Flood Risk and Drainage
Site Appraisal
January 2020

EAS

Newton Hall Industrial Estate

Newton, Cambridgeshire

Newton Hall Technical Services

EAS

Document History

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C					
D					
E					

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Contents

1 Introduction

1.1 EAS has been commissioned by Newton Hall Technical Services to prepare a Site Appraisal for Newton Hall Industrial Site, Town Street, Newton, 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 south of Town Street in Newton, with the Grade II listed Newton Hall to the west of the site and the Hoffer Brook along the southern boundary. The site is surrounded by agricultural land to the south beyond the Hoffer Brook.

1.4 The 4.97ha site is currently used as an industrial site and a location plan is contained within Appendix A. For the purposes of this report it is proposed that the site be developed as a retirement village with a 70 bed care home and approximately 100-120 smaller retirement dwellings with associated care and servicing facilities including a community hub.

1.5 The site falls predominantly within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps with a small area of Flood Zone 2/3 surrounding the Hoffer Brook to the south of the site. It is also shown to be at very low risk of surface water flooding with a small portion of the site at low 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 review of surface water drainage solutions
- 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 (2018)

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 proivision 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 high 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 southern boundary of the site and the land to the south are 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 within Newton itself.

2.10 In summary no evidence is presented within the SFRA which indicates that the majority of the development site is at a risk of flooding from any source. The SFRA shows that a small area along the southern boundary is at risk of flooding from the Hoffer Brook which is identified as land within Flood Zone 2 and 3. The local geology has been identified to have high potential for infiltration.

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 primarily 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 majority of 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 The Hoffer Brook along the southern boundary of the site is within Flood Zones 2 and 3 and has a small extent outside of its banks within the site which is also shown to be within Flood Zones 2 and 3. The extent within the brook itself and to the land south of the brook are shown to be within Flood Zone 3b as shown within Appendix D1.2 of the SFRA.

3.8 The Hoffer Brook is a tributary of the River Cam which is approximately 2.2km to the north of the site.

3.9 An allowance for climate change must be applied to the Flood Zone 3 extent to the site to determine the future impacts of climate change on the Hoffer Brook as part of a detailed FRA and analysed against a topographical survey of the site.

3.10 The climate change allowances applied to the Hoffer Brook flood levels are 35% for the Higher Central allowance and 65% for the Upper End in the Anglian region.

3.11 In the absence of the climate change impact analysis, it is recommended that as part of the initial master-planning that all built development remains outside of Flood Zone 2. This area can be utilised for landscaping and/or public open space but should remain free from all built development.

3.12 It is also recommended that a buffer zone of at least 8 metres is provided between the Hoffer Brook and any built development to provide a biodiversity and habitat corridor and sufficient space for maintaining the brook. This will provide a net biodiversity gain in close proximity to the Brook from the existing site.

3.13 **Groundwater:** The site has a bedrock of Zig Zag chalk formation and no superficial deposits. The area is shown to have a high groundwater vulnerability in DEFRA's Magic Map.

3.14 Appendix C2 and C2.2 of the SFRA show that there is high 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.

3.15 BGS borehole data shows two records within close proximity to the site. The nearest record is the well within the cellar of Newton Hall and groundwater was encountered at 12 feet (3.65m) below ground level in 1960. The second record is for Newton Farms in 2018 which is approximately 300m to the east of the site and ground water was struck at 4m below ground level. As such, the risk of groundwater flooding at the site is considered to be low.

3.16 **Sewer Flooding:** Anglian Water sewer records do not show any sewers in the vicinity of the site, and Table 4b of the SFRA does not indicate any sewer flooding incidents close to the site. As there are no other sewers in the vicinity, sewer flooding is not considered to be a significant flood risk to the development site.

3.17 **Surface Water/Overland Flow:** The EA surface water flood map shows the site to be at very low risk of flooding from surface water with an area of low risk building up against one of the commercial buildings. Given the local topography in the area, it is likely that the site drains to the Hoffer Brook and the low risk extent could be a topographic low point or the commercial building is blocking a small overland flow path. It is recommended that a topographic survey is carried out on site to determine the site levels to establish the likely cause of the low risk extent. A copy of the surface water flood risk has been included within Appendix C.

3.18 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. This has been discussed further in the next section.

