flooding in the 'B60 4' postcode; however, there have been no recorded incidents of flooding at the site or within its direct vicinity. It is outlined that much of South Worcestershire at risk of surface water flooding, however no previous incidents of this at the site have been outlined.

4.3 Furthermore, the EA Recorded Flood Outlines mapping shows that there have been no incidents of flooding within the site or its direct vicinity.

Tidal Flooding

4.4 Inundation of low lying coastal areas by the sea may be caused by seasonal high tides, storm surges and storm driven wave action. Tidal flooding is most commonly a result of a combination of two or more of these mechanisms, which can result in the overtopping or breaching of sea defences. River systems may also be subject to tidal influences.

4.5 There are no watercourses/waterbodies in the vicinity of the site that pose a tidal risk to the site. The risk of tidal flooding is therefore negligible.

Fluvial Flooding

4.6 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

4.7 The site is located within Flood Zone 1 as shown on **Figure 3.1**. This is the area shown to be at low risk of river flooding.

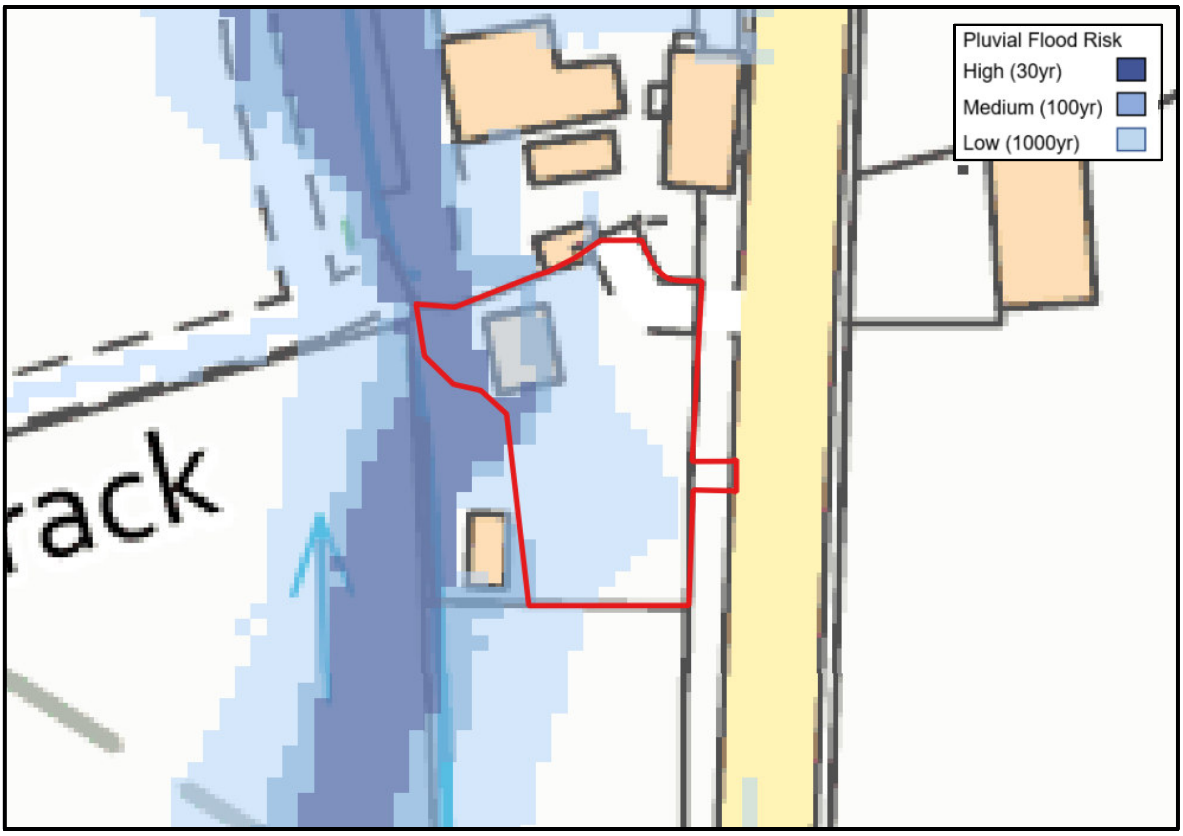
8 https://www.swdevelopmentplan.org/component/fileman/file/Documents/South%20Worcestershire%20Development%20Plan/SWDP%20Review/Evidence%20Base/SFRA/SFRA-Level-1-Final-Report-South-Worcestershire-Councils.pdf?routed=1&container=fileman-files

Pluvial Flooding

4.8 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.

4.9 Risk of flooding from surface water mapping has been prepared[9], this shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.

4.10 The Surface Water (Pluvial) Flood map provided by the Environment Agency (**Figure 4.1**) indicates that the site is at low to high risk of pluvial flooding. The area at risk is associated with the stream bypassing the western boundary of the site and the low point in topography this represents.

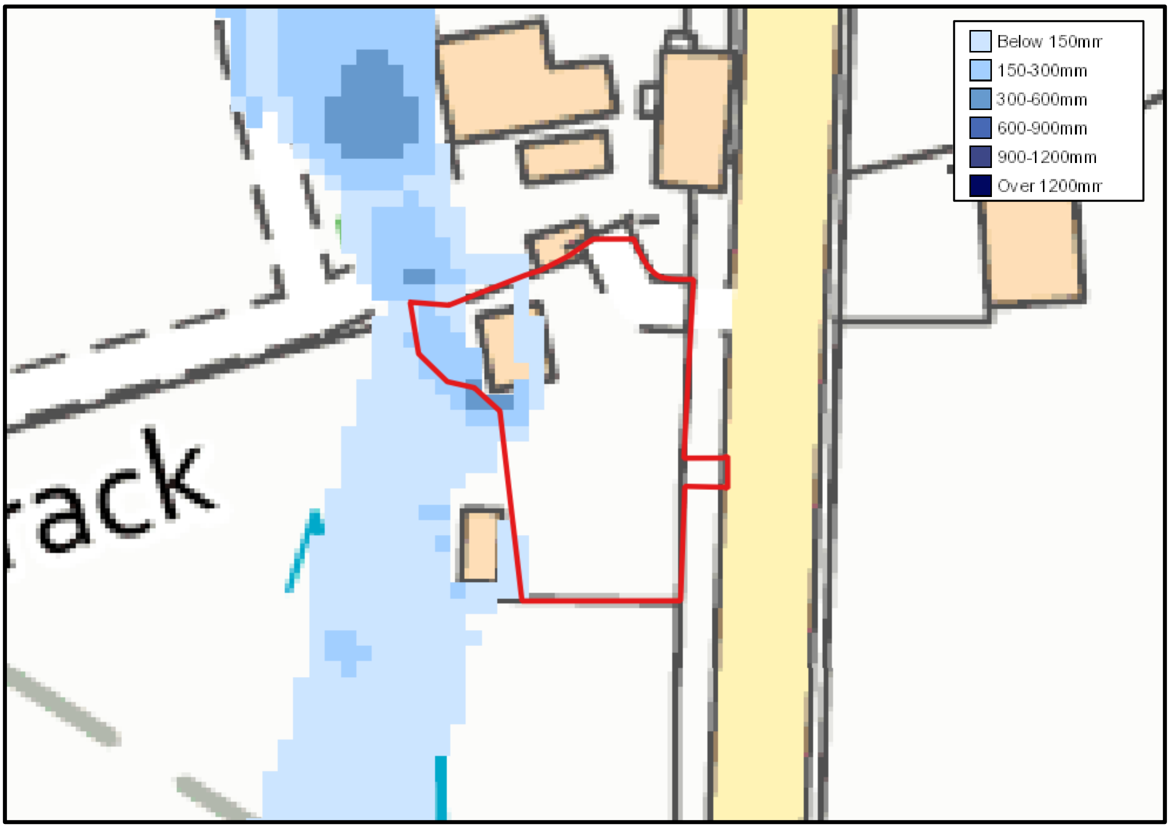


(Source: Environment Agency)

Figure 4.1 Pluvial Flood Map

4.11 **Figure 4.2** illustrates the pluvial flood depths that could be reached at the site in the design pluvial event, the 1 in 100-year storm. This shows that the flood depths that could be experienced at the site are mostly less than 150mm in depth, with areas at depths of 150-300mm. Pluvial flood depths of 300-600mm are shown to affect a minor area in the west of the site.

