

**Flood Risk and Drainage
Site Appraisal**
January 2020

The logo for EAS (Environmental Assessment Services) is a dark blue square with the letters 'EAS' in white, sans-serif font.

Bedlam Farm

**Milton Road, Impington
Cambridgeshire**

Chivers Farms Ltd.

Document History

JOB NUMBER: 2605/2020
DOCUMENT REF: Flood Risk and Drainage Site Appraisal
REVISIONS: A - Draft

Revision	Comments	By	Checked	Authorised	Date
A	Client Draft	ML	SA	SA	30/01/2020
B					
C					
D					
E					

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1 Introduction

- 1.1 EAS has been commissioned by Chivers Farms Ltd to prepare a Site Appraisal for land at Bedlam Farm, Milton Road, Impington, Cambridgeshire. This document has been prepared to inform site representations to the Greater Cambridge Local Plan Regulation 18 Issues and Options consultation.
- 1.2 The contents of this report form a preliminary assessment of the site in terms of flood risk and drainage.
- 1.3 The site is located to the north of Milton Road and is to the east of Impington and is surrounded by arable and agricultural land on all sides.
- 1.4 The 2.12ha site is currently a mixture of agriculture, commercial B1 and B2 and redundant residential buildings and a location plan is contained within Appendix A. For the purposes of this report it is proposed that the redundant residential dwellings will be demolished and the site will be redeveloped for commercial use, an illustrative masterplan has been included within Appendix G.
- 1.5 The site falls wholly within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps . It is also shown to be predominantly at very low risk of surface water flooding with some small isolated areas at risk of surface water flooding. This document will review the above risks further and provide advice to support the site representation and future masterplanning of the site.
- 1.6 This report is based on EA Flood Maps, South Cambs Strategic Flood Risk Assessment (SFRA), Cambridgeshire County Council Surface Water Management Plan (SWMP), BGS geological information and Anglian Water sewer records.
- 1.7 The report is set out as follows:
 - Section 2 – sets out the relevant flood risk and drainage policy background.
 - Section 3 – reviews and discusses the flood risk to the development and the future development drainage.
 - Section 4 – provides a brief review of surface water drainage requirements
 - Section 5 – provides a brief review of foul drainage solutions.
 - Section 6 – summarises the findings of the report.

2 Policy Background

Introduction

- 2.1 This section sets out the current local policy and examines the local strategic documents for flood risk and drainage matters.

Adopted South Cambridgeshire Local Plan (2014)

Policy CC/9: Managing Flood Risk

- 2.2 The policy states that:

1. "In order to minimise flood risk, development will only be permitted where:
 - a. The sequential test and exception tests established by the National Planning Policy Framework demonstrate the development is acceptable (where required).
 - b. Floor levels are 300mm above the 1 in 100 year flood level plus an allowance for climate change where appropriate and practicable also 300mm above adjacent highway levels.
 - c. Suitable flood protection/mitigation measures are incorporated as appropriate to the level and nature of flood risk, which can be satisfactorily implemented to ensure safe occupation, access and egress. Management and maintenance plans will be required, including arrangements for adoption by any public authority of statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime;
 - d. There would be no increase to flood risk elsewhere, and opportunities to reduce flood risk elsewhere have been explored and taken (where appropriate), including limiting discharge of surface water (post development volume and peak rate) to natural greenfield rates or low, and
 - e. The destination of the discharge obeys the following priority order:
 - I. Firstly, to the ground via infiltration;
 - II. Then, to a water body;
 - III. Then, to a surface water sewer
 - IV. Discharge to a foul water or combined sewer is unacceptable.
2. Site specific Flood Risk Assessments (FRAs) appropriate to the scale and nature of the development and the risks involved, and which takes account of future climate change, will be required for the following:
 - f. Development proposals over 1ha in size;
 - g. Any other development proposals in flood zones 2 and 3;
 - h. Any other development proposals in flood zone 1 where evidence, in particular the Strategic Flood Risk Assessment or Surface Water Management Plans, indicates there

are records of historic flooding or other sources of flooding, and/or a need for more detailed analysis.