4 Surface Water Drainage Assessment

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 various SuDS methods need to be considered in relation to site-specific constraints. Several SuDS options are available to reduce or temporarily hold back the discharge of surface water runoff. Table 5 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	May be suitable depending on design of buildings	Potentially
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Geology at site is likely to be suitable however, because of the current industrial use the potential for contamination must be considered with respect to the high groundwater vulnerability.	Potentially depending on the outcome of contamination assessment.
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Lined permeable paving can be utilised across the site for parking and road surfaces.	Yes
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	There is potential for use within the site. If community or domestic rain water harvesting is not suitable, simple systems such as water butts can be included to reduce mains water consumption for irrigation.	Yes
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Swales can be utilised within the site for conveyance.	Yes
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	Geology at site is likely to be suitable however, because of the current industrial use the potential for contamination must be considered with respect to the high groundwater vulnerability.	Potentially depending on the outcome of contamination assessment.
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	Geology at site is likely to be suitable however, because of the current industrial use the potential for contamination must be considered with respect to the high groundwater vulnerability.	Potentially depending on the outcome of contamination assessment.
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	These features could be utilised within the site for surface water storage in major events.	Yes
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	Attenuation should be provided by above ground features that provide multiple benefits.	Yes, as last resort.

Table 1: Sustainable Drainage Methods

4.6 Priority must be given to features that provide multiple benefits such as multi-functional spaces, biodiversity, amenity, water quality and reducing water consumption.

4.7 Features such as detention basins can provide areas that are dry for most of the year and can be used for recreational activities.

4.8 The site geology is a bedrock of Zig Zag Chalk formation with no superficial deposits (taken from BGS geology mapping) and is therefore likely to be conducive to infiltration methods. However, the current use of the site and the high groundwater vulnerability means that an attenuation strategy is preferable to drain the site.

4.9 Whilst an attenuation strategy has been recommended above, infiltration drainage should not be ruled out across the site and it may be possible to utilise infiltration drainage subject to further assessment.

4.10 Lined permeable paving can be used for private driveways, car parking areas and private access roads. This will provide water quality benefits in addition to providing attenuation. The permeable paving can discharge to another feature or have a controlled discharge to the watercourse.

4.11 Cambridgeshire County Council will also consider the adoption of permeable surfaces therefore the main access road could also be permeable if required subject to agreement with the Highway Authority. This should be considered when the stewardship model has been decided upon for the site.

4.12 It is likely given the assumed topography towards the Hoffer Brook that the site falls from north to south therefore the drainage should be restricted to the 1 in 1 year greenfield runoff rate and discharged to the Hoffer Brook via gravity.

4.13 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 water butts 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.

4.14 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 the Hoffer Brook. This will provide a significant improvement on the current discharge from the site and would meet the requirements of the LLFA if infiltration drainage is proven to not be suitable.

4.15 To understand the scale of attenuation volume that might be required at the site, Microdrainage was used to estimate greenfield runoff rates based on a site area of 4.97 hectares. The estimated runoff rates are:

QBAR = 0.3 l/s/ha (1.49 l/s)

Q1 year = 0.3 l/s/ha (1.49 l/s)

Q30 year = 0.8 l/s/ha (3.98 l/s)

Q100 year = 1.1 l/s/ha (5.47 l/s)

4.16 The MicroDrainage output is included in Appendix D.

4.17 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. It was assumed that 60% of the site was impermeable (roofs and hardstandings) for the purpose of this storage estimate, i.e. an impermeable area of 2.98 hectares. This results in a required attenuation volume of 3436m3. The Quick Storage Estimate parameters and results are included in Appendix E.

5 Foul Water Drainage Assessment

5.1 There are no public foul water sewers located within or adjacent to the site. However, Anglian Water records show that the closest public foul sewer is approximately 100 metres to the east of the site entrance with a diameter of 150mm. A copy of Anglian Water's sewer mapping has been included within Appendix F.

5.2 Due to the proposed number of units within the site, it would not be suitable to connect to non-mains drainage given the proximity of the public foul sewer.

5.3 It is unclear whether or not the existing drainage from the site connects to the public sewer but upgrades may be required to ensure that there is sufficient capacity in network.

5.4 It is recommended that consultation with Anglian Water is carried out to determine if it is feasible to connect to the sewer and the level of upgrades required.