[9] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map



(Source: Environment Agency)

Figure 4.2 Design Event Pluvial Flood Depths

4.12 Pluvial flood risk for the proposed development is considered to be low to high.

Groundwater Flooding

4.13 Groundwater flooding occurs when the water table rises above ground elevations. It is most likely to happen in low lying areas underlain by permeable geology. This may be regional scale chalk or sandstone aquifers, or localised deposits of sands and gravels underlain by less permeable strata such as that in a river valley.

4.14 BGS data shows that the bedrock geology underlying the site is Branscombe Mudstone Formation (mudstone). No superficial deposits are recorded at the site.

4.15 The SFRA indicates that most of South Worcestershire is at less than 25% risk of groundwater emergence. Areas of high risk are said to be associated with the main rivers. Little further detail is available on the site area.

4.16 The risk of flooding from groundwater at this stage is considered to be low.

Sewer Flooding

4.17 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

4.18 Severn Trent Water records show that there are no sewers located within the vicinity of the site.

4.19 The risk of sewer flooding to the site is therefore considered to be negligible.

Flooding from Artificial Sources

Reservoirs

4.20 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.

4.21 To help identify this risk, reservoir failure flood risk mapping has been prepared[10], this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide. This identifies the site isn't at risk from this source.

4.22 The "dry day" mapping shows reservoir flooding extents in the event that they fail and release their water held on a day when local rivers are at normal levels. The "wet day" mapping shows flooding which would occur in the same situation as "dry day", but local river levels have exceeded their banks.

4.23 The "Reservoir Flood Extents – Fluvial Contribution" shows the extent of flooding when river flooding is added to the reservoir model during the flooding, rather than following the reservoir flooding occurring and flooding the rivers which have already exceeded their banks as in the "wet day" scenario.

4.24 The mapping identifies the site isn't at risk from this source when river levels are normal and an isolated reservoir flooding event occurs. In a worst-case scenario, which the Environment Agency advise is unlikely, where a reservoir breach takes place coinciding with a fluvial flood event the site would not be inundated.

4.25 The development is considered to be at negligible risk of flooding from reservoirs.

Canals

4.26 The site is located approximately 1.7km southeast of the Worcester and Birmingham Canal. The canal is a waterbody maintained by the Canal and River Trust (CRT) and they are generally responsible for maintaining water levels within this canal system using reservoirs, feeders and boreholes and manages water levels by transferring it within the canal system.

4.27 Water in a canal is typically maintained at predetermined levels by control weirs. When rainfall or other water enters the canal, the water level rises and flows out over the weir. If the level continues rising it will reach the level of the storm weirs. The control weirs and storm weirs are normally designed to take the water that legally enters the canal under normal conditions. However, it is possible for unexpected water to enter the canal or for the weirs to become obstructed. In such instances the increased water levels could result in water overtopping the towpath and flowing onto the surrounding land.

[10] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

4.28 Flooding can also occur where a canal is impounded above surrounding ground levels, and the retaining structure fails.

4.29 The SFRA indicates that a breach of this canal occurred in 2008 at Shernal Green as well as three incidents of overtopping in 2007 and twice in 2012, however these did not affect the site or land within its vicinity.

4.30 The development is considered to be at low risk of flooding from canals.

5 Flood Mitigation Measures

Introduction

5.1 It is important to demonstrate that future users will not be at risk from flood hazards during the lifetime of the development, as well as ensuring that flood risk is not increased elsewhere.

Assessment Findings & Implications

5.2 The assessment undertaken has confirmed that the site is located within Flood Zone 1 on the Environment Agency Flood Map for Planning. This the area at low risk of fluvial flooding and where all forms of development are considered acceptable.

5.3 The site is at low to high risk of pluvial flooding and is at low risk of all other sources of flooding.

5.4 No records of flooding affecting the site have been obtained on research.

5.5 The location of the proposed dwelling will replace the caravan and the position of the caravan. This will mean there is no alteration to the passage of indicative surface water flooding or new obstruction.

Finished Floor Levels (FFLs)

5.6 It is recommended that FFLs be set a minimum of 150-300mm above the proposed ground levels to provide protection against flooding from surface water runoff.

Ground Levels

5.7 Ground levels should be profiled to remove hollows/depressions within the site topography and the area of potential risk of pluvial flooding.

5.8 Ground levels should be finished so that overland runoff is encouraged to flow away from the proposed new buildings and be directed to the nearest on site drainage system runoff collection point.

Access & Egress

5.9 Safe pedestrian access/egress is available onto Holmes Lane in order to access the wider road/street network to the east of the site.

Groundwater

5.10 The potential for shallow groundwater should also be considered during the construction phase of the development, particularly during the excavations. It is recommended that groundwater levels are monitored during the construction phase, and where groundwater is encountered appropriate dewatering should be employed.

Drainage

5.11 To mitigate the proposed developments impact on the current runoff regime through the increased rate of runoff that would result due to the impermeable areas to be introduced; it is proposed to incorporate surface water attenuation and storage as part of the development proposals. The proposed drainage strategy is discussed in Section 6.

6 Proposed Drainage Strategy

Introduction

6.1 Consideration of flood issues is not confined to the floodplain. This is recognised in the NPPF and associated guidance. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in a catchment, particularly flooding downstream; and replacing permeable vegetated areas with low permeability roofs, roads and other paved areas will increase the speed, volume and peak flow of surface water runoff.

6.2 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volume and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.

6.3 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the site and is discussed below.

Existing Drainage

6.4 The current site is a greenfield plot of land with a caravan located in the northwest, considered to drain via natural infiltration at existing greenfield rates of runoff to the watercourse.

6.5 The existing greenfield runoff rates have been calculated using the MicroDrainage and the Interim Code of Practice (ICP) SuDs method. The resulting calculations are included within **Appendix D**. The runoff rates were calculated as follows in **Table 6.1**:

Return Period (Yrs)	Runoff Rate (l/s)
1	0.0
30	0.0
100	0.1
QBAR	**0.0**

Table 6.1 QBAR

Surface Water Management

6.6 Sustainable drainage system measures (SuDS) should be used to control the surface water runoff from the proposed development site, thereby managing the flood risk to the site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the site.

6.7 The SuDS hierarchy demands that surface water run off should be disposed of as high up the following list as practically possible:

a) Into the ground (infiltration) and re-use, or then;
b) To a surface water body, or then;
c) To a surface water sewer, highway drain or another drainage system, or then;
d) To a combined sewer.

Infiltration Testing

6.8 Based on the geology shown to be underlying the site in the BGS online mapping, it is assumed that infiltration would not provide viable means of surface water discharge. Infiltration testing has not been undertaken at this stage.

6.9 Infiltration testing should be carried out in accordance with BRE 365 before ruling out this option of disposal. If infiltration is deemed viable as a result of this testing, infiltration should be considered at the detailed design phase.

6.10 The surface water strategy has been designed to account for a 'worst-case' scenario of infiltration not being deemed suitable. In accordance with the SuDS hierarchy, discharge to a watercourse should be considered next. The watercourse to the west of the site provides a suitable option to discharge to.

Proposed Drainage

6.11 The introduction of hardstanding associated with the proposed development will introduce an impermeable area of approximately 61m^2 (0.006ha), which will increase the amount of runoff generated and could increase flood risk elsewhere unless managed to LLFA/IDB drainage requirements. The impermeable area increases to approximately 0.007ha when an additional 10% of impermeable area is included to account for urban creep.

6.12 The drainage strategy includes the proposed use of new surface water sewers directing surface water from the proposed development into a below-ground geocellular online attenuation crate system, where a Hydro-brake chamber would then control the flow of discharge to the watercourse. This is subject to land drainage consent.

6.13 It is proposed to introduce a new gravity stormwater system with attenuation and a controlled discharge for up to a 1 in 100 year event plus 40% climate change allowance, which will reduce risk of flooding downstream.

