BUTTS CLOSE, MARNHULL

FLOOD RISK ASSESSMENT

P & D CROCKER

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EXECUTIVE SUMMARY

i. This Flood Risk Assessment has been prepared on behalf of P & D Crocker in connection with proposals for a development comprising 120 dwellings on land to the east of Butts Close, Marnhull, DT10 1QB.

ii. The site currently comprises arable agricultural land, bound by hedgerow and an unnamed ordinary watercourse along the eastern and northern boundary.

iii. With reference to the Environment Agency's Flood Map for Planning, the site falls within Flood Zone 1.

iv. In relation to Flood Risk Vulnerability and Flood Zone 'Compatibility', the planning practice guidance to the NPPF advises that all uses of land are appropriate in Flood Zone 1. On this basis the sequential test is passed.

v. In addition to flooding from rivers, this Flood Risk Assessment has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

vi. An assessment has been made of the potential risk from all sources of flooding to and from the development site, with reference to available flood risk information, for existing conditions pre-development, and post-development with the various development mitigation measures incorporated.

vii. The pre-development potential flood risk to the site from all sources of flooding is considered to be 'very low' to 'low'.

viii. An outline drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site. Flow balancing methods are proposed, in order to attenuate surface water runoff to greenfield runoff rates with discharges to the ditch system. The proposed surface water drainage measures incorporate Strategic SuDS Features, to attenuate and store surface water runoff, comprising a series of attenuation ponds, geocellular storage and conveyance SuDS features. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

ix. It is recommended that a number of elements to the scheme can be covered by suitably worded planning conditions requiring the submission of details to be submitted to and approved by the Local Planning Authority.

x. This Flood Risk Assessment demonstrates that the proposed development is compliant with the NPPF, DEFRA/Environment Agency guidance, and Local Plan Policies.

xi. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere when the proposed mitigation measures are taken into account, and would reduce flood risk overall.

1. INTRODUCTION

1.1. This Flood Risk Assessment has been prepared on behalf of P & D Crocker in connection with proposals for a development comprising 120 dwellings on land to the east of Butts Close, Marnhull DT10 1QB.

1.2. The overall site comprises approximately 8 hectares, located approximately 8.5km to the south of Gillingham, and lies in the district of North Dorset. The approximate grid reference for the site is ST 77991 19288. The location of the site is shown edged red on Figure 1 below.

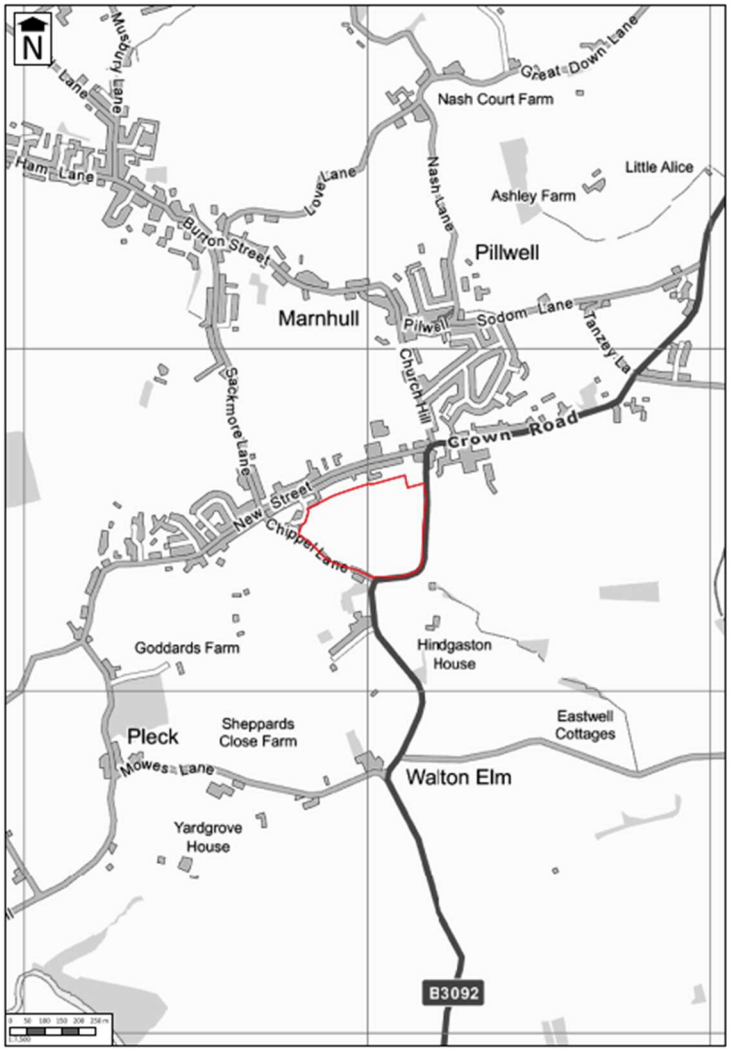


Figure 1: Site Location Plan

1.3. The main purpose of this site-specific Flood Risk Assessment is to provide sufficient flood risk information to support a planning application for the development proposals in order to demonstrate that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall.

2. SCOPE OF THE ASSESSMENT

2.1. The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. Policy on planning and flood risk in the NPPF is dealt with at paragraphs 159-169 in chapter 14 'Meeting the challenge of climate change, flooding and coastal change'. Chapter 14 was first published on 27 March 2012 and last updated on 20 July 2021.

2.2. The national planning practice guidance to the NPPF was launched as a web-based resource in March 2014. The category dealing with flooding is contained in Flood Risk and Coastal Change (Reference ID: 7) and last updated on 25 August 2022.

2.3. Paragraph 159 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future), but where development is necessary, the development should be made safe for its lifetime without increasing flood risk elsewhere.

2.4. Paragraph 160 states that strategic policies should be informed by a strategic flood risk assessment (SFRA), and should manage flood risk from all sources.

2.5. A Level 1 SFRA was prepared by JBA Consulting on behalf of North Dorset District Council, in February 2018, to support the development of their Local Development Framework. The SFRA provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.6. As set out in paragraph 161 of the NPPF, all plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, applying the sequential test and then, if necessary, the exception test.

2.7. Paragraph 162 states that the aim of the sequential test is to steer new development to areas with the lowest probability of flooding from any source. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

2.8. Paragraph 166 identifies that where appropriate; applications should be supported by a site-specific flood-risk assessment. Footnote 55 of the NPPF states a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

2.9. A copy of the Environment Agency's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2** below.

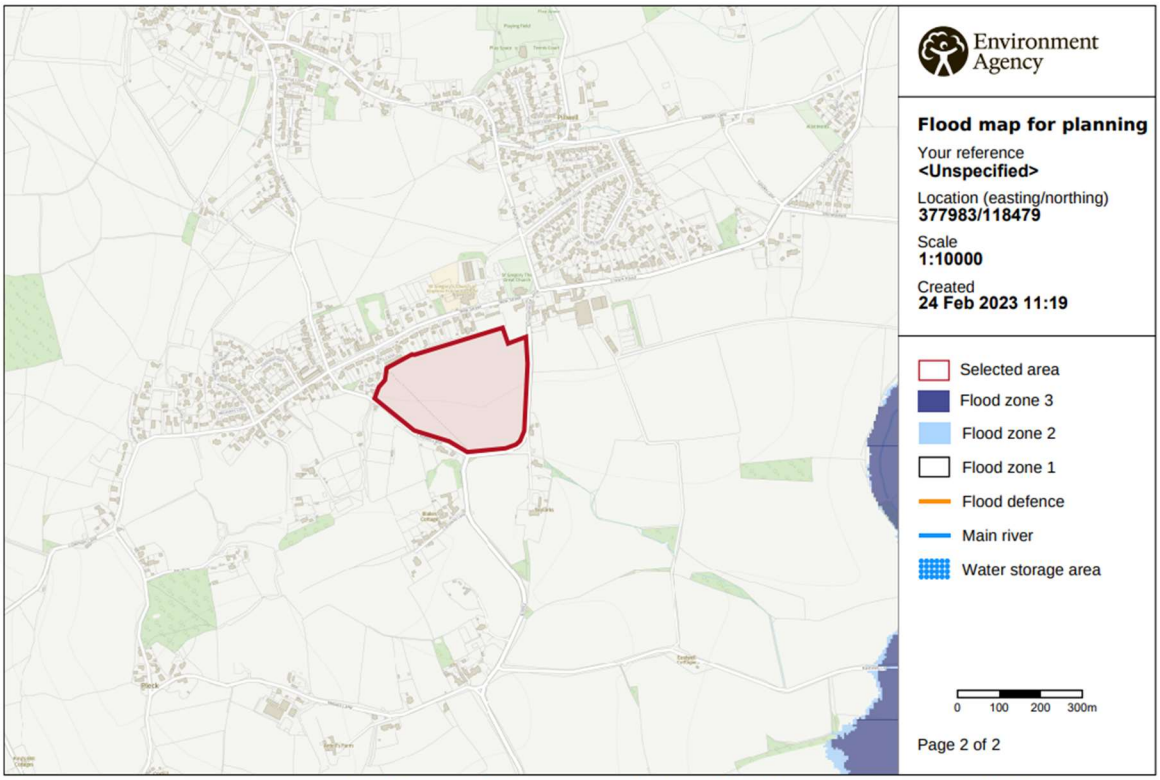


Figure 2: Environment Agency's Flood Map for Planning

2.10. The Environment Agency's Flood Zones refer to the probability of river flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning shows the area that could be affected by flooding coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading, this shows the area where flooding from rivers is very unlikely corresponding to Flood Zone 1.

2.11. The red line site boundary has been added to the Environment Agency's Flood Map for Planning on Figure 2. From an inspection of the Flood Map it can be seen that the site falls within Flood Zone 1. Areas of Flood Zone 1 have a less than 1 in 1,000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP)).

2.12. Paragraph 167 of the NPPF states:

> **'When determining any planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:**
>
> **a. within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;**

b. the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c. it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d. any residual risk can be safely managed; and

e. safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Flood Risk Assessment Planning Practice Guidance

2.13. Paragraph 30 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-030-20140306) advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The assessment should demonstrate 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.

2.14. For the purposes of applying the NPPF, paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-002-20140306) advises that "flood risk" is a combination of the probability and the potential consequences of flooding from all sources - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.15. Paragraph 31 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-031-20140306) advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature and location of development.