3. FRAs will need to meet national standards and local guidance (including recommendations of the South Cambridgeshire and Cambridge City Strategic Flood Risk Assessment (2010) and the Phase 1 and 2 Water Cycle Strategy or successor documents)."

Policy CC/8: Sustainable Drainage Systems

2.3 The policy is as follows:

"Development proposals must incorporate appropriate sustainable surface water drainage systems (SuDS) appropriate to the nature of the site. Development proposals will be required to demonstrate that:

- a. Surface water drainage schemes comply with the Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems and the Cambridgeshire Flood and Water Supplementary Planning Document or successor documents;
- b. Opportunities have been taken to integrate sustainable drainage with the development, create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space;
- c. Surface water is managed close to its source and on the surface where it practicable to do so;
- d. Maximum use has been made of low land take drainage measures, such as rain water recycling, green roofs, permeable surfaces and water butts;
- e. Appropriate pollution control measures have been incorporated, including multiple component treatment trains; and
- f. Arrangements have been established for the whole life management and maintenance of surface water drainage systems."

Policy CC/7: Water Quality

2.4 The policy states:

1. "In order to protect and enhance water quality, all development proposals must demonstrate that:
 - a. There are adequate water supply sewerage and land drainage systems (including water sources, water and waste water infrastructure) to serve the whole development, or an agreement with the relevant service provide to ensure the provision of the necessary infrastructure prior to the occupation of the development. Where development is being phased, each phase must demonstrate sufficient water supply and waste water conveyance, treatment and discharge capacity;
 - b. The quality of ground, surface or water bodies will not be harmed and opportunities have been explored and taken for improvements to water quality, including renaturalisation of river morphology, and ecology;

- c. Appropriate consideration is given to sources of pollution, and appropriate Sustainable Drainage Systems (SuDS) measures incorporated to protect water quality from polluted surface water runoff.
2. Foul drainage to a public sewer should be provided wherever possible, but where it is demonstrated that it is not feasible, alternative facilities must not pose unacceptable risk to water quality or quantity.”

South Cambridgeshire and Cambridge City Level 1 Strategic Flood Risk Assessment (SFRA) September 2010

- 2.5 The SFRA objectives are to:
- Assess the risks from all forms of flooding affecting the SCDS and CCC area;
 - Provide a reference and policy document to inform the preparation of future LDF documents;
 - Ensure that SCDC and CCC meet their obligations under the current PPS25 and Local Development Framework Policy guidelines and standards;
 - Inform the Sustainability Appraisal so that flood risk is taken into account when considering options and in the preparation of land use policies;
 - Provide a sufficient level of detail to allow SCDC and CCC to undertake the Sequential Test;
 - Advise and inform private and commercial developers of their obligations under PPS25 in relation to sustainable development and flood risk.
- 2.6 Appendix C2 and C2.2 illustrate that there is low potential for infiltration at this site.
- 2.7 Appendix C3 confirms that the site is not within a Source Protection Zone.
- 2.8 Appendix D1.2 shows that the site is not at risk of fluvial flooding.
- 2.9 Tables 4a and 4b from the SFRA contain historic flood records from sources including rivers, highway drainage and sewers and there are no records of historic flooding within the site or along Milton Road in Impington.
- 2.10 In summary no evidence is presented within the SFRA which indicates that the development site is at a risk of flooding from any source.

Cambridgeshire County Council Surface Water Management Plan (SWMP) August 2011 and County Wide Update (2014)

- 2.11 The SWMP was originally published in 2011 and was updated in 2014.
- 2.12 The objectives of the SWMP are to:
- Engage with partners and stakeholders
 - Map historical flood incident data
 - Map surface water influenced flooding locations

- Identify areas at risk of surface water flooding referred to as “wetspots”
- Identify measures, assess options and confirm preferred options to mitigate against surface water flooding in the prioritised “wetspots”
- Make recommendations for next steps

2.13 The update was to ensure that flooding incidents between 2011 and 2014 were taken in to consideration due to instances of surface water flooding across the County.