6.14 QBAR was indicated to be 0.0l/s, however it is unrealistic to suggest there is no runoff rate. Therefore, given the site area, the overall discharge rate from site will be restricted to 0.2l/s for all storm return periods. This is the lowest feasible discharge rate achievable by commercially available flow control devices.

6.15 It should be noted that low discharge rates such as this can increase blockage risk due to the small orifices required. It is therefore recommended that suitable mitigation is incorporated to try to reduce and manage blockage risk.

6.16 Permeable paving is recommended for the driveway to prevent silt and debris entering the system. Similarly, any downpipes, gullies and inspection chambers are to have suitable silt traps and/or catchpits incorporated.

6.17 Should it be deemed necessary, a suitable mesh guard can be incorporated over the flow control device within the control chamber.

6.18 To demonstrate that the necessary storage volumes can be accommodated on the site an illustrative drainage layout has been prepared and has been included as **Appendix E**. Supporting drainage calculations are included in **Appendix D**.

6.19 The final layout and design of the surface water drainage network will be determined at the detailed design stage as the development masterplan evolves.

Exceedance Events

6.20 The crate system will be designed with a capacity up to a 1 in 100-year (plus 40% climate change) event, based on the 0.2l/s restricted discharge rate. This provides a betterment (reduction) in runoff when compared to existing undeveloped conditions, where runoff is uncontrolled across all return periods.

6.21 A storm event in excess of this design standard would be extreme and would cause the crate system to backup (with no sudden deluge) and would then shed overland following the topography of the site, as per existing conditions.

6.22 Finished floor levels of the new dwelling will be set above external levels, which will mitigate the residual risk of overtopping.

Water Quality

6.23 The SuDS Manual (CIRIA C753) states that the design of surface water drainage should consider minimising contaminants in surface water runoff discharged from the site. The level of treatment required depends on the proposed land use, according to the pollution hazard indices. For this site contaminant risks come from the residential roofing and parking.

6.24 To ensure that adequate treatment is provided the SuDS mitigation indices for the development must be equal to, or exceed, the pollution hazard indices. Surface water runoff from residential roofs is considered to present a **very low** hazard to water quality, whilst general residential parking presents a **low** hazard.

6.25 To ensure a suitable mitigation index is achieved the affected stormwater system has been assessed. **Table 6.2** indicates satisfactory water quality is achieved.

6.26 It is also recommended, as good practice, that gullies and chambers have suitable silt traps/catchpits to reduce sediments entering the system.

6.27 Additionally, for further water quality benefits, the attenuation crates could be designed to allow infiltration to a lined 300mm bed of gravel before draining to the flow control device via perforated pipes.

		Pollution Hazard Level	Total suspended solids	Metals	Hydro-carbons
Land Use	**Residential Parking**	**Low**	**0.5**	**0.4**	**0.4**
Total			**0.5**	**0.4**	**0.4**
SuDS Component	**Pervious Pavement - To be proposed for parking space**		**0.7**	**0.6**	**0.7**
Total			**0.7**	**0.6**	**0.7**
Total SuDS Mitigation Indices ≥ Pollution Hazard Indices			**Yes**	**Yes**	**Yes**

(As per C753 The SuDS Manual)

Table 6.2 Water Quality Indices

Water Reuse

6.28 The proposed development provides an opportunity to reuse surface water throughout the provision of rainwater harvesting products.

6.29 Rainwater butts should be provided at suitable locations where feasible, to reduce the volume of water entering the underground drainage system and the demand on the water supply network.

6.30 Harvested rainwater may be used for garden watering and other applications where a pressurised hose connection is not required. Stored rainwater also provides a source of clean water when hosepipe bans are in effect.

Foul Water Management

6.31 Foul water from the proposed development shall be collected through a traditional gravity drainage system and directed to a proposed package treatment plant in the west of the site. This will provide primary and secondary wastewater treatment and will conform to BS EN 12566-3. The private foul package treatment plant shall be sized to accommodate the capacity required by the proposed development.

6.32 The treated water from the plant will then by discharged to the watercourse to the west of the site. This is subject to land drainage consent.

Maintenance Regime

6.33 Maintenance of SuDS features are essential to ensure that the surface water drainage system operates effectively and that flooding of the site and surrounding areas is prevented.

6.34 The responsibility of maintaining the private surface water and foul water drainage components would lie with the landowner of the site, who may delegate responsibility to an appointed external private management company.

6.35 A full maintenance regime should be carried out to ensure that the drainage system remains operational over its lifetime. **Table 6.3** summarises an initial maintenance plan for the drainage components proposed within the development. The SuDS Manual (CIRIA C753) and manufacturer's guidelines should be referred to for further maintenance information.

Drainage Component	Required Action	Typical Frequency
Pipework, manholes, flow control chambers, catch pits and silt traps	Stabilise adjacent areas	As required
	Remove weeds	As required
	Clear any poor performing structures.	As required
	Inspect all structures for poor operation	Three monthly, 48 hours after large storms in first six months
	Monitor inspection chambers. Inspect silt accumulation rates and determine silt clearance frequencies	Annually
Attenuation Tank	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
	Inspect inlets, outlets, banksides, structures, Repair/rehabilitate inlets, outlet, overflows and vents	As Required
	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.
Permeable Paving	Brushing and vacuuming	Once a year or as required
	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required.
	Inspect for evidence of poor operation and/or weed growth	3 monthly, 48 hours after large storms in first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

(As per C753 The SuDS Manual)

Table 6.3 Initial Operation and Maintenance Plan

7 Summary and Conclusions

Summary

7.1 This assessment has considered the risks of all types of flooding to the site including tidal, fluvial, surface, groundwater, sewer and artificial sources and provides mitigation measures to ensure that the flood risk to the site is minimised and that flood risk off-site is not increased.

Conclusions

7.2 The site is located within Flood Zone 1, as evidenced by the Environment Agency Flood Map for Planning. This is at low risk of fluvial flooding and is the area in which all forms of development are deemed acceptable.

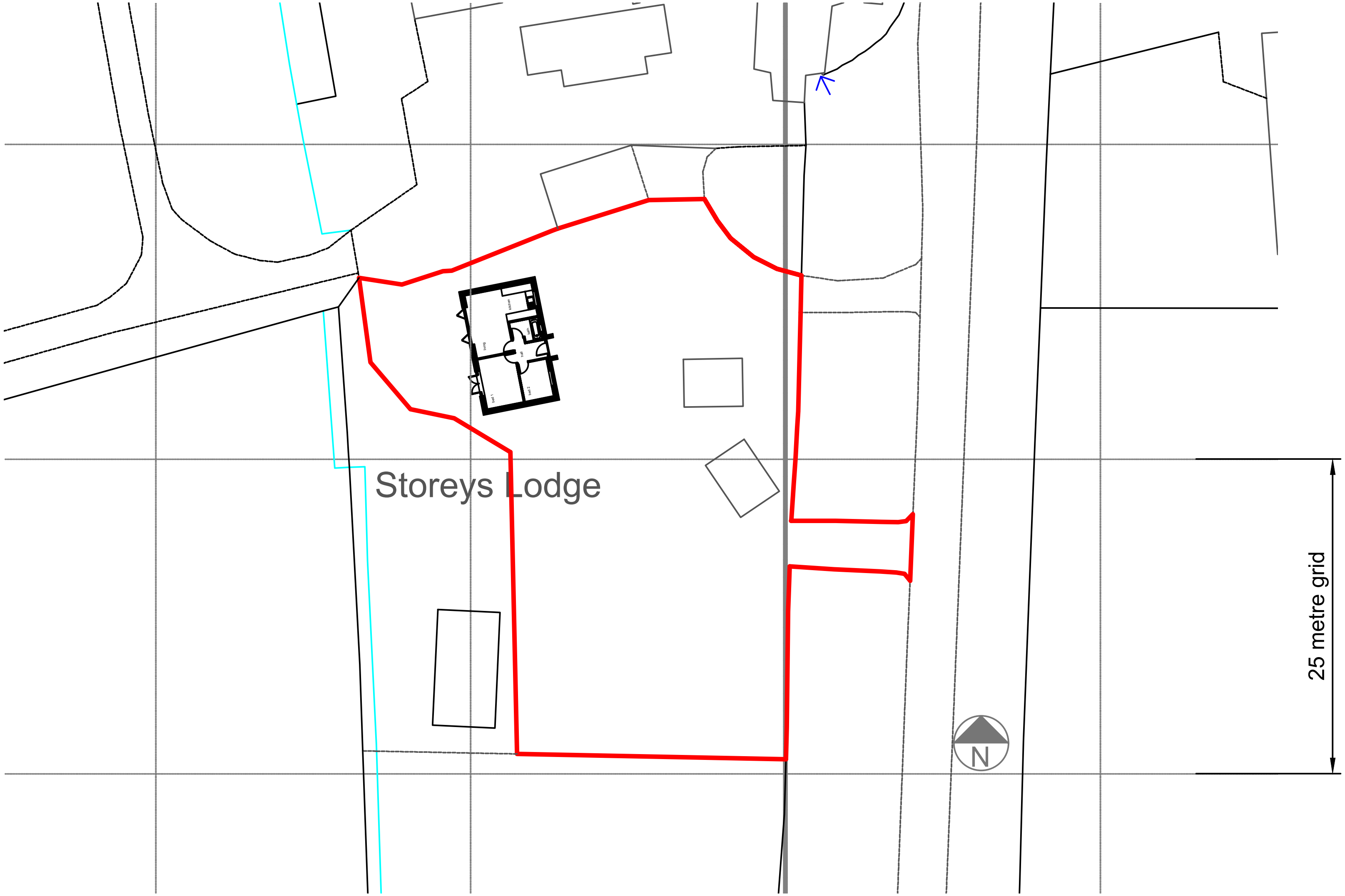
7.3 The site is at low to high risk of pluvial flooding and is at low risk of all other forms of flooding.