2.16. Paragraph 68 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-068-20161116) provides a model checklist for a site specific flood risk assessment.

2.17. With regard to what further advice is available on the preparation of a site-specific flood risk assessment, paragraph 32 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-032-20150415) refers to the Environment Agency Standing Advice on flood risk.

2.18. Guidance from the Department for Environment, Food & Rural Affairs (DEFRA) and Environment Agency (EA), published on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: 'Flood risk assessment in flood zones 2 and 3', 'Flood risk assessment in flood zone 1 and critical drainage areas', and 'Preparing a flood risk assessment: standing advice'. This guidance provides information on the range of factors that need to be considered when assessing flood risk.

2.19. Reference has also been made to: BS 8533:2017 'Assessing and managing flood risk in development - Code of practice'; BS 8582:2013 'Code of practice for surface water management for development sites'; and the Local Authority SuDS Officer Organisation (LASOO) document entitled 'Non-Statutory Technical Standards for Sustainable Drainage :Practice Guidance'.

2.20. The DEFRA/EA guidance 'Review individual flood risk assessments: standing advice for local planning authorities' sets out when local planning authorities must consult the Environment

Agency, their lead local flood authority or both, on any proposed developments at a higher risk from flooding before making a decision.

2.21. Local planning authorities also need to consult the Environment Agency if the development is within 20m of a main river in Flood Zones 1, 2 or 3.

2.22. In this context 'major development' is defined in the NPPF Annex 2: Glossary as follows: For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m2 or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management procedure) (England) Order 2015.

2.23. The proposed development is classed as 'major development' as it is for more than 10 dwellings. The local planning authority therefore needs to consult their lead local flood authority. However, it is not in an area with critical drainage problems and is not within 20m of a main river, so they do not need to consult the Environment Agency.

Local Plan Policies

2.24. The North Dorset Local Plan Part 1 was formally adopted in January 2016 and provides a planning policy framework for the district for the period up to 2031

2.25. Relevant policies from the Core Strategy include: Core Policy 3 and Core Policy 13.

2.26. Core Policy 3: 'Climate Change' states:

> **'Development should seek to minimise the impacts of climate change overall through:**
>
> **d) incorporation of measures to reduce water consumption; and**
>
> **e) avoidance of areas at risk of flooding of all sources and incorporation of measures to reduce flood risk overall; '**

2.27. Relevant 'saved' policies from the District Wide Local Plan (2003) include: Policy 1.16.

2.28. Policy 1.16 'Groundwater Source Protection'.

> **'Development which would have an unacceptable risk upon the water quality, quantity or natural flow patterns of a groundwater resource will not be permitted. This is especially important within the Groundwater Source Protection Areas defined on the Proposals Map and also where land may have been subject to previous contamination.'**

Summary of Scope

2.29. The scope of this Flood Risk Assessment is to provide sufficient information to satisfy the requirements of the NPPF, the planning practice guidance checklist, Local Plan Policies, guidance published by DEFRA/Environment Agency, the Government's 'Non-statutory technical standards for sustainable drainage systems' and North Dorset's Local standards.

3. FLOOD RISK ASSESSMENT

Development Site and Location

3.1. The Site is located to the east of Butts Close in Marnhull, in the district of North Dorset. The site is currently in agricultural use, mainly arable with some grasslands.

3.2. The Site Location Plan and the Environment Agency's Flood Map for Planning are based on the Ordnance Survey map of the area, and show geographical features and identify watercourses and other bodies of water in the vicinity of the site.

3.3. The nearest watercourse to the site is a ditch/minor watercourse, which runs along the south-western boundary of the site adjacent to Chippel Lane, which then passes under the B3092 to run eastwards generally to the north of Hindgaston House.

Development Proposals

3.4. The development proposals comprise approximately 120 dwellings.

3.5. A copy of the Illustrative Masterplan, showing the development proposals, is reproduced in **Appendix 1.**

Site Levels

3.6. A Topographical Survey was undertaken by Total Survey in September 2022. The copy of the survey is reproduced in **Appendix 2.**

3.7. The Topographical Survey indicates that the site falls downhill from around 85.0m AOD in the north, to around 74.0 AOD in the south-eastern corner of the site adjacent to the ditch.

Flood Risk Vulnerability and Flood Zone 'Compatibility'

3.8. Annex 3 of the NPPF sets out the Flood Risk Vulnerability Classification of development and categorises different types of development according to their vulnerability to flood risk. Paragraphs 77-78 of the Flood Risk and Coastal Change Planning Practice Guidance refer to two Flood Zone and Flood Risk Tables. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood risk vulnerability and flood zone 'compatibility' maps the vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

3.9. With reference to Annex 3 of the NPPF the proposed residential development falls into the 'More Vulnerable' flood risk vulnerability classification, which includes buildings used for dwelling houses. The proposed employment development falls into the 'Less Vulnerable' flood risk vulnerability classification, which includes buildings used for offices, general industry.

3.10. The Environment Agency's Flood Map for Planning indicates that the majority of the site falls within Flood Zone 1.

3.11. With reference to Table 2, all uses of land are appropriate in Flood Zone 1.

3.12. Notes to Table 2 states that the table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas.

The Sequential Test and Exception Test

3.13. Paragraph 161 of the NPPF states:

> **'All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:**
>
> **(a) applying the sequential test and then, if necessary, the exception test as set out below;'**

3.14. Paragraph 162 of the NPPF goes onto state:

> **'The aim of the sequential test is to steer new development to areas with the lowest probability of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'**

3.15. As the sites falls within Flood Zone 1 (the lowest risk zone) the Sequential Test is passed and the Exception Test does not need to be applied.

Climate Change

3.16. The NPPF and its guidance requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

3.17. Guidance on the lifetime of development is provided at paragraph 6 in the Flood Risk and Coastal Change Planning Practice Guidance. Residential development can be assumed to have a lifetime of at least 100 years, unless there is specific justification for considering a different period.

3.18. Paragraph 20 of the Guidance states site-specific flood risk assessments 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 links to Environment Agency Guidance entitled 'Flood risk assessments: climate change allowances' last updated on 27 May 2022. This sets out the climate change allowances to be used for peak river flow, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height.

Peak Rainfall Intensity Allowance

3.19. With respect to the peak rainfall intensity allowance, the site lies in the Dorset Management Catchment. The Guidance advises for development with a lifetime beyond 2100 assess the upper end allowance for the 2070s epoch (2061 to 2125) and design your development so that for the upper end allowance in the 1% annual exceedance probability event there is no increase in flood risk elsewhere and your development will be safe from surface water flooding. The total potential change anticipated for 2070s epoch (2061 to 2125) is +45% for the central allowance in the 1% AEP rainfall event.

Standard of Protection

3.20. In terms of providing an acceptable standard of protection against flooding for new development, where development is necessary in flood risk areas the development should be made safe for its lifetime without increasing flood risk elsewhere. The Site-specific flood risk assessment checklist makes reference to the assessment of the 'design flood'.

3.21. Paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance defines a "design flood" as follows:

'This is a flood event of a given annual probability, which is generally taken as:

- **river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or**
- **tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or**
- **surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),**

plus an appropriate allowance for climate change.

3.22. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, the development should be appropriately safe without increasing flood risk elsewhere in the 'design flood'.

3.23. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Site Specific Flood Risk

3.24. In addition to flooding from rivers it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

3.25. The Government's GOV.UK website contains 'Long Term Flood Risk Information' which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories: High risk means that each year this area has a chance of flooding of greater than 3.3% (1 in 30); Medium risk between 1% and 3.3% (1 in 100 and 1 in 30); Low risk between 0.1% and 1% (1 in 1000 and 1 in 100); and Very low risk less than 0.1% (1 in 1000).

3.26. The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map, which includes flood depth and flood speed.

Flooding from Watercourses

3.27. The Environment Agency's Flood Map for Planning shows the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning indicates that the site is unaffected by any floodplain and falls entirely within Flood Zone 1 where flooding from rivers is very unlikely. In Flood Zone 1 there is a less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

Flooding from Surface Water

3.28. The GOV.UK's Flood risk from surface water map indicates where surface water may be expected to flood or pond. Surface water flooding happens 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. The

GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. The information shown is a general indicator of an area's flood risk. A copy of the GOV.UK's Flood risk from surface water map is reproduced in **Figure 3** below.

Figure 3: Flood risk from surface water map

3.29. The GOV.UK's Flood risk from surface water map shows the site lies in an area with Very Low (less than 1 in 1000 (0.1%)) chance of surface water flooding. There is a very small area of low risk (less than 1 in 100 (1%)) on the western boundary and towards to east.

3.30. The extent of the Low risk surface water flood event is shown on Drawing No. C798/21 contained in **Appendix 3**. The Low risk flood depths range from 0mm to 150mm. The modelled velocities in the low risk event are over 0.25 m/s indicating the surface water flooding is associated with overland flow routes through the site. Assessing the steep topography of the site, these flood depths would run downslope away from the development.

3.31. The required standard of protection against flooding for the development is that no flooding of property should occur as a result of a 1 in 100 year flood event, which corresponds to the Medium risk scenario on the GOV.UK's 'Long Term Flood Risk Information' maps.

Flooding from Groundwater

3.32. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks such as sands, gravels, limestone and chalk. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas

the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

3.33. The SFRA does not identify any incidents of groundwater flooding in the vicinity of the site.

Flooding from Overwhelmed Sewers and Drainage Systems

3.34. Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity. Enquiries have been made to Wessex Water to establish the location of the existing public sewers in the vicinity of the site.

3.35. There is an existing foul sewer which crosses through the site from west to east which drains to a wastewater treatment works to the south of the village.

3.36. The SFRA does not identify any incident of sewer flooding affecting the site.

Flooding from Artificial Sources

3.37. The GOV.UK's Flood risk from reservoirs map indicates the site is unaffected by flooding from any reservoirs.

Summary of Flood Risk

3.38. A summary of the potential flood risk from all sources of flooding associated with existing conditions pre-development is shown in Table A below.

Table A: Pre-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses	X				The site is located in Flood Zone 1.
Surface Water	X	X			The topography of the land indicates that any overland flow would be directed into the ditch network away from the site.
Groundwater	X				The SFRA does not identify any groundwater flooding affecting the site and the underlying geology suggests risk of groundwater flooding is low.
Overwhelmed Sewers	X	X			There is an existing sewer crossing the site. The SFRA does not identify any incident of sewer flooding affecting the site.
Artificial Sources	X				The site is not affected

3.39. The SFRA, and historic flood information, provides an assessment of the impact of all other sources of potential flooding. Based on the SFRA and available information, there are no historic flood incidents recorded on the site from all sources of potential flooding.