6 Summary and Conclusions

6.1 This report has dealt with a proposed development of a retirement village with a 70 bed care home and approximately 100-120 smaller retirement dwellings with associated care and servicing facilities including a community hub. This land is currently an industrial site.

6.2 The site falls predominantly within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps with a small area of Flood Zone 2/3 surrounding the Hoffer Brook to the south of the site. It is also shown to be at very low risk of surface water flooding with a small portion of the site at low risk of surface water flooding.

6.3 Further analysis of the impacts of climate change will need to be considered at a more detailed stage however, for the purposes of masterplanning the built development should be kept wholly outside of the Flood Zone 2/3 extent and with a natural buffer of at least 8 metres from the Hoffer Brook along the southern boundary for maintenance purposes and to provide a habitat and biodiversity corridor. This will provide a net biodiversity gain in close proximity to the Brook from the existing 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 chalk geology and the Strategic Flood Risk Assessment show that there is high potential for infiltration drainage. However, due to the potential for contamination based on the based on the current and historic uses on the site and the high groundwater vulnerability means an attenuation drainage strategy is likely.

C) A more detailed investigation in to contaminated land and the use of infiltration drainage should be undertaken at a later stage as there may be locations within the site that infiltration drainage is appropriate.

D) Runoff to the Hoffer Brook will be restricted to the 1 in 1 year greenfield runoff rate and storage will be provided for all events up to and including the 1 in 100 year + 40% climate change event.

E) The surface water drainage strategy should utilise drainage features that provide multiple benefits and functions including above ground features such as infiltration or detention basins that can be used as recreation space when dry.

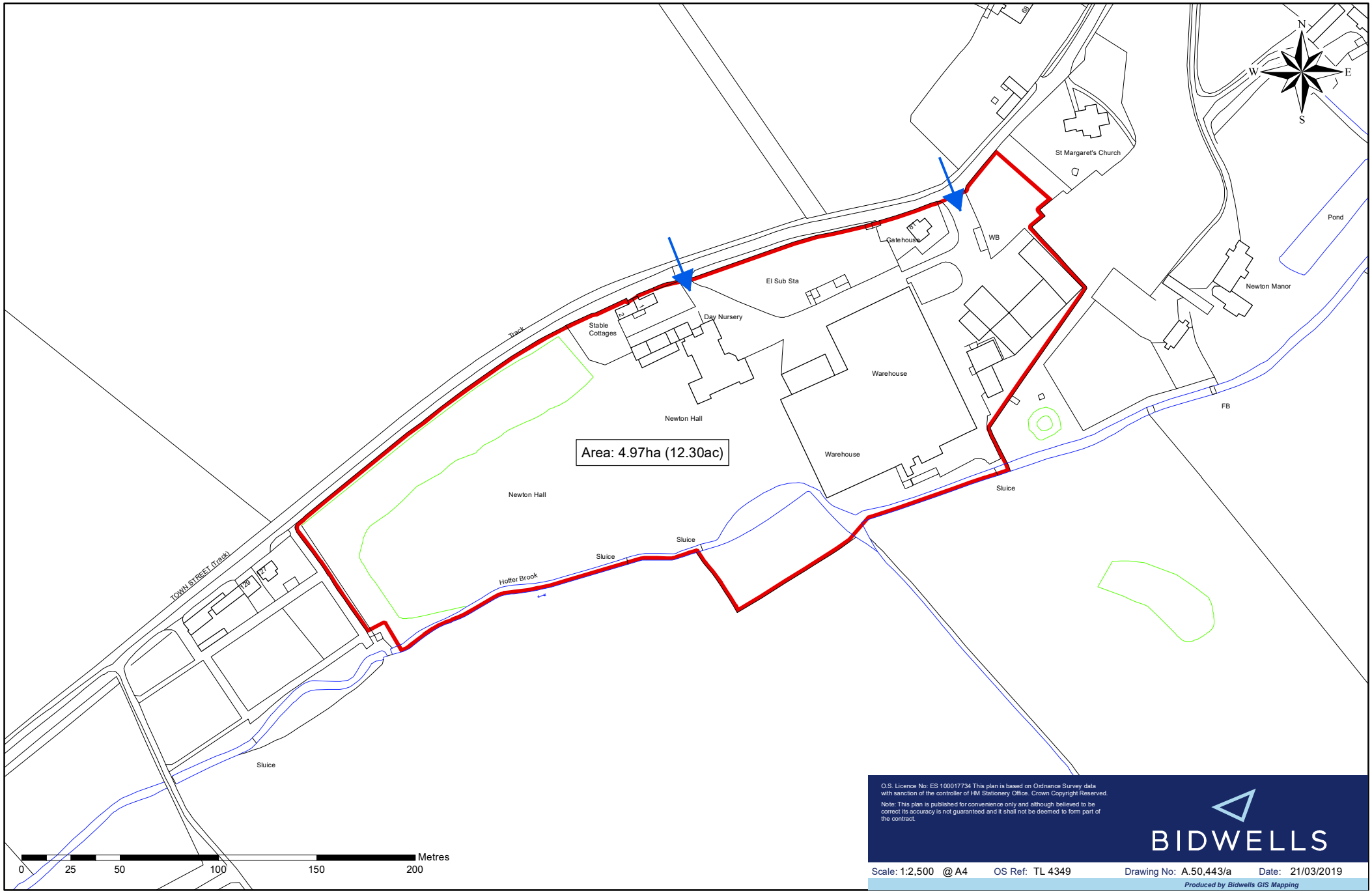
F) The surface water drainage strategy should also include features that improve water quality, biodiversity, amenity and habitat creation.