7.4 Profiled ground levels and raised finished floor levels of the proposed dwelling will protect it from any further risk.

7.5 Surface water drainage from the site is to be controlled through the use of proposed new surface water sewers to direct runoff to a below-ground geocellular online attenuation crate system. A Hydro-brake chamber would then control the flow of discharge to the watercourse. The discharge rate from site will be restricted to 0.2l/s.

7.6 In compliance with the requirements of the National Planning Policy Framework, and subject to the mitigation measures proposed, the development will not cause or be subject to significant flood risk issues.

Appendix A – Proposed Development Drawings

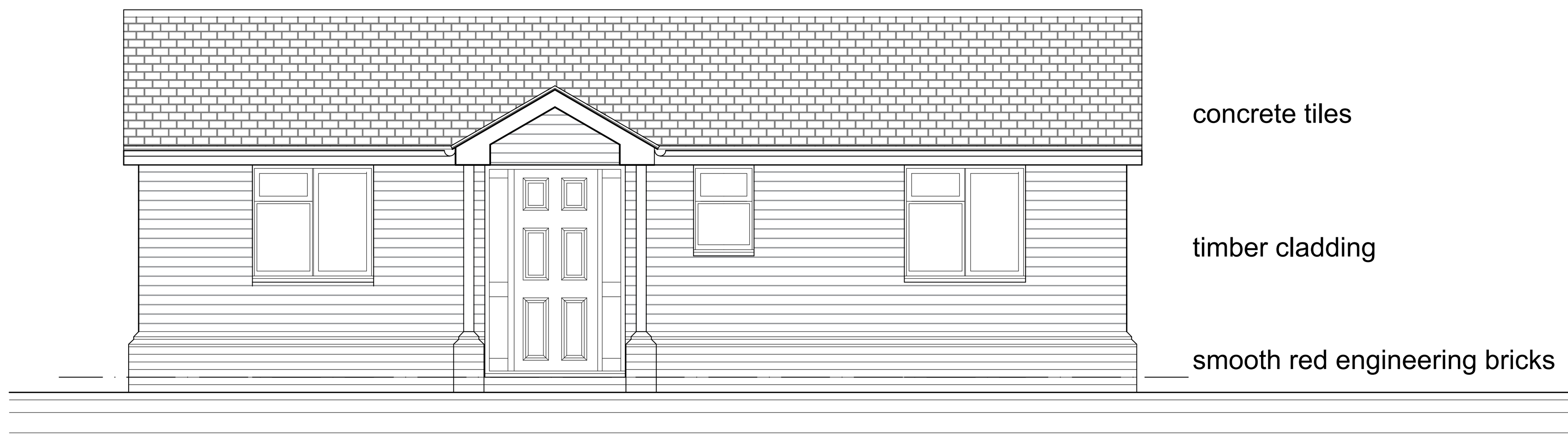


existing site plan 1:500

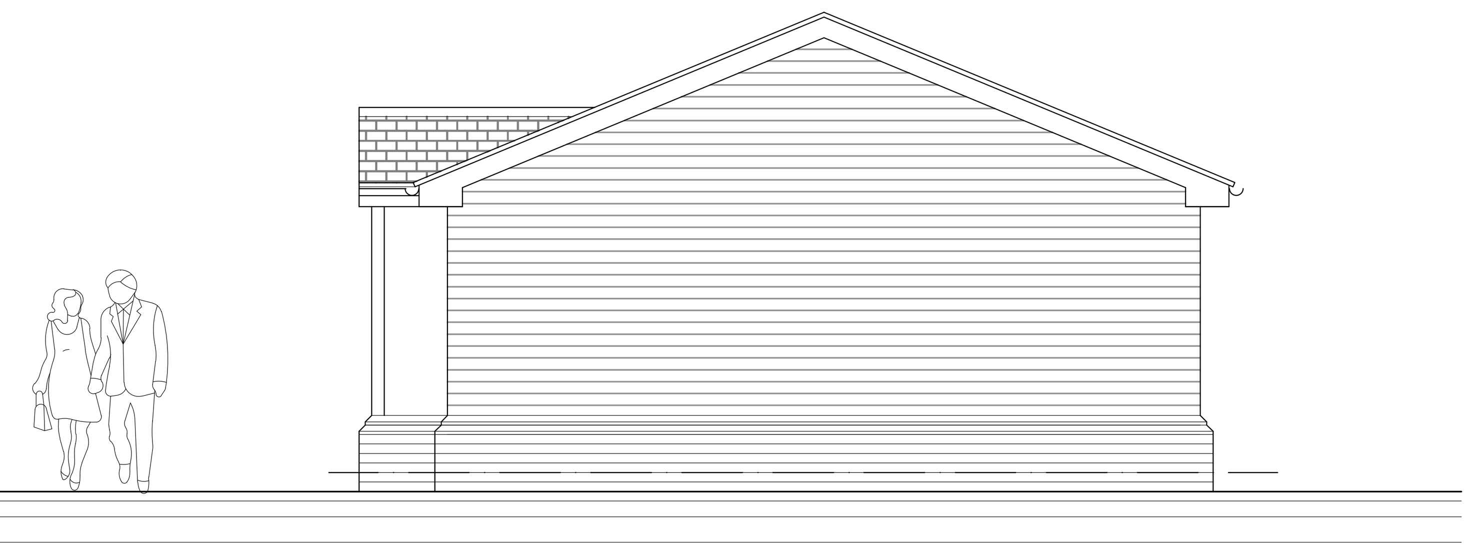
SCALE	DATE	Media	
1:500	June 2023	A4	

DRAWING No.