3.40. The pre-development potential flood risk to the site from all sources of flooding is considered to be 'very low' to 'low'

4. DRAINAGE STRATEGY

Sustainable Drainage Systems

4.1. Paragraph 169 of the NPPF states:

> **'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:**
>
> **a) take account of advice from the lead local flood authority;**
>
> **b) have appropriate proposed minimum operational standards;**
>
> **c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and**
>
> **d) where possible, provide multifunctional benefits.'**

4.2. 'Major development' is defined in the NPPF Annex 2: Glossary as:

> **'For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m^2 or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management procedure) (England) Order 2015.'**

4.3. Paragraph 55 in the Flood Risk and Coastal Change planning practice guidance advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems can contribute to the causes and impacts of flooding and deliver a wider range of additional biodiversity and environmental net gains.

4.4. In terms of what sort of sustainable drainage system should be considered, paragraph 56 in the Guidance advises Where possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer.

4.5. The drainage hierarchy is also set out in Section 3.2 of Approved Document H of the Building Regulations.

4.6. The Government's 'Non-statutory technical standards for sustainable drainage systems' relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development. The Government's 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6).

4.7. Guidance on the design and construction of SuDS is provided in Ciria C753 'The SuDS Manual' as well as in the Design and Construction Guidance (DCG) published by Water UK.

4.8. There are a number of potential SuDS techniques that might be used on any particular site. These include rainwater harvesting systems, pervious pavements, infiltration devices such as soakaways and infiltration trenches, bioretention systems, as well as flow balancing methods including swales, ponds/detention basins, and underground storage facilities.

4.9. The use of soakaways, pervious pavements and infiltration devices to discharge surface water runoff to ground depends upon the underlying strata having a suitable permeability. In addition, the Environment Agency will seek to control discharges into underground strata from areas subject to contamination or where groundwater is judged to be at risk from pollution caused by possible contamination.

4.10. The SuDS Manual promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed development seeks to follow the concept of a SuDS management train.

Ground Conditions

4.11. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by:

• **Hazelbury Bryan Formation**: The formation consists of clays, clayey sands and sands, mostly in coarsening – upward sequences. Thin sandy limestones occur locally in the upper part of coarsening upwards sequence. The sands generally have pronounced spring lines at their bases. The sands in the Hazelebury Bryan Formation range in mean grain size from a very fine to medium grain.

• **Woodrow Clay Member**: The Woodrow Clay Member comprises grey slight sandy and locally oolitic and fossiliferous clay. These have a thickness of up to 5m.

• **Cucklington Oolite Member**: The Cucklington Oolite Member comprise shelly, locally sandy oosparite limestone with interbeds of oolitic marl. These have a typical thickness between 2m and 5m.

4.12. Based on the Flood Studies Report Winter Rainfall Acceptance Potential (WRAP) Map, as shown reproduced on Drawing Number C798/01 in **Appendix 4**, the site is located in a 'Soil Index Class 1' area. Soil Index Class 1 has the highest winter rainfall acceptance potential and lowest standard percentage runoff, and so suggests the underlying soil has good permeability.

4.13. The Cranfield Soil and AgriFood Institute (CSAI), incorporating the National Soil Resources Institute (NSRI,) at Cranfield University maintains soil reports and maps for England and Wales. The Soilscapes dataset map indicates that soils in the area are 'shallow lime-rich soils over chalk or limestone. These soils are identified as 'freely draining'. These soils absorb rainfall readily and allow it to drain through to underlying layers.

4.14. A site investigation was undertaken by OMNIA in November 2022. As part of the site investigation, soakaway tests were carried out across the site in accordance with BRE Digest 365. An effective depth was not reached in all soakaways across the site due to the cohesive nature of the fine-grained soils found on the site. Therefore, infiltration tests were not calculated. A copy of the site investigation is reproduced in **Appendix 5.**

Groundwater Source Protection

4.15. From an inspection of the Environment Agency's Aquifer Designation Map dataset held on Natural England's MAGIC website, the central part of the site is underlain by a Secondary A Aquifer. A copy of the Aquifer Designation Map dataset information is reproduced in Figure 4 below.

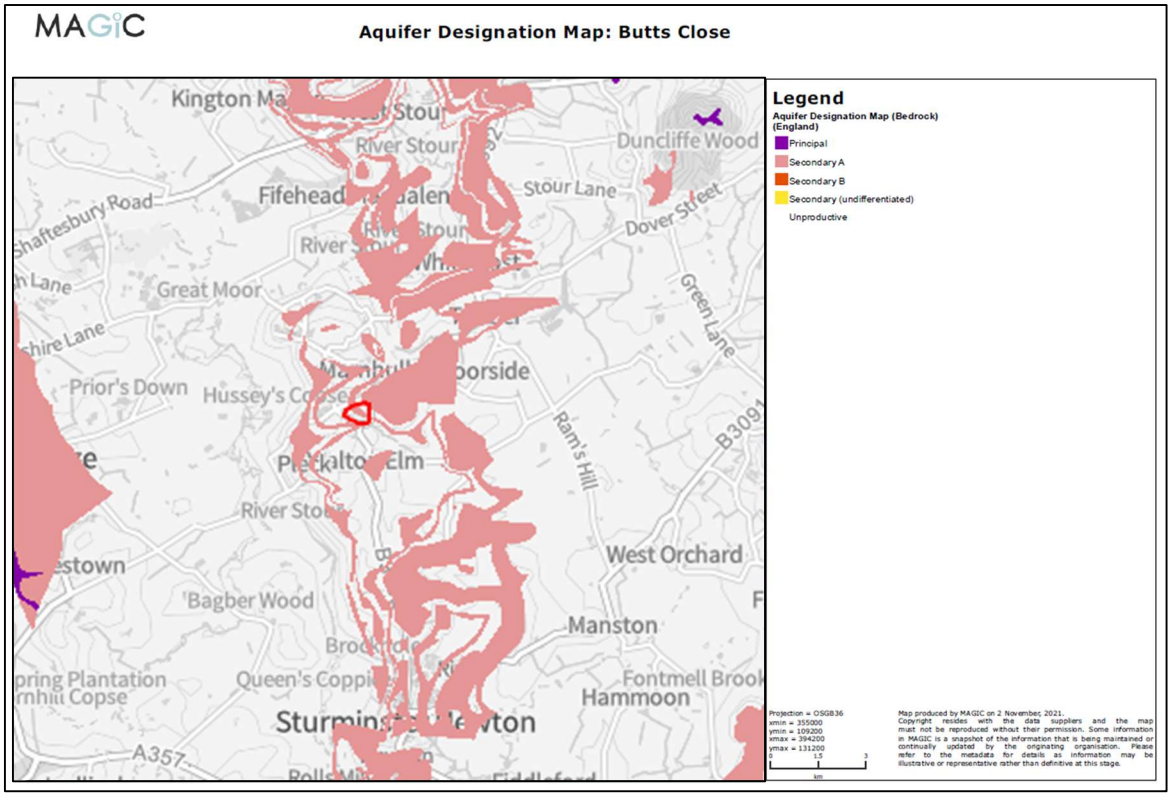


Figure 4: Aquifer Designation Map

4.16. From an inspection of the Environment Agency's Source Protection Zones dataset the site does not fall into a Source Protection Zone. A copy of the Source Protection Zone Map dataset information is reproduced in **Figure 5** below.

4.17. From an inspection of the Environment Agency's Groundwater Source Protection Maps the site does not fall within a Groundwater Source Protection Zone.

Surface Water Management

4.18. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

4.19. As the use of infiltration devices is not feasible it is necessary to use flow balancing methods in order to store and attenuate surface water runoff to greenfield runoff rates with discharges to the ditch system. The required storage may be provided using swales and ponds/detention basin.

4.20. A preliminary surface water drainage strategy is shown on the Indicative Surface Water Drainage Strategy Plan, Drawing Number C798/26, a copy of which is also contained in **Appendix 6.**

4.21. Winter Groundwater monitoring was undertaken by Omnia in November 2022 and March 2023. The Omnia report, reproduced in **Appendix 7** indicates that the base of the majority of the proposed SuDS features shown on the Indicative Surface Water Drainage Strategy Plan, Drawing No. C798/26 would be above the maximum winter groundwater level. The proposed underground storage (GS1)

would be below the maximum groundwater level, as summarised in Table 3.2 of the report; at the detailed design stage, SuDS Feature GS1 suitable measures should therefore be provided to prevent floatation.

4.22. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

4.23. In terms of the SuDS 'management train', the drainage strategy for the proposed development seeks to address the quality and quantity of runoff as follows:-

i) Prevention

4.24. Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design includes the provision of trapped gullies to retain sediment, and suitably designed ponds or grassed detention basins contribute to the pollutant and sediment removal capability of the management train. The housekeeping measures cover maintenance of the drainage system, including the ponds/detention basins, and general site maintenance.

ii) Source Control

4.25. Source control is defined in the The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source control measures such as detention areas are priority features of SuDS networks serving urbanised networks and highways. Planting within these areas encourages evapotranspiration.

iii) Site Control

4.26. Site control is the management of water from several sub-catchments within a site. The proposed surface water drainage system amalgamates the runoff from the roofs, roads, and paved areas, for each area of development on the site, and deals with it in a combination of swales and ponds/detention basins, to attenuate flows and reduce the rate of runoff from the site.

4.27. The detention basins would provide attenuation, and would also contribute to the pollutant and sediment removal capability of the SuDS management train, as well as enhance the site's amenity value and provide biodiversity betterment.

iv) Regional Control

4.28. Regional control is the management of runoff from more than one site and so in this case is covered by the site control techniques.

Greenfield Runoff Rate - IH Report 124 Method

4.29. The ICP SuDS module in the Micro Drainage design software enables the calculation of greenfield runoff rates based on the IH Report 124 estimation method with pro-rata values for sites smaller than 50ha.

4.30. Greenfield runoff rates have been determined using Micro Drainage design software based on the method set out in IH Report 124. Catchment descriptors have been obtained from the Flood Estimation Handbook (FEH), published by the Institute of Hydrology. Rainfall and soil parameters have been obtained from maps in Volume V of the Flood Studies Report (FSR) within the MicroDrainage design software. FSSR 2 and 14 regional growth curve factors are used to calculate the greenfield peak flow rates for 1, 30 and 100 year return periods.