G) The closest public sewer is approximately 100 metres to the east of the site. Due to the likely number of properties proposed as part of any development non-mains drainage would not be acceptable due to the proximity of the public sewer.

Appendices

Appendix: A - Location Plan

Newton Hall Industrial Estate, Town Street, Newton, Cambridgeshire



BIDWELLS

Scale: 1:2,500 @ A4 OS Ref: TL 4349 Drawing No: A.50,443/a Date: 21/03/2019

Produced by Bidwells GIS Mapping

Appendix: B – EA Flood Map for Planning

Environment Agency

Flood map for planning

Your reference
Newton

Location (easting/northing)
543339/249036

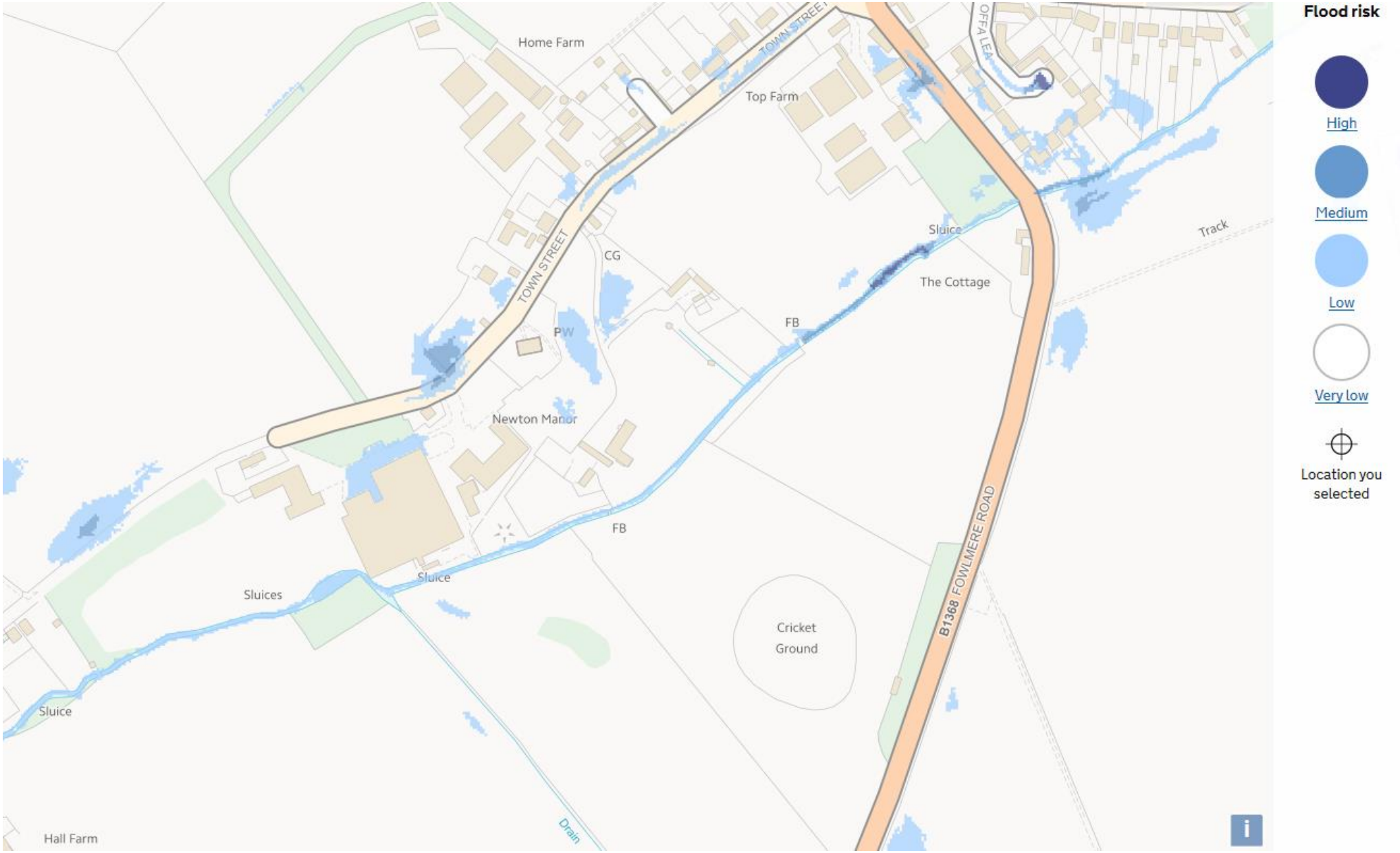
Scale
1:2500

Created
20 Dec 2019 13:45

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting 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

ICP SUDS Mean Annual Flood

Input

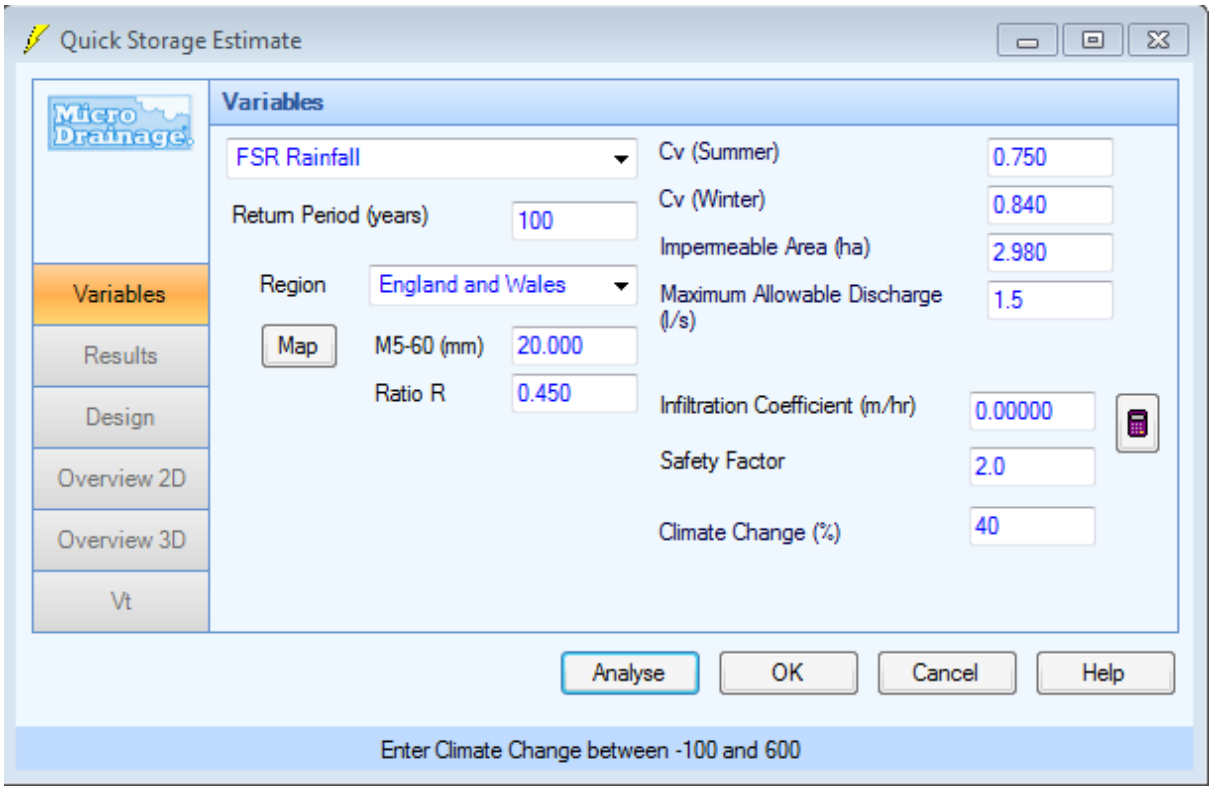
Return Period (years)	100	Soil	0.150
Area (ha)	1.000	Urban	0.000
SAAR (mm)	574	Region Number	Region 5