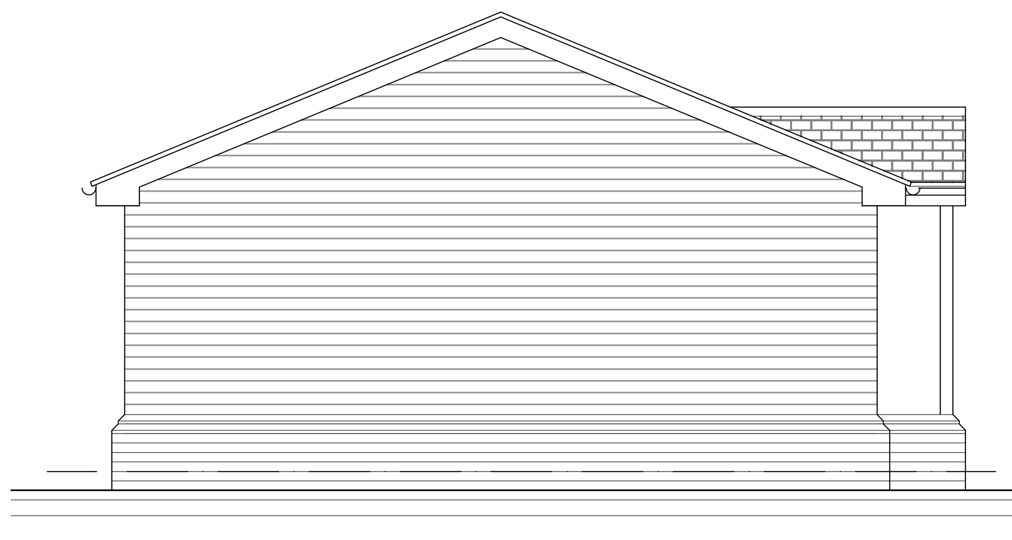
Storeys Lodge, Holmes Lane B60 4HQ
PROPOSED SITE PLAN



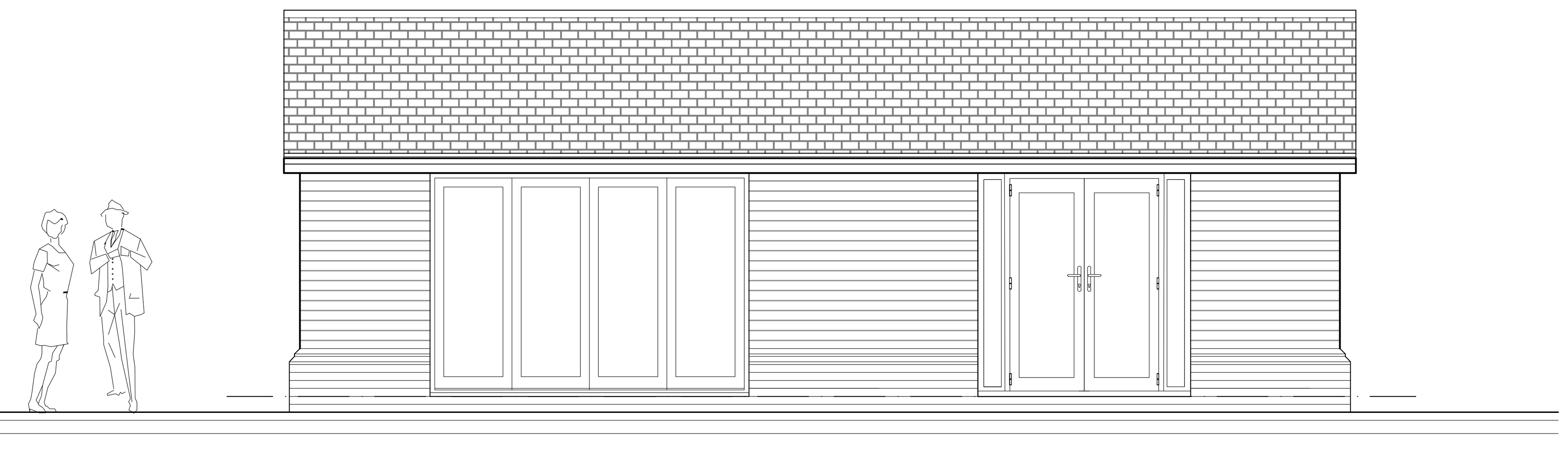
front elevation



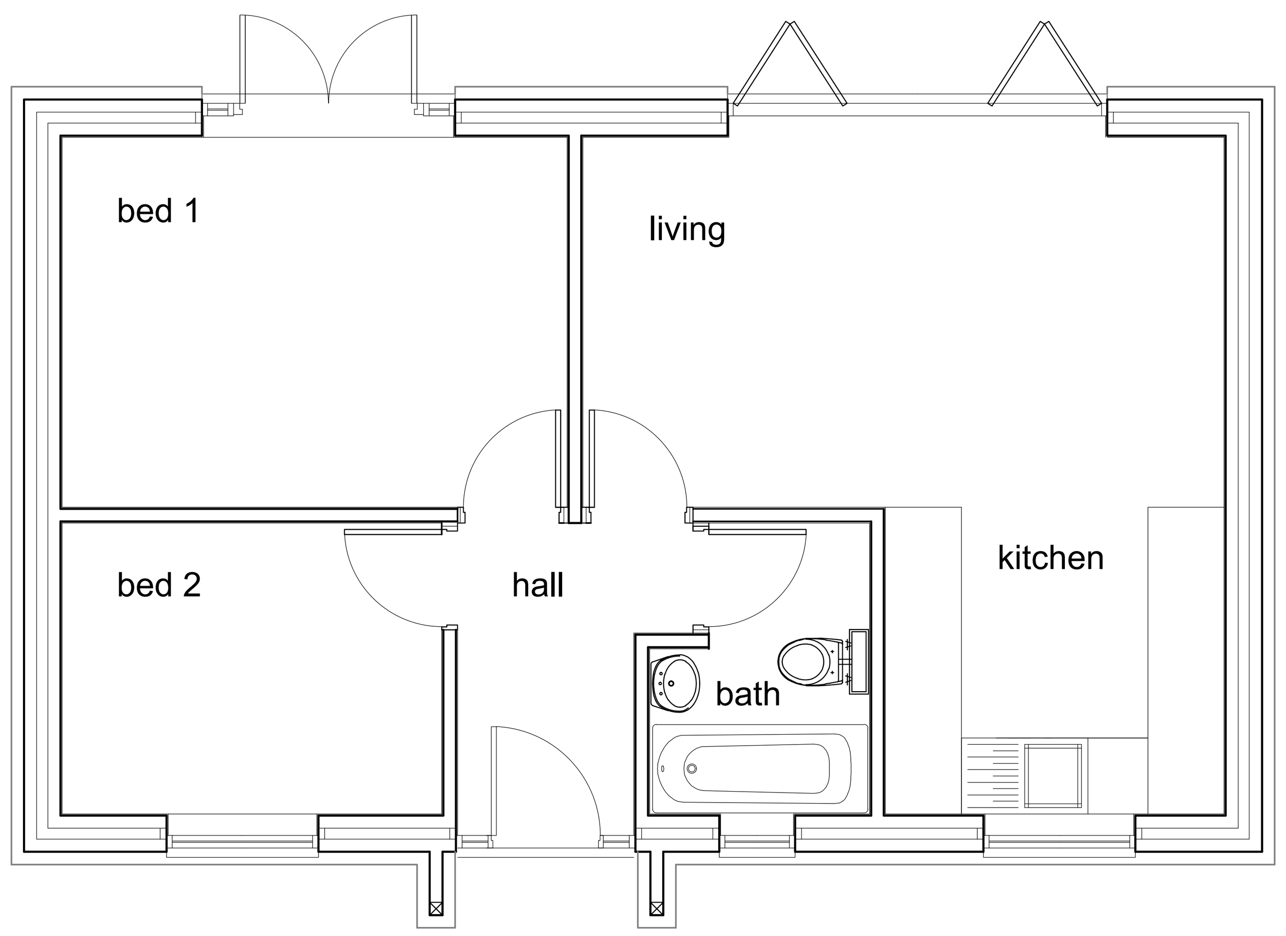
side elevation



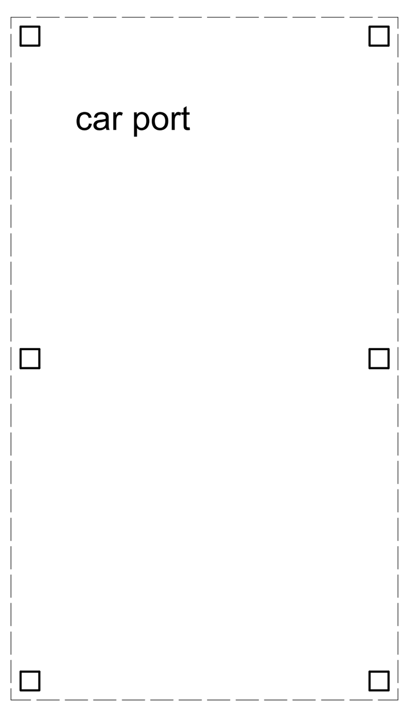
side elevation



rear elevation



floor plan



scale bar:

METRES 0 1 2 3 4 5 6 7 8 9 10

scale bar:

METRES 0 1 2 3 4 5 6 7 8 9 10

site plan scale 1:200

Job:
Storey Lodge,
Holmes Lane,
Hanbury, Worcs.