4.31. The FSR WRAP Map, shown in **Appendix 4**, indicates the site is located in 'Soil Index Class 1', which has the lowest standard percentage runoff and suggests the underlying soil has good permeability. However, the site investigation shows the overlying superficial deposits are relatively impermeable.

4.32. Due to the observed relatively impermeable nature of the site, using a Soil Index Class 1 in IH 124 would underestimate Q_{BAR}. On the basis of the site investigation and soakaway tests, and with reference to the WRAP Map, the soils underlying the site more closely relate to Soil Index Class 4 with a relatively higher standard percentage runoff. A Soil Index value of 0.45, which more closely represents the site specific soil value, has there been used to calculate Q_{BAR} in IH Report 124.

4.33. Copies of the MicroDrainage greenfield runoff calculations for the site are included in **Appendix 8**. A summary of the greenfield runoff rates for the various return period events is shown in **Table B**. The mean annual peak rate of runoff, referred to as Q_{BAR} in IH Report 124, is 23.2 l/s.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	Q_{bar}	30	100
Greenfield Runoff Rates (l/s)	19.7	23.2	52.5	73.9

4.34. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{BAR} for all rainfall events up to the 100 year return period event, including a 45% allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield runoff rates.

Urban Creep

4.35. Paragraph 85 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-085-20150323) advises that any sustainable drainage system should be designed so that the capacity takes account of the likely impacts of climate change and likely changes in impermeable area within the development over its lifetime and continues to provide effective drainage for properties. The likely changes in impermeable area within the development over its lifetime are considered under the term urban creep.

4.36. Urban creep is defined in The SuDS Manual 2015 (CIRIA C753) as any increase in the impervious area that is drained to an existing drainage system without planning permission being required, and therefore without consideration of whether capacity of the receiving sewerage system can accommodate the increased flow. It is limited to residential development and for example covers the construction of patios, conservatories, paved driveways etc (post initial construction).

4.37. The Local Authority SuDS Officer Organisation (LASOO) document entitled 'Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance' sets out the appropriate allowances to be applied to the impermeable area within the property curtilage based on residential development densities. For a residential development with a density of 25 or less dwellings per hectare a 10% allowance is applied, reducing to 2% for a density of 50 dwellings per hectare and above, and 0% for flats and apartments.

4.38. The proposed residential development on the site equates to a density of 13 dwellings per hectare. Therefore, in order to ensure the capacity of the drainage system takes account of urban creep within the development over its lifetime, a 10% increase has been applied to the impermeable area within property curtilages when designing the drainage system.

Surface Water Flow Balancing

4.39. The use of flow balancing methods, comprising detention basins, geocellular storage and conveyance SuDS feature, are proposed in order to attenuate surface water runoff to greenfield runoff rates with discharge to the local watercourse and ditch system.

4.40. Preliminary storage calculations have been undertaken to establish the required storage for the development catchment areas on the site using Micro Drainage for the 1 in 10, 30 and 100 year events plus a 45% increase in peak rainfall intensity to take account of climate change. The outflow from the drainage system has been constrained to $Q_{BAR.}$

4.41. For the preliminary storage calculations the development has been split up into 11 sections which will drain to a number of attenuation basins and storage structures located across the site. These areas would give rise to net impermeable areas of 3.36ha (approximately 65% of the respective development catchment area for residential development and including urban creep). **Table C and D** below show the development catchment, the required average storage in the detention basin or storage structure crates for the 1 in 10, 30 and 100 year events plus a 45% increase in peak rainfall intensity to take account of climate change, and the resulting discharge. Copies of Micro Drainage calculation results showing resulting discharge from the storage structures are reproduced in **Appendix 9 and 10**.

Table C: Detention Basin Volumes

Detention Basin No.	Development section	Impermeable area (ha)	Total Allowable Discharge for whole area (l/s)	1 in 10 yr Storage Vol. (m^3)	Resulting Discharge (l/s)	1 in 30 yr Storage Vol. (m^3)	Resulting Discharge (l/s)	1 in 100 yr + 45% CC Storage Vol. (m^3)	Resulting Discharge (l/s)
4	11	0.131	-	22.1	4.4	29.2	4.5	62.1	4.5
3	1	0.248	-	84.2	4.5	111	4.5	234.5	4.5
	9	0.116							
2	3	0.340	-	111.2	7.2	149.5	7.2	321.2	7.2
	4	0.182							
1	8	0.696	23.2	339.3	23.1	444	23.1	945.5	23.1
	5	0.558							
	7	0.278							

Table D: Storage Structure Volumes

Cellular Storage No.	Development section	Impermeable area (ha)	Total Allowable Discharge for whole area (l/s)	1 in 10 yr Storage Vol. (m^3)	Resulting Discharge (l/s)	1 in 30 yr Storage Vol. (m^3)	Resulting Discharge (l/s)	1 in 100 yr + 45% CC Storage Vol. (m^3)	Resulting Discharge (l/s)
3	6	0.152	-	27.6	3.5	36.7	3.8	73.4	5.3
2	10	0.179	-	33.1	3.8	44.9	3.8	95.5	4.1
1	2	0.430	-	123.8	3.4	154.3	3.8	317.1	3.8

4.42. Detention Basin 1 is the only attenuation structure that is discharging into the onsite ordinary watercourse. From an inspection of Table C the final SuDS features peak runoff rate for the 1 in 10, 30 and 100 year rainfall event never exceed the peak greenfield runoff rate for the same event. The proposed surface water drainage measures therefore ensure the proposed development satisfies

the peak flow control standards in the Government's 'Non-statutory technical standards for sustainable drainage systems'.

4.43. As a final check, the SuDS Features have been analysed using a Cascade in MicroDrainage. The Cascade Summaries are included as **Appendix 11** and summarised in **Table E** below.

Table E: Summary table of the total storage volumes across the site

	Return Period
	1 in 100 year plus 45% climate change
Combined Features	
Total Storage Volume (m^3)	3190.25
Storage used (m^3)	2677.8
Greenfield Runoff Rate (l/s)	23.2
Post-development Runoff Rate (l/s)	23.2

4.44. Table E demonstrates the total available storage provided by the SuDS features across the site, the resulting storage volume used during a 1 in 100 year rainfall event including climate change, the greenfield runoff rates and the post development runoff rates.

4.45. The above calculations demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

Flood Risk Management Measures

Overland Flood Flow Paths

4.46. Standard S9 in the Government's 'Non-statutory technical standards for sustainable drainage systems' states that the design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.

4.47. Overland flood flow paths will follow the natural topography of the land towards the ditch located along the southern boundary of the site. The design of the internal road network would convey flows towards School House Lane in line with the existing situation. The proposed drainage systems would reduce uncontrolled overland flows.

Off Site Impacts

4.48. By reducing the rate of runoff and intercepting uncontrolled overland flows the proposed development would reduce flood risk overall.

Residual Risk

4.49. Paragraph 41 in the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-041-20220825) advises that residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual risk include:

- a breach of a raised flood defence, blockage of a surface water conveyance system or failure of a pumped drainage system

- a flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot accommodate.

4.50. The site lies within Flood Zone 1 and so the proposed development is fully in accordance with the sequential approach to development set out in the NPPF, the aim of which is to steer new development to areas with the lowest probability of flooding.

4.51. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event including an appropriate allowance for climate change.

4.52. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

Summary of Flood Risk with Management Measures

4.53. A summary of the potential risk from all sources of flooding post-development with the various development mitigation measures incorporated is shown in **Table F** below.

Table F: Post-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk				Description
	Very Low	Low	Medium	High	
Watercourses	X				Proposed site is entirely within a Flood Zone 1.
Surface Water	X	X			The risk would be further mitigated by providing a surface water drainage system.
Groundwater	X				Any risk would be further mitigated by ensuring that the slab levels of any dwellings are set above the surrounding ground levels as is standard building practice.
Overwhelmed Sewers	X				The proposed drainage system and detention basin would further mitigate any potential off-site sewer flooding affecting the site.
Artificial Sources	X				The site is not affected
Off-site Impacts	X				By reducing the rate of runoff and intercepting overland flows the proposed development would reduce flood risk overall.

Water Quality Assessment

4.54. The proposed Outline Surface Water Drainage Strategy incorporating Strategic SuDS Features provides treatment of surface water runoff which in turn delivers water quality benefits.

4.55. The proper implementation of a SuDS management / treatment train using a combination of upstream Source Control and Strategic SuDS Features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance.

Creating a diverse SuDS scheme encourages sedimentation, filtration and biological uptake throughout the site.

4.56. Ensuring that the principles of the Outline Surface Water Drainage Strategy are taken forward into the future detailed design of the individual development parcels and ensuring that effective maintenance and management procedures are followed will be the key to ensuring the overall effectiveness of the SuDS scheme.

4.57. With reference to Chapter 26 of the CIRIA SuDS Manual 2015 a water quality assessment of the proposed Outline Surface Water Drainage Strategy has been undertaken using the simple index approach.

4.58. To deliver adequate treatment the SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index > pollution hazard index

4.59. Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required, where:

Total SuDS mitigation Index = mitigation index$_1$ + 0.5(mitigation index$_2$) + etc

4.60. From Table 26.2 in the CIRIA SuDS Manual 2015 the pollution hazard indices for each contaminant type for the proposed land use comprising commercial roofs non-residential car parks, and low traffic roads are shown in Table G below.

Table G: Pollution hazard indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential carparks, low traffic roads and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

4.61. From Table 26.3 in the CIRIA SuDS Manual 2015 the indicative SuDS mitigation indices for discharges to surface waters for different SuDS features which could be utilised on the development site are shown in **Table H** below.

Table H: Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6

4.62. **Table I** below summarises the catchment areas on the development site, the associated pollution hazard indices and the appropriateness of the proposed SuDS feature to deliver adequate treatment.

Table I: Total Mitigation Index

Catchment	Pollution hazard level	SuDS Feature (minimum proposed[1])	SuDS mitigation index					
			Total suspended solids (TSS)		Metals		Hydrocarbons	
			SuDS Mitigation Index *[Target]*	Pass / Fail	SuDS Mitigation Index [*Target*]	Pass / Fail	SuDS Mitigation Index [*Target*]	Pass / Fail
Residential Roofs	Very Low	Detention Basin	0.5 *[0.2]*	P	0.5 *[0.2]*	P	0.6 *[0.05]*	P
Individual property driveways, residential carparks, low traffic roads	Low	Detention Basin	0.7 *[0.5]*	P	0.6 *[0.4]*	P	0.7 *[0.4]*	P

Notes:
[1] Opportunities for Source Control features should be considered when detailed layouts are developed.