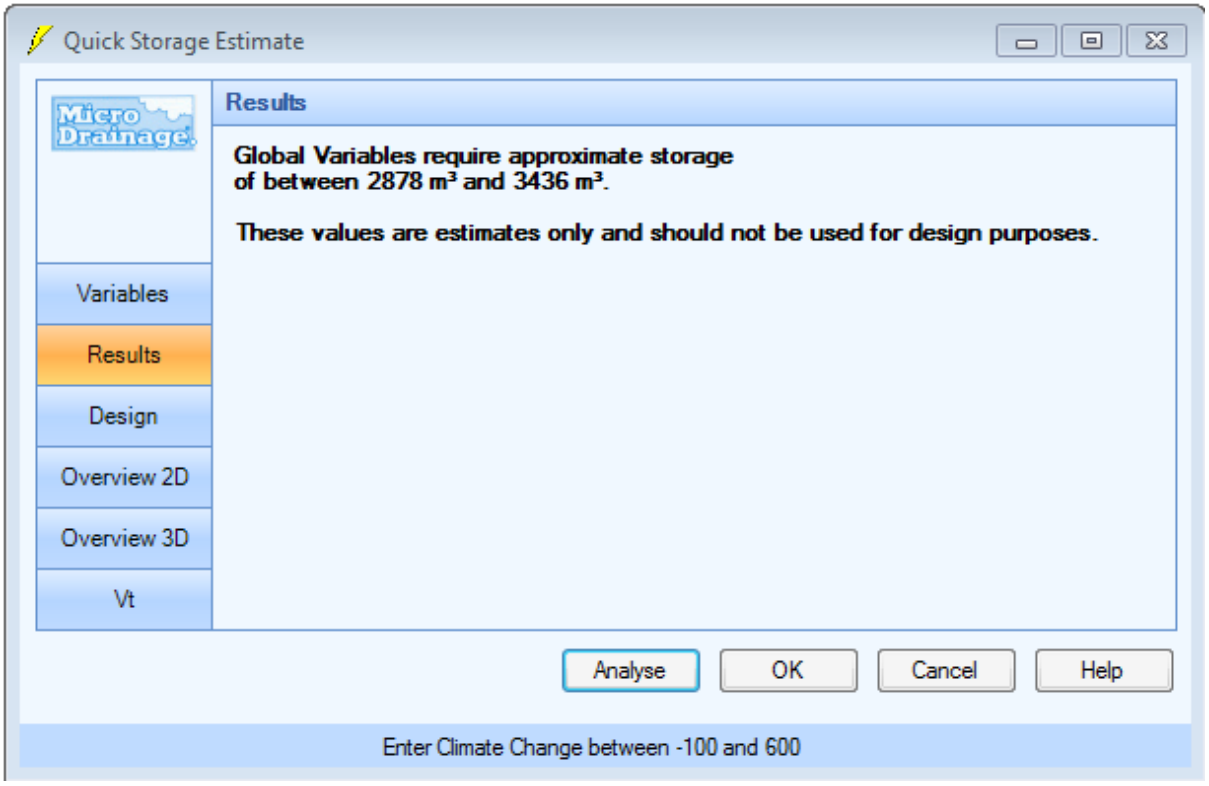
Results l/s

QBAR Rural	0.3
QBAR Urban	0.3
Q100 years	1.1
Q1 year	0.3
Q30 years	0.8
Q100 years	1.1