Client:
Fisher German

Title:
Plans and elevations:
as proposed

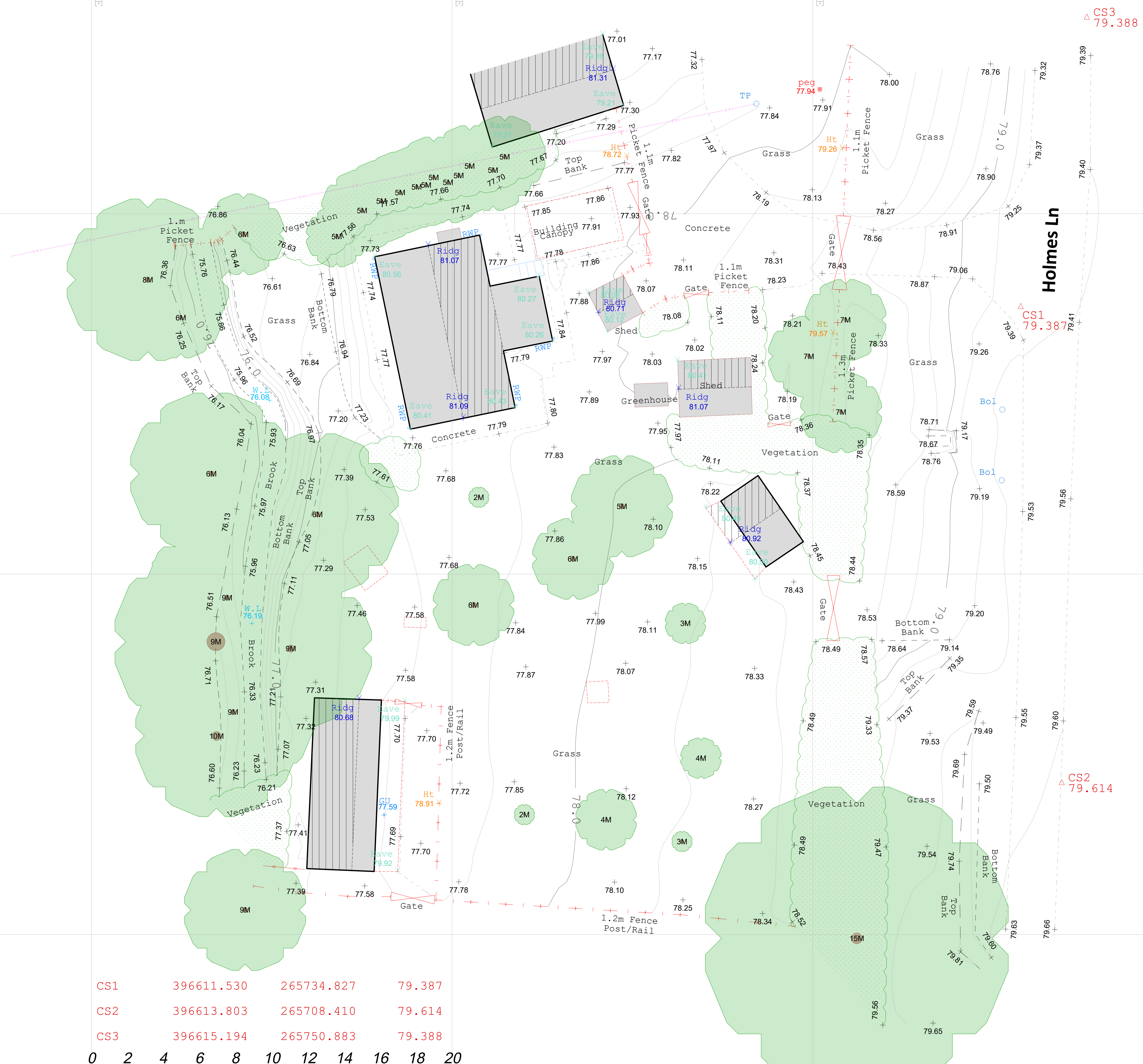
PURVIS DAWES & PARTNERS LTD
BUILDING DESIGN AND PROJECT MANAGEMENT
178a Lower High Street Stourbridge DY8 1TG
Tel: 01384 905058 e: enquiries@pdp-ltd.co.uk

Scale: 1:50 on A1

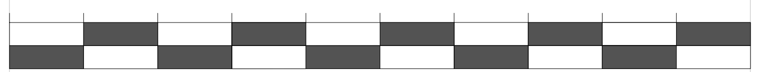
Date: July 2023

Drawing No.
2382–2b

Appendix B – Topographical Survey



CS1	396611.530	265734.827	79.387
CS2	396613.803	265708.410	79.614
CS3	396615.194	265750.883	79.388



Scale Bar m

Floor Plan Legend:

- Window Cill & Head Height — SHI: Sill Height From FFL, HHI: Head Height From FFL
- Door Height From FFL
- Overhead Detail
- Stairs/Step
- Radiator
- Ventilation / Overhead
- Access Hatch
- TV Point
- Phone Point
- 13A Power Socket
- Fused Socket
- Shaver Socket
- Extractor Fan
- Lantern Light
- Down Light
- Light Dimmer Switch
- Light Switch
- Fixed Lighting
- Fire Alarm Button
- Fire Extinguisher
- Reception — Room Name
- Carpet — Floor Covering
- 2.49 — Ceiling Height
- IFL 145.80 — Internal Floor Level

Topographic Legend:

- Buildings / Walls
- Building Canopy / Overhang
- Concrete edge
- Kerb line
- Centre Line
- Barrier
- Hedge
- Security Fence
- Panel Fence
- Gate
- Overhead Line
- Tree / Sapling
- Tree Canopy Line
- Chambers
- Survey Station & Name
- Bench Mark
- Temporary Bench Mark
- Cover level
- Invert level
- Pipe invert (diameter)
- Gully
- Manhole
- Inspection chamber

THE SURVEY ASSOCIATION

CASTLE SURVEYS LTD

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Info@castlesurveys.co.uk
WWW.CASTLESURVEYS.CO.UK

SCANNING · BUILDING INFORMATION MODELLING · SITE ENGINEERING & SETTING OUT · UNDERGROUND UTILITY · DRAINAGE CCTV SURVEYS & REPORTS · QUALITY ASSURANCE SURVEYS & REPORTS · DIGITAL TWIN SURVEYS · DRONE SURVEYS & INSPECTION · ACCURATE VERIFIED VIEW SURVEYS · SCAN TO BIM

SITE DETAILS: Story Lodge, Holmes Lane Hanbury

TITLE: Topographical

DRAWING NO.: 23452-23-01

REV: -

SCALE: 1: 200

DATE: 25/07/2023

DRAWN: GT

CHECKED:

LEVEL DATUM: OSGB36(15)

Paper Size - A2

Comments:

This plan should only be used for its original purpose. Castle Surveys Ltd dos not accept any responsibility for this plan if supplied to any other party, other than the original client.

All dimensions and levels should be check on site prior to design and construction.