4.63. With reference to Table G above it can be seen that the total pollution exceeds the pollution hazard index (for each contaminant type) for the majority of the proposed land uses and so the proposed surface water drainage scheme delivers adequate water quality treatment.

Non-statutory technical standards for sustainable drainage systems

4.64. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.

4.65. The 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2) and volume control technical standards (S4, and S6).

4.66. Standard S2 states:

'S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.'

4.67. In terms of volume control, standard S4 states:

'S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.'

4.68. Standard S6 states:

'S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.'

4.69. In accordance with Points 8 and 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, the limiting discharge rate that does not adversely affect flood risk, for any return period up to the 100 year event, is the mean annual peak rate of runoff for the greenfield site referred to as QBAR or 2 l/s/ha, whichever is greater.

4.70. In terms of flood risk within the development, the Government's 'Non-statutory technical standards for sustainable drainage systems' include standards S7, S8 and S9.

4.71. Standard S7 states:

'S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.'

4.72. Standard S8 states:

'S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (eg pumping station or electricity substation) within the development.'

4.73. Standard S9 states:

'S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.'

4.74. **Table J** demonstrates how the proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'

Table J: Compliance with Non-statutory technical standards for sustainable drainage systems

Standard	Justification for compliance
Flood risk outside the development	
S1	N/A
Peak flow control	
S2	The peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 10, 30 and 1 in 100 year rainfall event never exceed the peak greenfield runoff rate for the same event.
S3	N/A.

Volume control	
S4	It is considered not reasonably practicable to constrain the runoff volume from the development in the 1 in 100 year, 6 hour rainfall event to the greenfield runoff volume for the same event. Therefore, it has been demonstrated that runoff rates from the development to any highway drain, sewer or surface water body up to the 1 in 100 year rainfall event, including climate change allowance, never exceeds the peak greenfield runoff rate for the same event.
S5	N/A.
S6	The runoff volume to any drain, sewer or surface water body is discharged at a rate that does not adversely affect flood risk, corresponding to less than QBAR.
Flood Risk within the development	
S7	The surface water drainage system will be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event.
S8	The surface water drainage system will be designed so that flooding does not occur during a 1 in 100 year rainfall event within the development.
S9	The design of the site ensures that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.
Structural integrity	
S10	Components would be designed to ensure structural integrity of the drainage system under anticipated loading conditions over the design life of the development.
S11	The materials specified by the designer at the detailed design stage would be of a suitable nature and quality for their intended use.
Designing for maintenance considerations	
S12	N/A. Pumping is not proposed.
Construction	
S13	The mode of construction with the existing drainage system would comply with the appropriate standards and be inspected by the relevant authority so would not be prejudicial to the structural integrity and functionally of the drainage system.
S14	Any damage to the drainage system would be rectified before the drainage system is completed to the satisfaction of the relevant authority.

Foul Water Drainage

4.75. Enquiries have been made to Wessex Water to establish the location of the existing public sewers in the vicinity of the site, the available capacity at the sewage treatment works, and the adequate point of connection to the public foul water sewer system for the proposed development. A copy of the Public Sewer map is reproduced in **Figure 6** below.

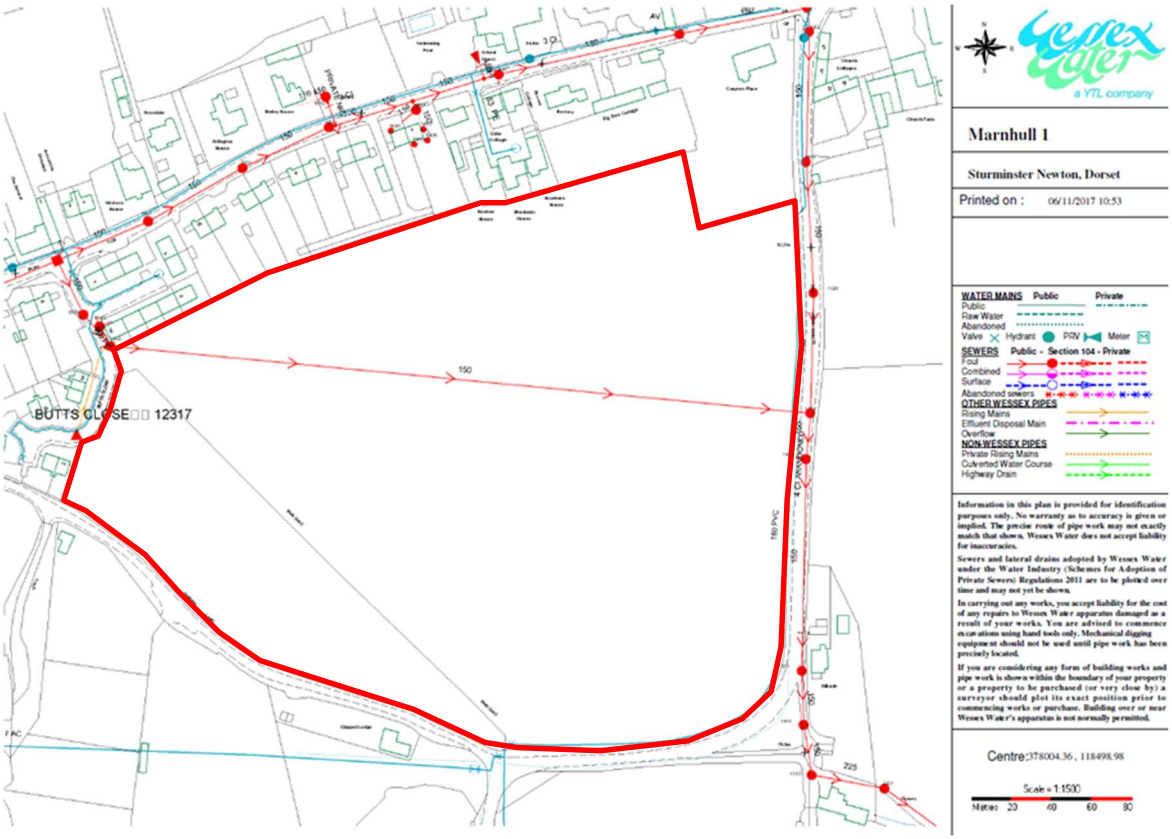


Figure 6: Public Sewer Map

4.76. The public sewer map indicates there is an existing public foul water sewer which crosses the site. The northern part of the site could drain directly to this sewer however, the southern part of the site will require a new gravity sewer to connect into the existing sewer at, or in the vicinity of, MH reference 1302 adjacent to Hillside off School House Lane to the east. The illustrative masterplan envisages a diversion of the existing sewer so as to enable the entire site to be drained by the main village sewer – this will require agreement from Wessex Water.

4.77. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

Maintenance Strategy

4.78. Paragraph 169 of the NPPF states that for major developments the sustainable drainage systems used should have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.

4.79. In terms of the maintenance strategy for the proposed drainage measures, the main surface and foul water drainage systems would be adopted by Wessex Water, in its role as sewerage undertaker, under a Section 104 Agreement of the Water Industry Act 1991. Wessex Water would therefore be responsible for the future maintenance of the adopted drainage systems

4.80. It is proposed that the SuDS system, ponds/detention basins, would be maintained by a Management Company.

4.81. Guidance on the operation and maintenance requirements of sustainable drainage systems is contained in The SuDS Manual 2015 (CIRIA C753). There are three categories of maintenance: regular, occasional and remedial. The Management Company would be responsible for putting in

place a suitable maintenance plan in accordance with the recommendations in CIRIA C753 'The SuDS Manual'. Outline maintenance procedures for the SuDS features are set out in Table K below.

Table K: Maintenance Procedures

Maintenance Schedule	Required Action	Frequency
Detention Basin		
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing seasons) or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chpater 23)
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required
Attenuation Storage Tanks		

Maintenance Schedule	Required Action	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

5. CONCLUSIONS

5.1. This Flood Risk Assessment has been prepared in connection with proposals for a residential development on land at Butts Close, Marnhull.

5.2. The overall site comprises approximately 8 hectares and is located approximately 8.5km to the south of Gillingham, and lies in the district of North Dorset.

5.3. The development proposals comprise up to 120 dwellings.

5.4. With reference to the Environment Agency's Flood Map for Planning, the site falls within Flood Zone 1, which has the lowest probability of flooding.

5.5. In relation to Flood Risk Vulnerability and Flood Zone 'Compatibility', the planning practice guidance to the NPPF advises that all uses of land are appropriate in Flood Zone 1. On this basis the sequential test is passed.

5.6. In addition to flooding from rivers, this Flood Risk Assessment has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

5.7. An assessment has been made of the potential risk from all sources of flooding to and from the development site, with reference to available flood risk information, for existing conditions pre-development, and post-development with the various development mitigation measures incorporated.

5.8. The SFRA, and historic flood information, provides an assessment of the impact of all other sources of potential flooding. Based on the SFRA and available information, there are no historic flood incidents recorded on the site from all sources of potential flooding.

5.9. The pre-development potential flood risk to the site from all sources of flooding is considered to be very low to low.

5.10. In terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood event, taking account of climate change.

5.11. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by Hazelbury Bryan Formation, Woodrow Clay Member and Cucklington Oolite Member.

5.12. A site investigation was undertaken by OMNIA in November 2022. As part of the site investigation, soakaway tests were carried out across the site in accordance with BRE Digest 365. An effective depth was not reached in all soakaways across the site due to the cohesive nature of the fine-grained soils found on the site. Therefore, infiltration tests were not calculated. Winter Groundwater monitoring was also undertaken by Omnia in November 2022 and March 2023. The Omnia report indicates that the base of the majority of the proposed SuDS features shown on the Indicative Surface Water Drainage Strategy Plan would be above the maximum winter groundwater level. The proposed underground storage (GS1) would be below the maximum groundwater level; at the detailed design stage, suitable measures should therefore be provided to prevent floatation.