3. Flood Risk Assessment

- 3.1 A copy of the Environment Agency's current Flood Map included in Appendix B shows the development site to be located wholly in Flood Zone 1, and therefore deemed to be at a low risk of fluvial flooding.
- 3.2 The NPPF requires that for a development site located within Flood Zone 1 which is larger than one hectare, an FRA must accompany the planning application which demonstrates that the proposals would not be exposed to an unsatisfactory level of flood risk, and would not result in an increase in the existing level of flood risk to the surrounding area.
- 3.3 In addition to the requirements of the NPPF and as a result of changes to the roles of Lead Flood Authorities, from 15 April 2015 all major applications (over 10 dwellings) submitted to the Lead Local Flood Authority (LLFA) which for this site is Cambridgeshire County Council and must include a 'Surface Water Drainage Strategy' which will set out the appropriateness of SuDS to manage surface water run-off, including the provision of the maintenance for the lifetime of the development which they serve. Major applications which do not meet this requirement will not be made valid.
- 3.4 The site is not within an area managed by an Internal Drainage Board (IDB).

Local Policy

- 3.5 From a review of the South Cambridgeshire and Cambridge City Council SFRA undertaken in Section 2 of this report, there were no sources of flooding identified which would impact on the development site nor historic flooding incidents associated with the site.

Sources of Flooding

- 3.6 **Fluvial Watercourses:** A copy of the Environment Agency's Flood Map for the area is included in Appendix B. The mapping shows that the site is located within Flood Zone 1 and therefore deemed to be at a low risk of fluvial flooding; less than a 0.1% annual probability of flooding from fluvial sources.
- 3.7 **Groundwater:** The site has a bedrock of Gault formation (mudstone) and no recorded superficial deposits. The area is shown to have unproductive groundwater vulnerability in DEFRA's Magic Map.
- 3.8 Appendix C2 and C2.2 of the SFRA show that there is low potential for infiltration whilst appendix B3 confirms that there are no recorded incidents of groundwater flooding at this location. The Flood Incidents Register contained within the 2015 Cambridgeshire County Council Surface Water Management Plan also shows include any records of groundwater flooding. The register held no records of groundwater flooding at this location.
- 3.9 BGS borehole data shows four records within 1km of the site. The nearest record is approximately 700m to the south east of the site which struck groundwater at 24.5m below ground level with a rest level 5.98m below ground level. As such, the risk of groundwater flooding at the site is considered to be low.
- 3.10 **Sewer Flooding:** Anglian Water sewer records show that a rising main is located along the northern boundary of the site. There are no other sewers within close proximity to the site. Table 4b of the SFRA does not indicate any sewer flooding incidents close to the site. Any

new units would be provided within the southern portion of the site therefore sewer flooding is not considered to be a significant flood risk to the development site.

- 3.11 **Surface Water/Overland Flow:** The EA surface water flood map shows the majority of the site to be at very low risk of flooding from surface water with the majority of surface water contained within the watercourse which bisects the site. The mapping also shows that there is a low point between the two large existing buildings in the northern half of the site, this area is at high risk with low flood depths below 300mm as seen in Appendix C. The low risk event (0.1-1% annual probability) also shows some low flood depths surrounding the watercourse, both of these are likely to be due to low topographic points in the site. It is recommended that a topographic survey is carried out on site to determine the site levels however, these small areas of surface water flood risk are unlikely to represent any causes for concern and could be mitigated against as part of any development proposal.
- 3.12 It is important that an effective surface water drainage system is included in the proposed development to ensure surface water runoff does not pose a significant flood risk to the development or to adjacent land and properties. This has been discussed further in the next section.
- 3.13 **Artificial Sources:** The EA flood map shows that there is no risk of flooding from reservoirs.