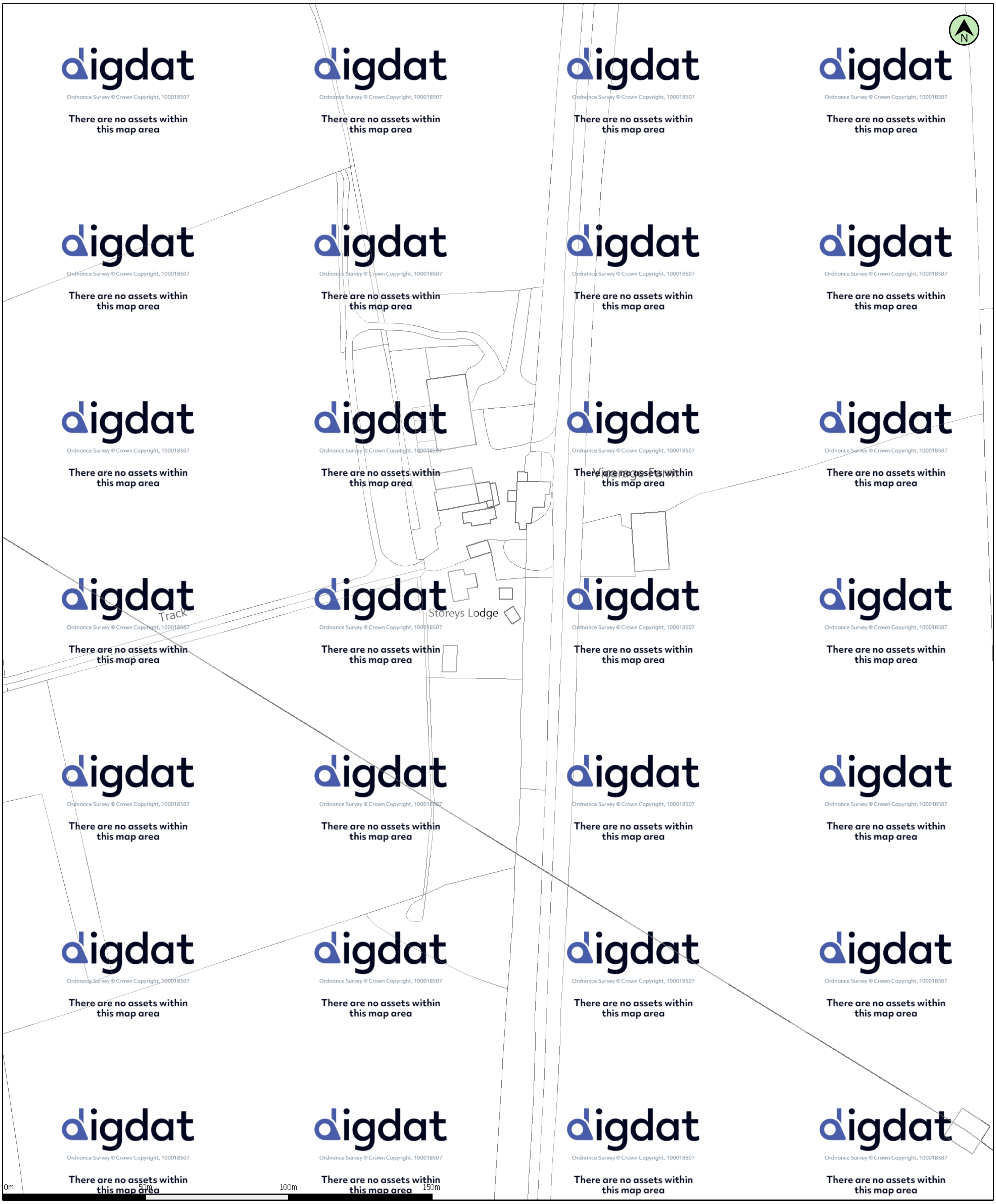
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only. Some services may have been omitted due to parked vehicles or due to the site being overgrown with vegetation.

Tree information (where applicable) has been surveyed from ground level and therefore should be treated as approximate only. Advise that a tree survey should be carried out.

Roof linework (where applicable) is indicative only.

DO NOT SCALE

Appendix C – Sewer Records



Data updated: 14/09/23	Scale: 1:1250	Date: 02/10/23	Wastewater Plan A3
	Map Centre: 396592,265728	Our Ref: 1286115 - 1	Powered by digdat

Public Foul Gravity/Lateral Drain	Highway Drain	Manhole Foul
Public Combined Gravity/Lateral Drain	Overflow Pipe	Manhole Surface
Public Surface Water Gravity/Lateral Drain	Disposal Pipe	Abandoned Pipe
Pressure Foul	Culverted Water Course	Chamber
Pressure Combined	Pumping Station	Section 104 sewers are shown in green
Pressure Surface Water	Fitting	Private sewers are shown in magenta

infadmin@rappor.co.uk

Storeys Lodge

SEVERN TRENT

Appendix D – Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.006	Urban	0.000
SAAR (mm)	674	Region Number	Region 4

Results	**l/s**
QBAR Rural	0.0
QBAR Urban	0.0
Q100 years	0.1
Q1 year	0.0
Q30 years	0.0
Q100 years	0.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 139 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	76.619	0.219	0.0	0.2	0.2	1.6	O K
30 min Summer	76.675	0.275	0.0	0.2	0.2	2.0	O K
60 min Summer	76.714	0.314	0.0	0.2	0.2	2.2	O K
120 min Summer	76.717	0.317	0.0	0.2	0.2	2.3	O K
180 min Summer	76.705	0.305	0.0	0.2	0.2	2.2	O K
240 min Summer	76.692	0.292	0.0	0.2	0.2	2.1	O K
360 min Summer	76.667	0.267	0.0	0.2	0.2	1.9	O K
480 min Summer	76.644	0.244	0.0	0.2	0.2	1.7	O K
600 min Summer	76.622	0.222	0.0	0.2	0.2	1.6	O K
720 min Summer	76.600	0.200	0.0	0.2	0.2	1.4	O K
960 min Summer	76.554	0.154	0.0	0.2	0.2	1.1	O K
1440 min Summer	76.479	0.079	0.0	0.2	0.2	0.6	O K
2160 min Summer	76.420	0.020	0.0	0.2	0.2	0.1	O K
2880 min Summer	76.400	0.000	0.0	0.2	0.2	0.0	O K
4320 min Summer	76.400	0.000	0.0	0.1	0.1	0.0	O K
5760 min Summer	76.400	0.000	0.0	0.1	0.1	0.0	O K
7200 min Summer	76.400	0.000	0.0	0.1	0.1	0.0	O K
8640 min Summer	76.400	0.000	0.0	0.1	0.1	0.0	O K
10080 min Summer	76.400	0.000	0.0	0.1	0.1	0.0	O K
15 min Winter	76.649	0.249	0.0	0.2	0.2	1.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.106	0.0	1.7	18
30 min Summer	86.802	0.0	2.3	32
60 min Summer	54.368	0.0	2.8	62
120 min Summer	32.929	0.0	3.4	108
180 min Summer	24.243	0.0	3.8	140
240 min Summer	19.399	0.0	4.1	172
360 min Summer	14.081	0.0	4.4	242
480 min Summer	11.225	0.0	4.7	310
600 min Summer	9.408	0.0	4.9	380
720 min Summer	8.140	0.0	5.1	448
960 min Summer	6.474	0.0	5.4	578
1440 min Summer	4.680	0.0	5.9	808
2160 min Summer	3.378	0.0	6.4	1128
2880 min Summer	2.678	0.0	6.7	0
4320 min Summer	1.927	0.0	7.3	0
5760 min Summer	1.525	0.0	7.7	0
7200 min Summer	1.271	0.0	8.0	0
8640 min Summer	1.095	0.0	8.3	0
10080 min Summer	0.965	0.0	8.5	0
15 min Winter	132.106	0.0	1.9	18

Summary of Results for 100 year Return Period (+40%)