5.13. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

5.14. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

5.15. Greenfield runoff peak flow rates have been derived using the guidance in the Environment Agency's 'Rainfall runoff management for developments' Report – SC030219 published in October 2013. In accordance with this guidance the limiting discharge for any return period up to the 100 year event would not be greater than the mean annual peak rate of runoff for the greenfield site, referred to as $Q_{BAR,}$ which approximates to a return period of 2.3 years, and hence a reduced rate of runoff for higher return periods.

5.16. By limiting the development rate of runoff to the mean annual peak rate of runoff, Q_{BAR}, for all rainfall events up to the 1 in 100 year return period event, including an allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield rates.

5.17. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event taking account of climate change.

5.18. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would therefore ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

5.19. The proposed surface water drainage measures would ensure the proposed development satisfies the peak flow control standards and volume control technical standards in the Government's 'Non-statutory technical standards for sustainable drainage systems'.

5.20. The Micro Drainage calculations contained in this Flood Risk Assessment demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

5.21. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

5.22. The proposed foul and surface water drainage arrangements can be covered by a suitably worded condition requiring the submission of details to be submitted to and approved by the Local Planning Authority.

5.23. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere, and would reduce flood risk overall.

Appendices

Appendix 1

SUMMARY

Site Area 7.99ha

N. of dwellings 120 units

HOUSING MIX

- 2 Bedroom units 79m2 (33no.)
- 3 Bedroom units 93m2 (31no.)
- 3 Bedroom units 97m2 (6no.)
- 3 Bedroom units 102m2 (13no.)
- 4 Bedroom units 106m2 (2no.)
- 4 Bedroom units 116m2 (6no.)
- 4 Bedroom units 135m2 (5no.)

Total of 96 housing units

PARKING

- 192 allocated parking spaces
- 27 garages
- 15 visitors parking

BUNGALOW MIX

- 2 Bed Bungalow 76m2 (4no.)
- 2 Bed Bungalow 77m2 (11no.)
- 2 Bed Bungalow 95m2 (3no.)
- 3 Bed Chalet Bungalow 115m2 (6no.)

Total of 24 bungalow units

PARKING

- 48 allocated parking spaces
- 24 garages
- 4 visitors parking

- Indicative proposed main vehicular access
- Indicative proposed emergency access
- Red line boundary
- Soft buffer

60% Open market (72 units)
40% Affordable housing (48 units)
(AR) 17% Affordable Rent = 8 units
(FH) 52% First Home = 25 units
(SO) 31% Shared Ownership = 15 units

Notes:

- All drawings are subject to Planning and Building Control consent.
- The details shown are for design intent purposes only and are subject to further design development with suppliers and sub-contracters
- Proposals subject to consultation and approval from Local Authority Building Control or an Approved Inspector
- All setting out dimensions should be checked on-site prior to construction and any discrepancies and/or omissions should be reported to the Architect immediately

0 5 10 15 20 25m

Scale 1:500

Rev.	Date	Details	Drawn	Chckd
*	06.04.23	Issued for planning.	MBC	JT

Drawn By: MBC Date: 14.02.23 Checked By: JT Date: 14.02.23

Issued for:

PLANNING

Drawing: Proposed Site Layout Butts Close, Marnhull

Project No: 22039

Scale: 1:500 @A0

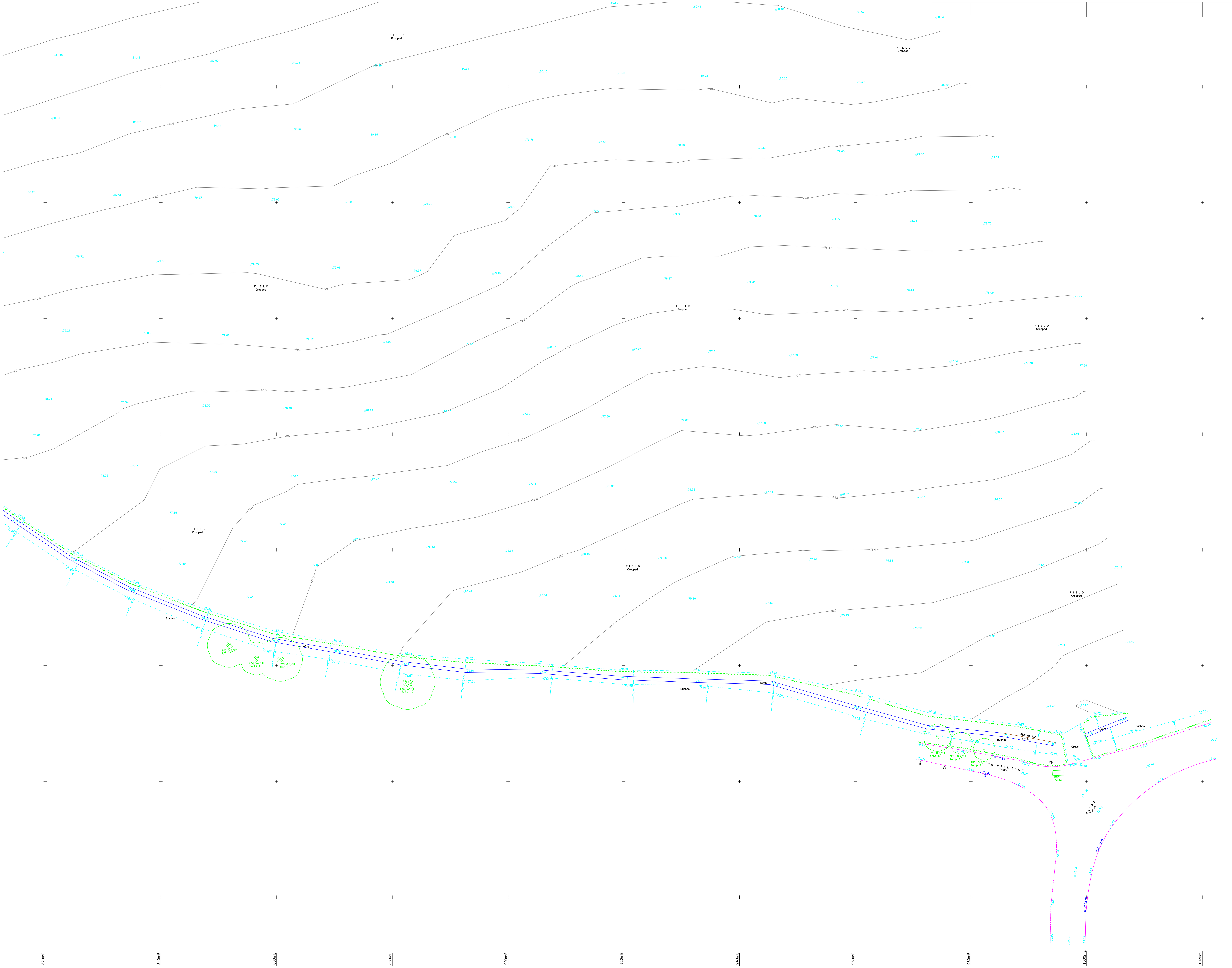
Project/Client: Marnhull Commercial Centre & Residential Sites

Dwg No: P201

Rev: *

BrightSPACE architects
27 Glasshouse Studios, Fryern Court Road, Fordingbridge, Hampshire, SP6 1QX
T: (01425) 655806
www.brightspacearchitects.com

Appendix 2



DRAINAGE
Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only and therefore the complete accuracy of this information cannot be guaranteed

NORTHPOINT
The survey grid is based on arbitrary co-ordinates and the Northpoint is indicative only

LEVELS
Levels are related to an OSBM Value 86.536m located on Jasmine Cottage, New Street, Marnhull

Total Survey Solutions
Land & Building Survey Consultants

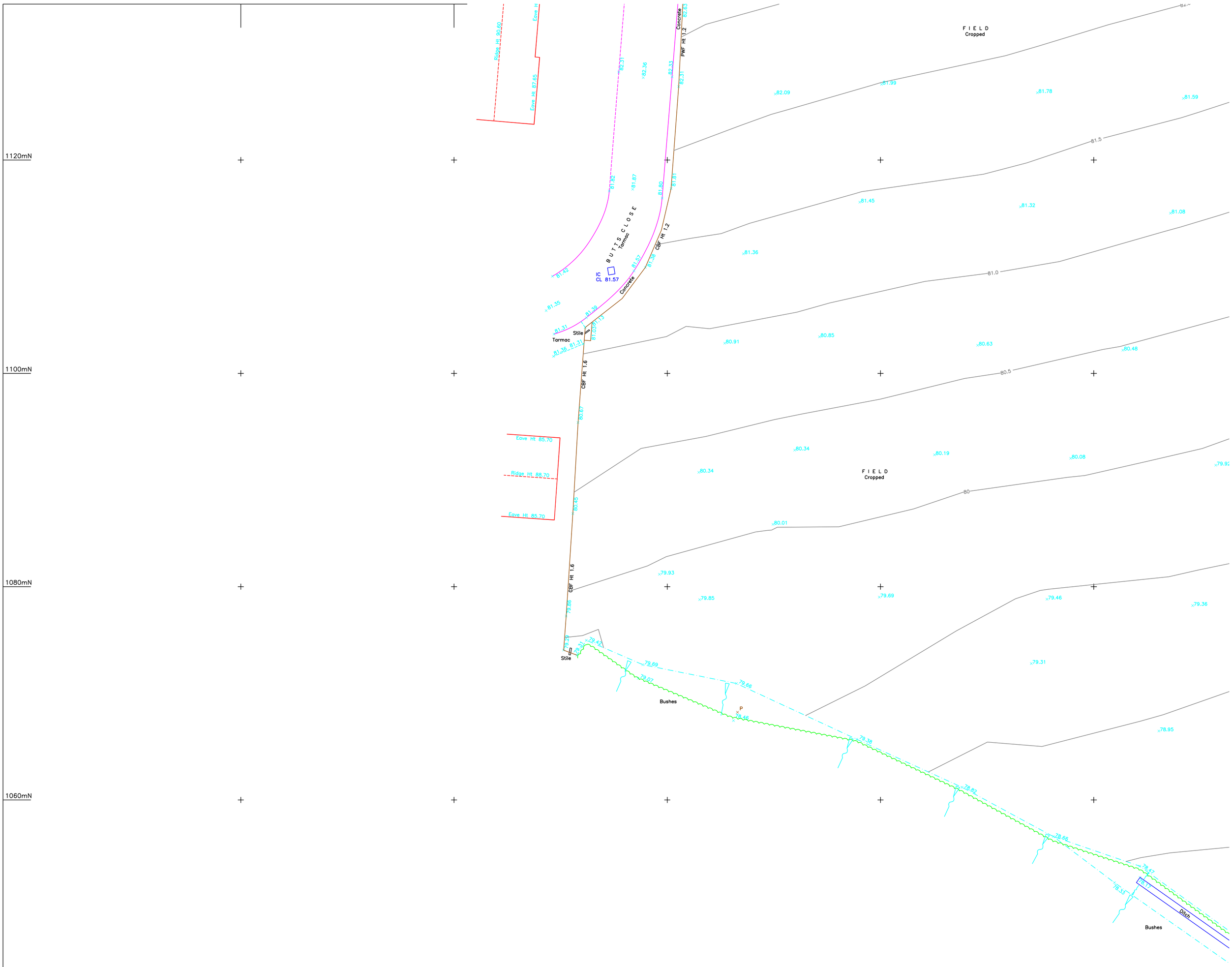
Unit F1
10 Whittle Road
Ferndown Ind Est
Dorset
BH21 7RU