4 Surface Water Drainage

- 4.1 The NPPF states within Flood Zone 1, “developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques (SuDS)”.
- 4.2 SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.
- 4.3 The SuDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:
- Discharge to ground.
 - Discharge to a surface water body.
 - Discharge to a surface water sewer.
 - Discharge to a combined sewer.
- 4.4 The philosophy of SUDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:
- Reducing runoff rates, thus reducing the flood risk downstream.
 - Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
 - Groundwater recharge.
 - Contributing to the enhanced amenity and aesthetic value of development areas.
 - Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site-Specific SuDS

- 4.5 The site geology is a bedrock Gault Mudstone formation with no recorded superficial deposits (taken from BGS geology mapping) and therefore an attenuation strategy would be required.
- 4.6 The site is mostly flat with a slight fall from south to north and east to west. There are two watercourses within the site, the first as mentioned above bisects the site and flows from east to west across the middle of the site before joining the second watercourse which runs adjacent to the access track from Milton Road to the northern boundary of the site before heading west.
- 4.7 Previous experience working with Cambridgeshire County Council (CCC) has identified the requirement for source control measures to be included across the site. The use of

permeable paving, bioretention areas, green roofs and rainwater harvesting are all considered to be source control measures and therefore would need to be included in any drainage strategy to satisfy CCC when submitting a planning application.

- 4.8 An assessment of the volume of storage has been based on the 1 in 1 year greenfield runoff rate for the site assuming a connection to a watercourse. This would meet the requirements of the LLFA.
- 4.9 To understand the scale of attenuation volume that might be required at the site, Micro Drainage was used to estimate greenfield runoff rates based on an impermeable site area of 1.02 hectares. The estimated runoff rates are:

$$Q_{BAR} = 3.3 \text{ l/s/ha (3.4 l/s)}$$

$$Q_{1 \text{ year}} = 2.9 \text{ l/s/ha (3.0 l/s)}$$

$$Q_{30 \text{ year}} = 8.0 \text{ l/s/ha (8.2 l/s)}$$

$$Q_{100 \text{ year}} = 11.8 \text{ l/s/ha (12.0 l/s)}$$

- 4.10 The MicroDrainage output is included in Appendix D.
- 4.11 A MicroDrainage Quick Storage Estimate was carried out to determine the likely storage volume required for a 1 in 100 year (+40% climate change) restricted to the 1 in 1 year greenfield runoff rate. The impermeable area has been determined by indicative figures provided within the illustrative masterplan included within Appendix G, i.e. an impermeable area of 1.02 hectares. This results in a required attenuation volume of 880m³. The Quick Storage Estimate parameters and results are included in Appendix E.
- 4.12 It is noted that this is disproportionately large volume of storage and discussion with the LLFA should be sought to determine whether a compromise on the 1 in 1 year discharge rate could be agreed to provide a significant betterment for the overall site including the existing buildings which currently discharge to the adjacent watercourse unattenuated.

5 Foul Water Drainage Assessment

- 5.1 There is a rising main which runs along the northern boundary of the site. Anglian Water records do not show any connections to the rising main and the closest gravity sewer is approximately 660m to the south.
- 5.2 It has been confirmed by Chivers Farms Ltd that the site is currently served by a sewage treatment plant (STP).
- 5.3 Given the distance to the closest sewer it is appropriate to utilise a sewage treatment plant for the proposed additional commercial buildings.
- 5.4 It is likely that the STP will need to be upgraded to ensure that the system has sufficient capacity and meets the requirements of the Environment Agency, Local Planning Authority and Building Regulations.
- 5.5 An Environmental Permit from the Environment Agency will be required where the General Binding Rules cannot be met.