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	76.714	0.314	0.0	0.2	0.2	2.2	O K
60 min Winter	76.762	0.362	0.0	0.2	0.2	2.6	O K
120 min Winter	76.776	0.376	0.0	0.2	0.2	2.7	O K
180 min Winter	76.759	0.359	0.0	0.2	0.2	2.6	O K
240 min Winter	76.741	0.341	0.0	0.2	0.2	2.4	O K
360 min Winter	76.706	0.306	0.0	0.2	0.2	2.2	O K
480 min Winter	76.671	0.271	0.0	0.2	0.2	1.9	O K
600 min Winter	76.637	0.237	0.0	0.2	0.2	1.7	O K
720 min Winter	76.604	0.204	0.0	0.2	0.2	1.5	O K
960 min Winter	76.531	0.131	0.0	0.2	0.2	0.9	O K
1440 min Winter	76.435	0.035	0.0	0.2	0.2	0.2	O K
2160 min Winter	76.400	0.000	0.0	0.1	0.1	0.0	O K
2880 min Winter	76.400	0.000	0.0	0.1	0.1	0.0	O K
4320 min Winter	76.400	0.000	0.0	0.1	0.1	0.0	O K
5760 min Winter	76.400	0.000	0.0	0.1	0.1	0.0	O K
7200 min Winter	76.400	0.000	0.0	0.1	0.1	0.0	O K
8640 min Winter	76.400	0.000	0.0	0.0	0.0	0.0	O K
10080 min Winter	76.400	0.000	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	86.802	0.0	2.5	32
60 min Winter	54.368	0.0	3.2	60
120 min Winter	32.929	0.0	3.9	116
180 min Winter	24.243	0.0	4.3	146
240 min Winter	19.399	0.0	4.6	184
360 min Winter	14.081	0.0	5.0	262
480 min Winter	11.225	0.0	5.3	336
600 min Winter	9.408	0.0	5.5	410
720 min Winter	8.140	0.0	5.7	482
960 min Winter	6.474	0.0	6.1	608
1440 min Winter	4.680	0.0	6.6	820
2160 min Winter	3.378	0.0	7.2	0
2880 min Winter	2.678	0.0	7.6	0
4320 min Winter	1.927	0.0	8.2	0
5760 min Winter	1.525	0.0	8.6	0
7200 min Winter	1.271	0.0	9.0	0
8640 min Winter	1.095	0.0	9.3	0
10080 min Winter	0.965	0.0	9.5	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.007

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.007

Model Details

Storage is Online Cover Level (m) 77.700

Cellular Storage Structure

Invert Level (m) 76.400 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	7.5	7.5	0.401	0.0	11.9
0.400	7.5	11.9			

Hydro-Brake® Optimum Outflow Control

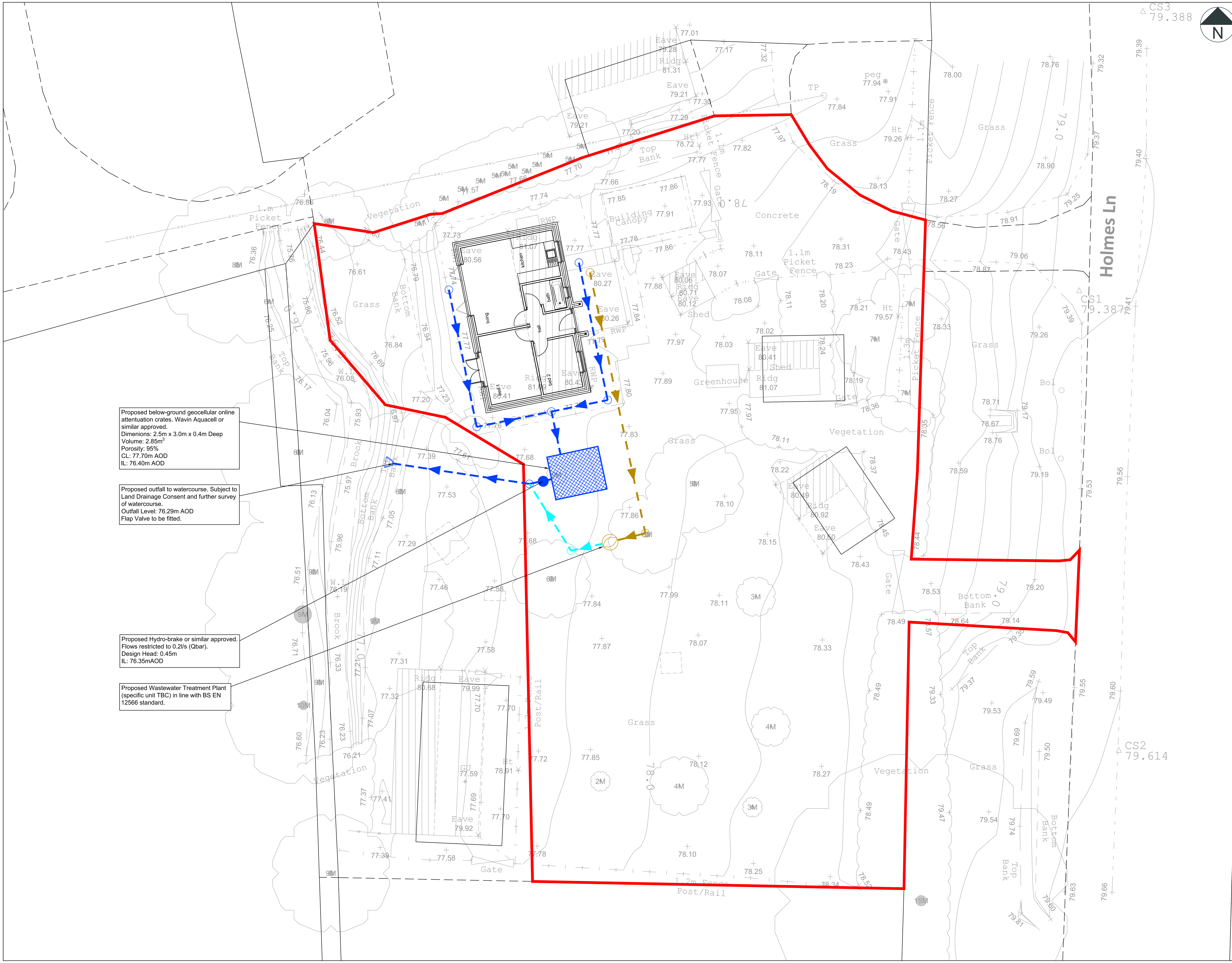
Unit Reference	MD-SHE-0023-2000-0450-2000
Design Head (m)	0.450
Design Flow (l/s)	0.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	23
Invert Level (m)	76.350
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.450	0.2
Flush-Flo™	0.105	0.2
Kick-Flo®	0.211	0.1
Mean Flow over Head Range	-	0.2

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	0.2	1.200	0.3	3.000	0.4	7.000	0.7
0.200	0.2	1.400	0.3	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.3	4.000	0.5	8.000	0.7
0.400	0.2	1.800	0.4	4.500	0.5	8.500	0.7
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.6		
1.000	0.3	2.600	0.4	6.500	0.6		

Appendix E – Drainage Strategy



N

Notes:

1. Do not scale from this drawing. All dimensions are in metres, unless stated otherwise.
2. This drawing is based on the Architect's layout by Purvis Dawes & Partners Ltd.
3. Ordnance Survey, (c) Crown Copyright 2023. All rights reserved. Licence number 100022432.
4. Drawing to be read in conjunction with all other drawings. Any discrepancies are to be reported to the engineer 5 working days in advance of undertaking any work.

Key:

Proposed

- Surface Water Inspection Chamber/Manhole
- Surface Water Sewer
- Geocellular Attenuation Crates
- Headwall
- Hydrobrake
- Foul Water Inspection Chamber/Manhole
- Foul Water Sewer
- Package Treatment Plant
- Treated Foul Water

Rev	Date	Details	By	Chkd
P02	05.12.23	Issued for Planning	AS	BF
P01	18.10.23	Issued for Information	AS	CG

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CLIENT:
Worcester Diocesan Board of Finance Ltd

PROJECT:
Storeys Lodge
Hanbury

TITLE:
Proposed
Drainage Layout

SCALE @ A1:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:100	17.10.23	AS	CG	BF

STATUS:
PLANNING

DRAWING NO: 230467-RAP-V1-XX-DR-D-3100

REVISION: P02

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