Tel 01202 897319

www.totalsurveysolutions.co.uk

Client	Savills on behalf of P and D Crocker		
Location	Site 2, Land off Chippel Lane Marnhull DT10 1QB		
Type of Survey	Topographical		
Scale	1:200	**Date**	Nov 2017
Ref No	161117–2666–2	**Q A Checked**	rf
Drawing Number	1 of 1	**Revision**	

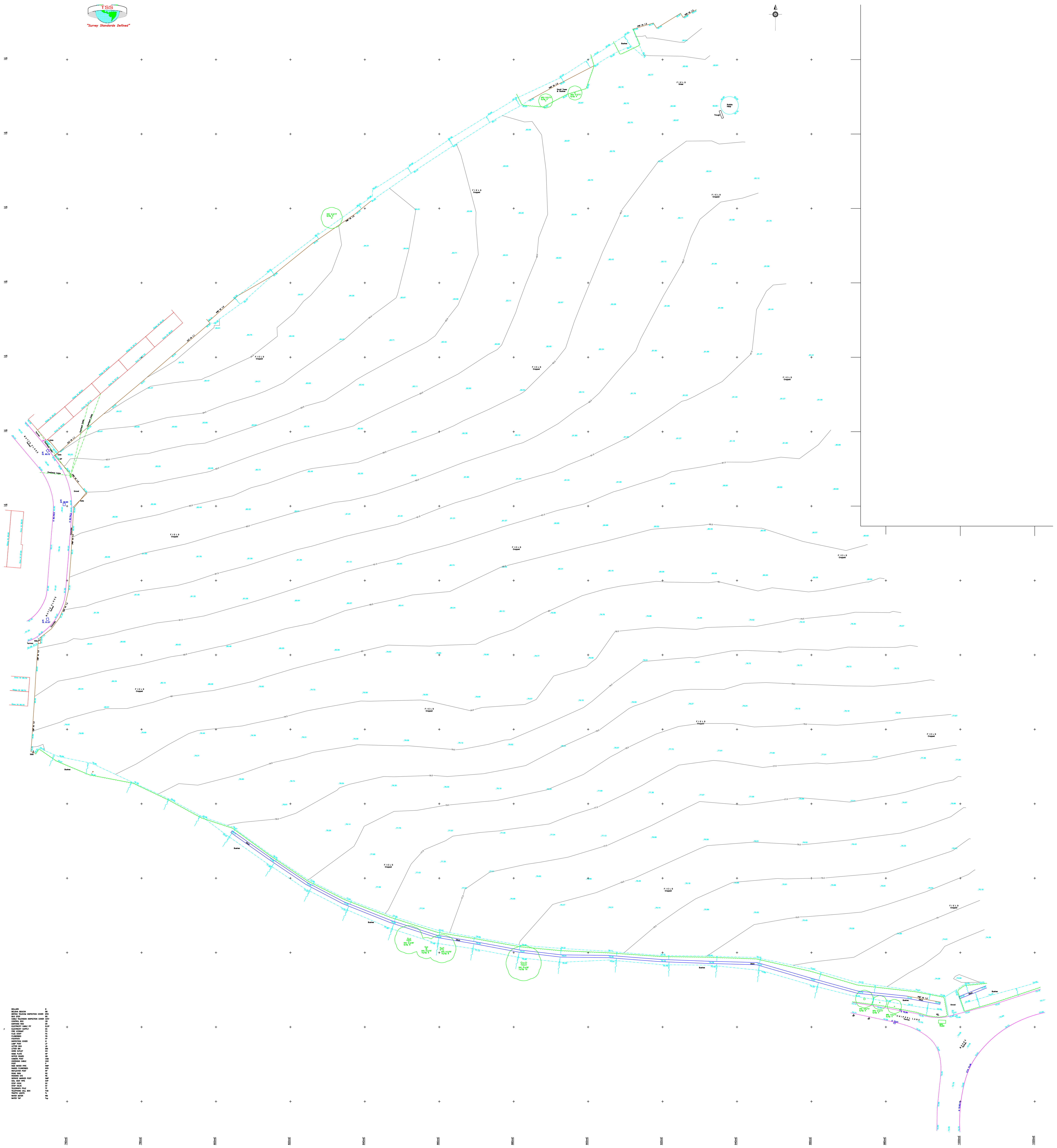

1280mN
1260mN
1240mN
1220mN
1200mN
1180mN
1160mN
1140mN
TSS
"Survey Standards Defined"
F I E L D
Grass
F I E L D
Cropped
F I E L D
Cropped
F I E L D
Cropped
F I E L D
Cropped
F I E L D
Cropped
Bushes
Small Trees & Bushes
Rubble Heap
Trough
Gate
Gravel
Overhead Cable