6 Summary and Conclusions

- 6.1 This report has dealt with a proposed development which consists of the demolition of the existing residential dwellings and the redevelopment of the site for commercial use.
- 6.2 The site falls wholly within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps. It is also shown to be predominantly at very low risk of surface water flooding with small areas of flood risk with low depths. It is assumed that these areas are topographic low points and will be mitigated against by the new development. This will be also be mitigated by installing an effective surface water drainage system on the site.
- 6.3 The surface water drainage will be restricted to 1 in 1 year greenfield runoff rates and discharged to the watercourse within the site.
- 6.4 The following recommendations are made as a result of this assessment in order to demonstrate the feasibility of the proposals at a planning application stage:
- A) All sources of flooding have been considered by means of a desktop assessment and no significant risks have been identified.
 - B) The mudstone geology is unlikely to be suitable for infiltration drainage therefore an attenuation strategy is recommended.
 - C) The drainage strategy will be restricted and storage will be provided for all events up to and including the 1 in 100 year + 40% climate change event with at least one source control feature included within the design. It is recommended that discussions with Cambridgeshire County Council as the LLFA are sought to discuss whether a discharge rate higher than the 1 in 1 year greenfield runoff rate could be agreed if the runoff from the existing buildings is included within any new drainage design and therefore providing betterment from the whole site.
 - D) There is a rising main along the northern boundary of the site however, the closest gravity sewer is over 650m to the south of the site. The existing site is currently served by a sewage treatment plant and it is recommended that non-mains drainage is the most viable solution for this site.
 - E) It is likely that the sewage treatment plant will need to be upgraded as part of any future development.
- 6.5 In conclusion, the site is at low risk of flooding overall with practical and sustainable solutions for both foul and surface water drainage.

Appendices




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Appendix: A - Location Plan

Bedlam Farm, Milton



Legend

-  Area: 1.521ha (3.76ac)
-  Area: 2.12ha (5.24ac)
-  Access

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Trumpington Road, Cambridge, CB2 9LD



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Scale: 1:2,500 @ A4

OS Ref: TL 4564

Drawing No: A.52,701

Date: 15/03/2019

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Appendix: B – EA Flood Map for Planning









Flood map for planning

Your reference
Bedlam Farm

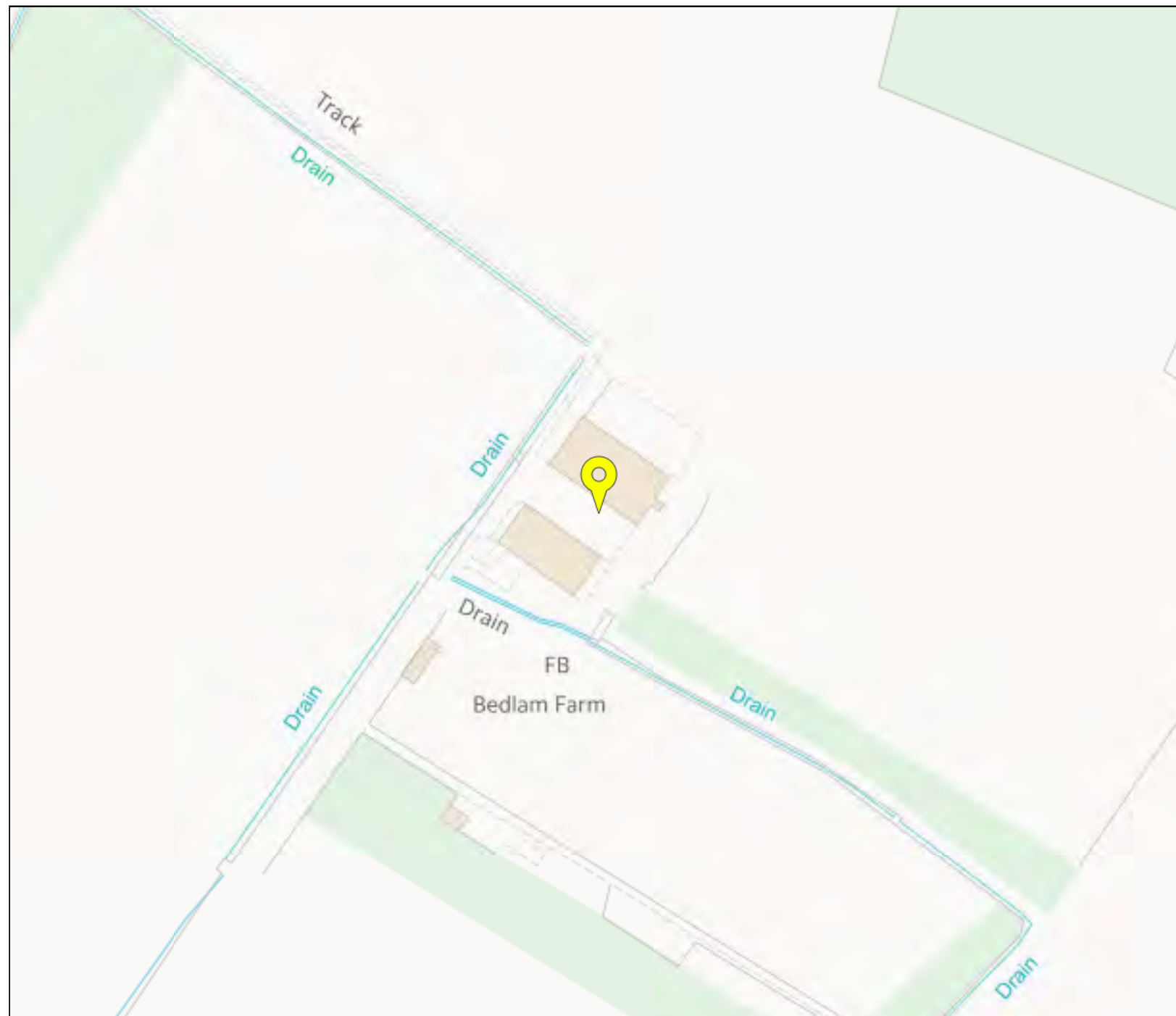
Location (easting/northing)
545975/264187