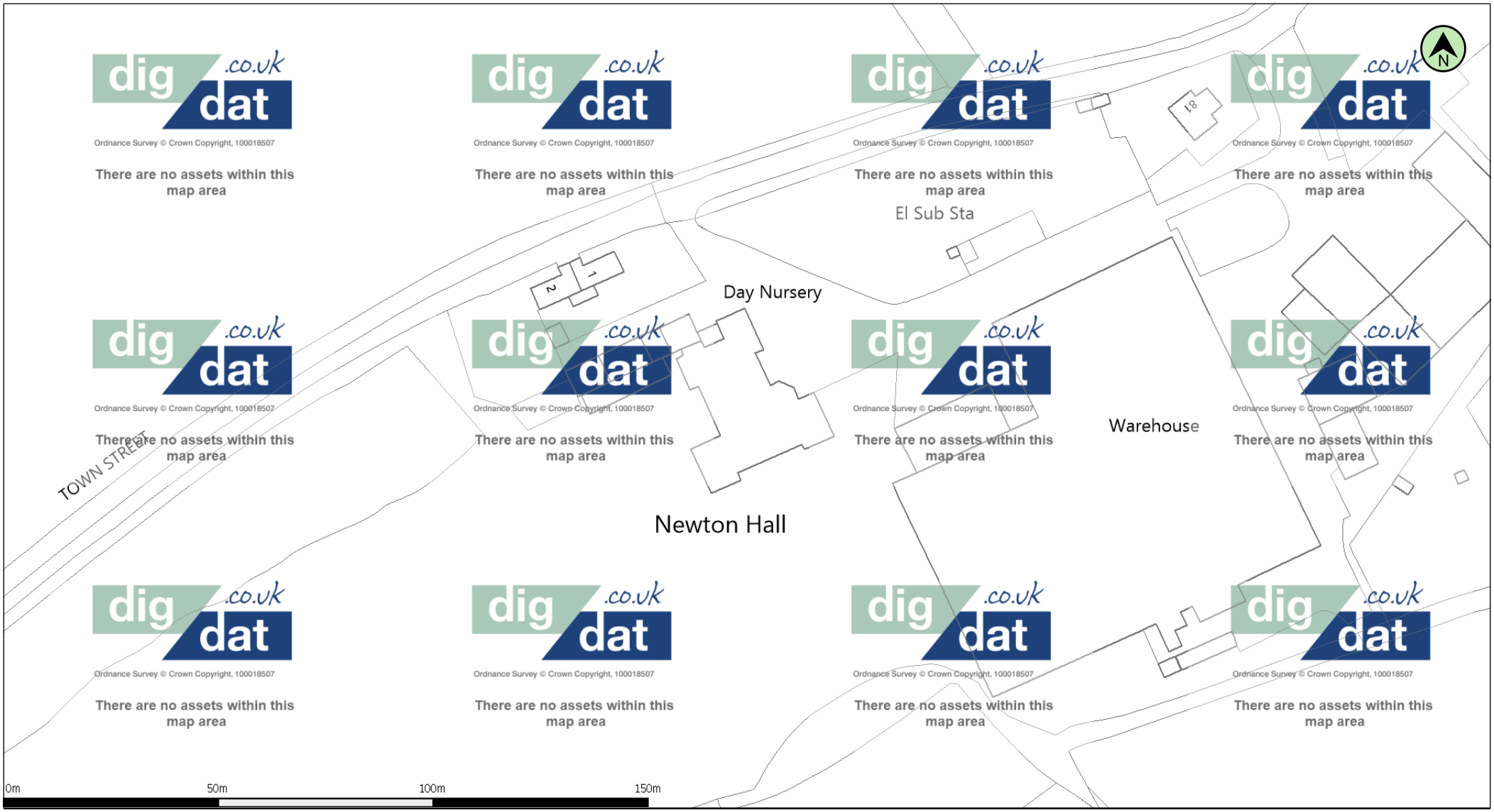
Appendix: E – MicroDrainage Quick Storage Estimate

1 in 1 year runoff rate with storage for the 1 in 100 year + 40% climate change event.