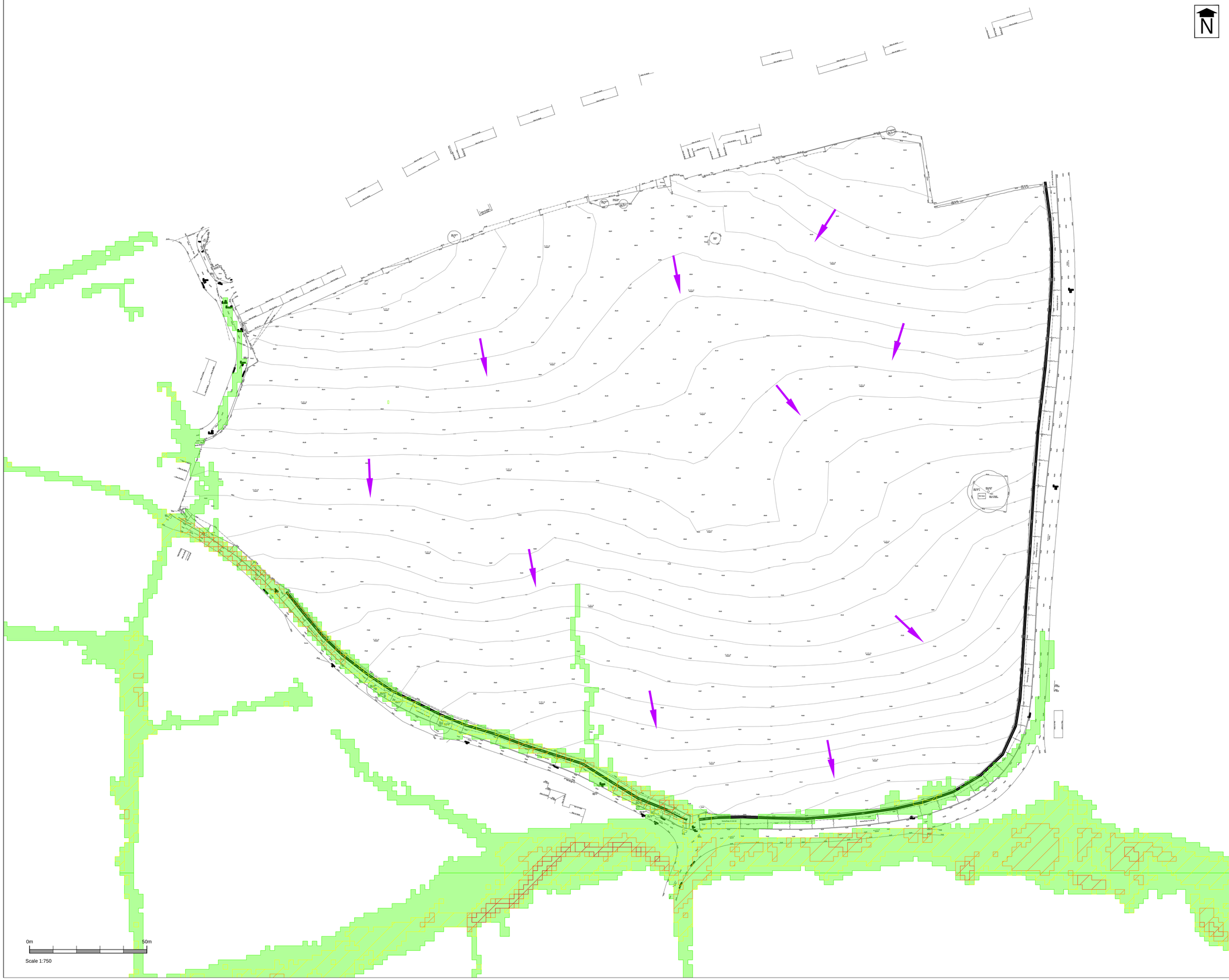
LEGEND

ALDER	ALD	BARBED WIRE FENCE	BWF	BOLLARD	B
ASH	ASH	CORRUGATED IRON FENCE	CIF	BELISHA BEACON	BB
BEECH	BCH	CLOSE BOARD FENCE	CBF	BRITISH TELECOM INSPECTION COVER	BTIC
CEDAR	CED	CHAIN LINK FENCE	CLF	BUS STOP	BS
CHERRY	CHY	CRASH BARRIER	CB	CABLE TELEVISION INSPECTION COVER	CATV
DEAD	DED	IRON RAILINGS	IRF	CONTROL BOX	CB
ELM	ELM	INTERWOVEN FENCE	IWF	EARTHING ROD	ER
FIR	FIR	LARCH LAP FENCE	LLF	ELECTRICITY CABLE PIT	ELCP
FRUIT	FRT	MISCELLANEOUS FENCE	Misc F	ELECTRICITY SUPPLY	ES
HAWTHORN	HAW	POST AND CHAIN FENCE	PCF	FIRE HYDRANT	FH
HAZEL	HZL	POST AND RAIL FENCE	PRF	FLAG STAFF	FS
HOLLY	HLY	POST AND WIRE FENCE	PWF	FLOWERBED	FB
HORSE CHESTNUT	HCH	WIRE MESH FENCE	WMF	FOOTPATH	FP
HORNBEAM	HRM	TRELLIS	TLS	INSPECTION COVER	IC
LIME	LIM	RETAINING WALL	RWall	LAMP POST	LP
LOCUST	LOC			LETTER BOX	LB
LONDON PLANE	LPN	BED LEVEL	BL	LITTER BIN	BIN
MAGNOLIA	MAG	COVER LEVEL	CL	KERB OUTLET	KO
MAPLE	MPL	DAMP PROOF COURSE	DPC	NAME PLATE	NP
OAK	OAK	FLOOR LEVEL	FL	NOTICE BOARD	NB
PINE	PNE	INVERT LEVEL	IL	CAMERA POST	CAM
POPLAR	POP	OUTFALL LEVEL	OL	OVERHEAD CABLE	OHC
PRUNUS	PNS	THRESHOLD LEVEL	THL	POST	P
RHODODENDRONS	RDN	FOUL WATER	FW	RAIN WATER PIPE	RWP
ROWAN	RWN	SURFACE WATER	SW	RAISED FLOWERBED	RFB
SILVER BIRCH	SIB	UNABLE TO LIFT	UTL	REFLECTOR POST	RP
SORBUS	SOR	OBSTRUCTED	OBS	ROAD SIGN	RS
SWEET CHESTNUT	SCH	WATER LEVEL	WL	RODDING EYE	RE
SYCAMORE	SYC			SERVICE MARKER POST	SMP
WALNUT	WNT	CONCRETE	Conc	SOIL VENT PIPE	SVP
WILLOW	WLW	PAVING SLABS	PS	STOP COCK	SC
YEW	YEW	BRICK PAVING	BP	STOP VALVE	SV
SPECIES UNKNOWN	SPU	STONE SETS	SS	TELEGRAPH POLE	TP
		TACTILE PAVING	Tac	TELEPHONE CALL BOX	TCB
		DRAINAGE CHANNEL	DRC	TRAFFIC LIGHTS	TL
				WATER METER	WM
				WATER TAP	Tap

TREES .3 / 3T / 12 / Sp 10
(Bol Size) (No of Bols) (Height) (Spread)
Spreads and heights are indicative only


TSS
"Survey Standards Defined"
F I E L D
Cropped
BOLLARD B
BELISHA BEACON BB
BRITISH TELECOM INSPECTION COVER BTIC
BUS STOP BS
CABLE TELEVISION INSPECTION COVER CATV
CONTROL BOX CB
EARTHING ROD ER
ELECTRICITY CABLE PIT ELCP
ELECTRICITY SUPPLY ES
FIRE HYDRANT FH
FLAG STAFF FS
FLOWERBED FB
FOOTPATH FP
INSPECTION COVER IC
LAMP POST LP
LETTER BOX LB
LITTER BIN BIN
KERB OUTLET KO
NAME PLATE NP
NOTICE BOARD NB
CAMERA POST CAM
OVERHEAD CABLE OHC
POST P
RAIN WATER PIPE RWP
RAISED FLOWERBED RFB
REFLECTOR POST RP
ROAD SIGN RS
RODDING EYE RE
SERVICE MARKER POST SMP
SOIL VENT PIPE SVP
STOP COCK SC
STOP VALVE SV
TELEGRAPH POLE TP
TELEPHONE CALL BOX TCB
TRAFFIC LIGHTS TL
WATER METER WM
WATER TAP Tap
760mE

Appendix 3



PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
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KEY

Site Boundary

Overland Flow Routes

Flood Constraints

Low risk of Surface Water Flooding (Between 1 in 100 (1%) and 1 in 1000 (0.1%))

Modeled Surface Water Depths Low Risk (1 in 1000) Event (m)

0.30–0.60

0.60–0.90

0.90–1.20

>1.20

NOTES

1. Topographical Survey produced by Total Survey Solutions, dated: September 2022

2. Surface water flood risk zones based on the extract from Environmental Agency website (RoFSW–ST71, Dated September 2022)

3. Contains Public sector information licensed under the Open Government Licence v3.0

Rev	Date	Description	Drawn	Check
#	xx/xx/xx	First Issue.	IS	xx

Status

FOR INFORMATION

Client

Chapman Lily Planning Ltd

Project

Butts Close, Marnhull

Drawing Title

Flood Constraints Plan

Drawing No.

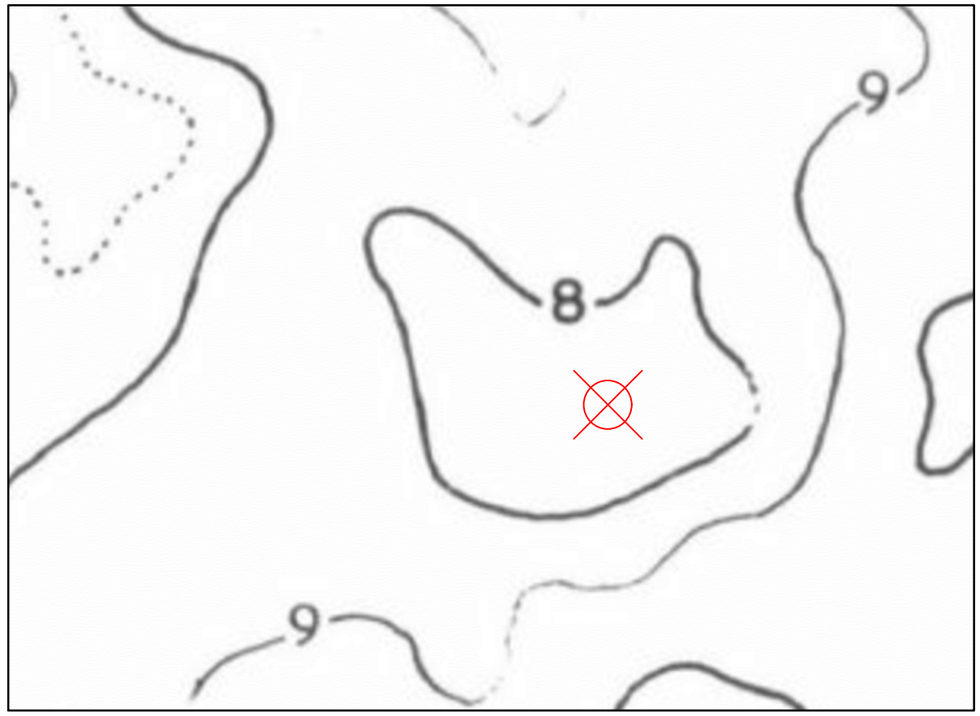
C798/21

Date: April 2023 | Scale: 1:750 @ A1

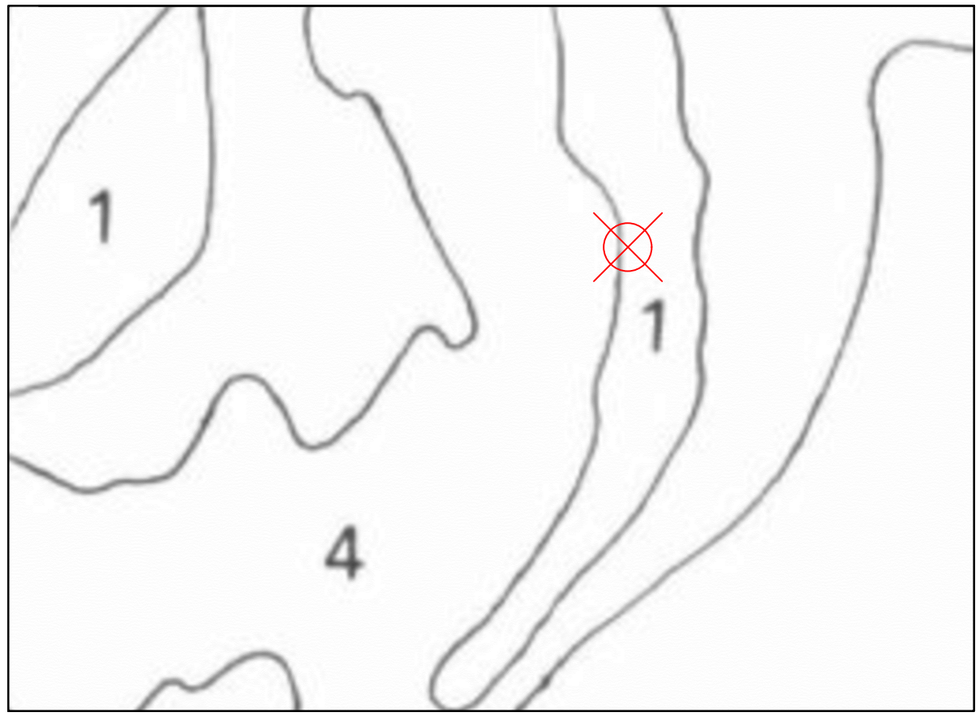
E-Mail: istevenson@pfaplc.com

Appendix 4

Location Plan



Standard Average Annual Rainfall (SAAR) (in hundreds of mm)



Winter Rain Acceptance Potential (WRAP)

PFA consulting

Stratton Park House, Wanborough Road
Swindon, SN3 4HG

Telephone
01793 828000

Website
www.pfaplc.com

NOTES

1. Standard Average Annual Rainfall (SAAR) and Winter Rain Acceptance Potential (WRAP) map extracts shown on this drawing are reproduced from the maps contained in Volume V of the Flood Studies Report – NERC: 1975.

Soil Classification			
Soil Class (WRAP)	Soil Index (IoH)	SPR (FEH)	St (ADAS)
1	0.15	10	0.1
2	0.30	30	0.5
3	0.40	37	0.8
4	0.45	47	1.0
5	0.50	53	1.3

Rev	Date	Description	Drawn	Check
#	03/11/17	First Issue.	NS	GE

Status
FOR PLANNING

Client
LANDS AT MARNHULL

Project
P & D CROCKER

Drawing Title
SAAR and WRAP Maps

Drawing No.
C798/01

Date: November 2017 | Scale: Not to Scale

E-Mail: nszczap@pfaplc.com