Scale
1:2500

Created
30 Jan 2020 12:24

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefiting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m



Appendix: C – EA Surface Water Flood Map



Source: Long Term Flood Risk Map (<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)

Appendix: D – Greenfield Runoff Rates

Unit 108 The Maltings
 Stanstead Abbotts
 Hertfordshire SG12 8HG



Date 31/01/2020 09:37
 File

Designed by Maz
 Checked by

Micro Drainage

Source Control 2013.1.1

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	550	Region Number	Region 5

Results 1/s

QBAR Rural 3.3
 QBAR Urban 3.3

Q100 years 11.8

Q1 year 2.9
 Q30 years 8.0
 Q100 years 11.8

Appendix: E – MicroDrainage Quick Storage Estimate

Storage for the 1 in 100yr + 40% climate change event

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall

Return Period (years) 100

Region England and Wales

Map

M5-60 (mm) 20.000

Ratio R 0.450

Cv (Summer) 0.750

Cv (Winter) 0.840

Impemeable Area (ha) 1.02

Maximum Allowable Discharge (l/s) 3.0

Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

Quick Storage Estimate

Micro Drainage

Results

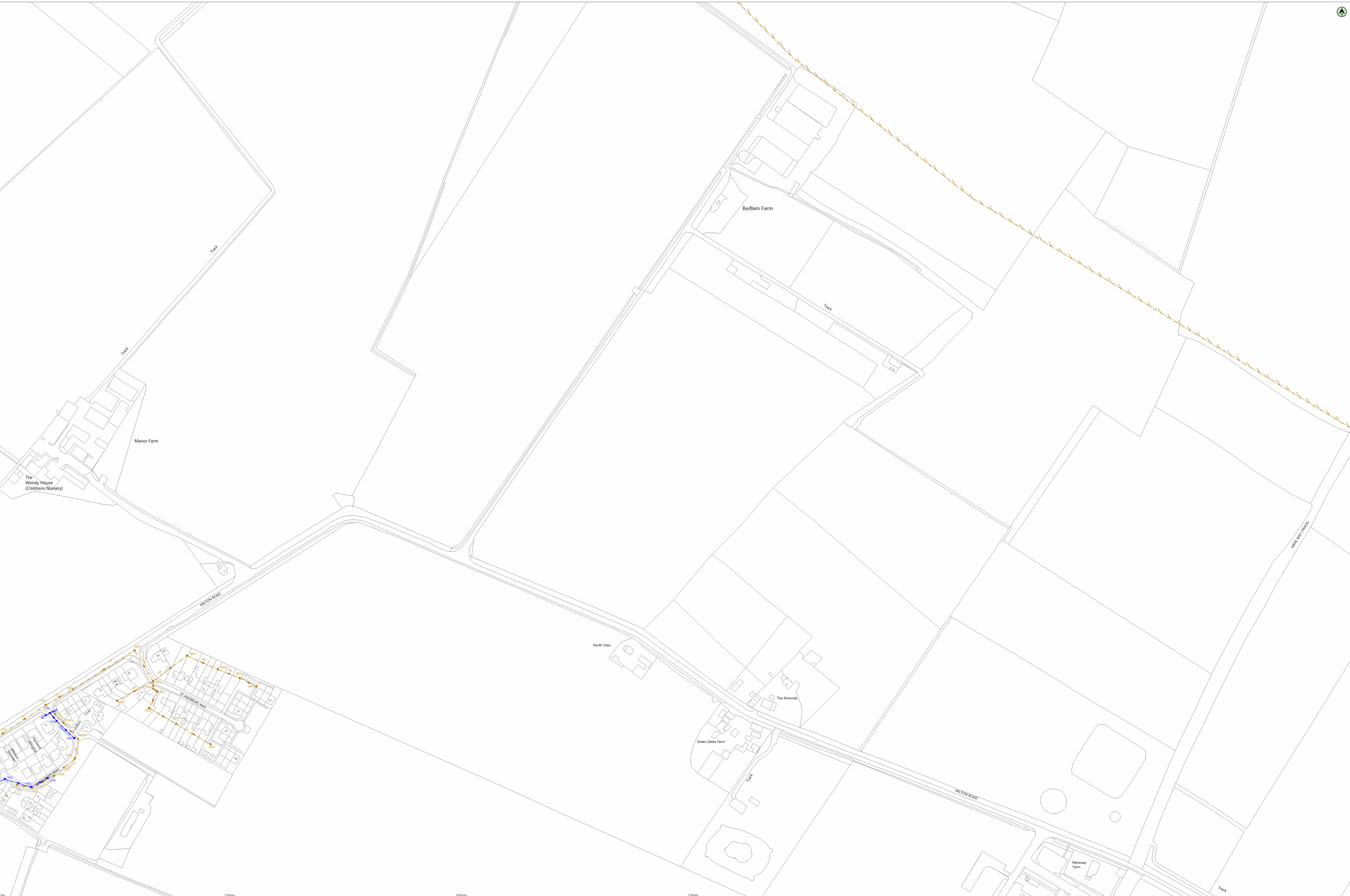
Global Variables require approximate storage of between 685 m³ and 880 m³.

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

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

Appendix: F – Anglian Water Sewer Records



0m 250m 500m 750m

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Date: 30/01/20	Scale: 1:1250	Map Centre: 545849.263852	Data updated: 02/12/19	Our Ref: 365018 - 1	Wastewater Plan A0
Foul Sewer		Outfall		Sewage Treatment Works	
Surface Sewer		Inlet		Public Pumping Station	
Combined Sewer		Manhole		Decommissioned Pumping Station	
Final Effluent				Private Sewer	
Rising Main				Decommissioned Sewer	


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	Bedlam Farm



Appendix: G – Illustrative Masterplan



KEY

 Site Boundary
(2.12ha)

INDICATIVE SCHEDULE:

Mixed B1, B2 & B8 Uses -

3,500sqm - 5,000sqm

INDICATIVE PLOT DENSITY RATIO:

Total Site Area: 2.12ha


Net Developable Area: 1.02ha

Proposed Floorspace: 3,500-5,000 sqm

PLOT DENSITY RATIO: 35-50%

Rev.	Date.	Details.
-	-	-

Do not scale from this drawing.
All dimensions to be checked on site. This plan is to be read with all accompanying documentation. © Bidwells 2020



Scale Bar: 0 50

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BEDLAM FARM, HISTON

ILLUSTRATIVE MASTERPLAN

Job Code: 57673 OS License Number: 100017734

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