Appendix: F – Anglian Water Sewer Records



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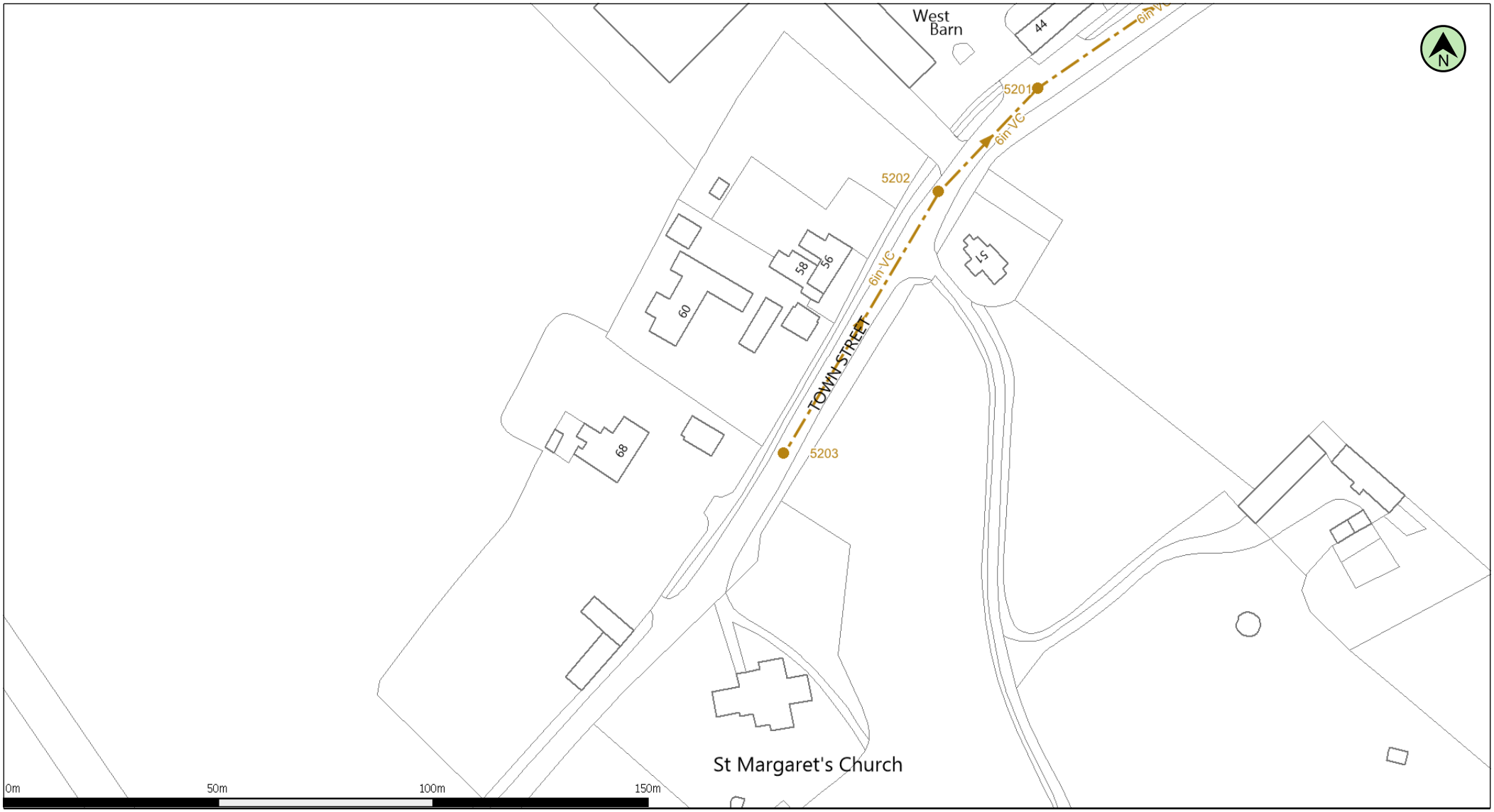
- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decomissioned Pumping Station

*(Colour denotes effluent type)

Newton Hall 1

love every drop anglianwater



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Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*
Outfall*
Inlet*
Manhole*
Sewage Treatment Works
Public Pumping Station
Decomissioned Pumping Station
*(Colour denotes effluent type)

Newton Hall 2

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5201	F	-	-	1.95
5202	F	-	-	1.97
5203	F	-	-	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert