Flood Risk Assessment

February 2023

EAS

Ladymead Farm, Quainton
Farm Track

Buckinghamshire Unitary Council

Antony Barrett

EAS

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The content of this report is based on information available as of February 2023, the validity of the statements made may therefore vary over time as planning guidance / policies and the evidence base change.

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1 Introduction

1.1 EAS have prepared this Flood Risk Assessment (FRA) report to accompany a retrospective planning application for a farm track and hardstanding area, located at Ladymead Farm, Quainton, Buckinghamshire, HP22 4AN. The site location plan and road layout are illustrated in **Appendix A**.

1.2 Part of the farm track and hardstandings, fall within Flood Zone 2 deemed to be at a medium risk of flooding, with an annual risk of flooding of between 1% and 0.1%; therefore, a Flood Risk Assessment is required to accompany a planning application to meet the requirements of the National Planning Policy Framework (NPPF). All sources of flooding have been evaluated in this report and mitigation measures are discussed.

1.3 The proposed agricultural land use is defined as a 'less vulnerable use' and is suitable within Flood Zone 2 without the application of the exception test (Annex 3 of the NPPF and Table 2 of the flood risk PPG guidance).

1.4 The contents of this FRA is based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021, Annex 3: Flood risk vulnerability classification, also from the NPPF and PPG 'Guidance for Flood Risk and Coastal Change', updated in August 2022.

1.5 This report is based on the Environment Agency Flood Maps, geology mapping, OS mapping, topographic survey, Strategic Flood Risk Assessment and local policy.

1.6 This document includes the following sections:

Section 2 - describes the relevant policy;

Section 3 - site description, including site levels, proximity to watercourses etc.;

Section 4 - outlines potential sources of flooding;

Section 5 – details the proposed drainage strategy; and

Section 6 - concludes the report.

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2 Policy Context

Introduction

2.1 This section sets out the policy context. This FRA is based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021 and the Planning Practice Guidance (PPG) published March 2014, which is updated on an ad hoc basis.

National Planning Policy Framework

2.2 Paragraph 167 footnote 55 of the NPPF states:

"A site-specific flood risk assessment should be provided for all developments 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."

2.3 The flood zones are defined as:

Flood Zone 1 – Land assessed as having a less than 1 in 1,000 (<0.1%) annual probability of flooding from fluvial sources;

Flood Zone 2 – Land assessed as having between a 1 in a 100 and 1 in 1,000 (1% to 0.1%) annual probability of flooding from fluvial sources;

Flood Zone 3a – Land assessed as having a 1 in 100 or greater (>1%) annual probability of flooding from fluvial sources, or at least 0.5% annual probability of tidal flooding;

Flood Zone 3b – Land where water has to flow or be stored in times of flood.

2.4 Paragraph 159 discusses the suitability of development location, particularly with regards to future risks induced by climate change:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere".

2.5 Paragraph 160 of the National Planning Policy Framework (NPPF) sets out how:

"Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards".

2.6 The EA Flood Map for Planning shows the farm track being applied for retrospectively is mostly within Flood Zone 1, at low risk of flooding from fluvial sources. This is considered to be an area with less than 0.1% (1 in 1000) annual probability of flooding. A short section of the farm track and the hardstanding to the north of the farm track falls within Flood Zone 2. This is considered to be an area with between a 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of flooding. The EA Flood Map for Planning has been enclosed in **Appendix B**.

Local Policy

Aylesbury Vale District Council Core Strategy

2.7 The Aylesbury Vale District Council Core Strategy was published in June 2009 to provide suitable guidance to inform development control decisions within the Aylesbury Vale district.

2.8 Paragraph 2.7.5. of the Core strategy sets out 'set shaping principles':

"The development will meet the requirements in paragraph 2.7.4 and the following place-shaping principles; the details of these principles are set out in the evidence paper on the SDA33:

[…]

5) We will encourage developers to meet the expectation that minimum national / regional sustainable construction standards will be exceeded for residential and non-residential buildings.

6) Provide a sustainable and strategic approach to flood mitigation and urban drainage, linked to multifunctional green infrastructure, to control surface water flows and flooding (as set out in the Milton Keynes Strategic Flood Risk Assessment and Water Cycle Study)."

Aylesbury Vale Strategic Flood Risk Assessment Level 1 and Level 2 (2017)

2.9 The Level 1 Strategic Flood Risk Assessment (SFRA) was published in 2017 to provide suitable guidance and mapping to inform development control decisions within the Aylesbury Vale District. Much of the SFRA is focused on areas at risk of fluvial flooding which are located within Flood Zones 2 and 3; however some information is also provided on other sources of flooding.

2.10 Although the District has experienced several historic flood incidents, the site has not been specifically mentioned as being at risk. UA006 Ladymead Farm, is mentioned on page 86 of the report as site 'UA006' being identified to be suitable for employment, with the Flood Zone 2 designation noted and a small area identified to be at risk of surface water flooding.

2.11 The SFRA notes that the risk from groundwater flooding is typically low across the district due to the geology of the area.

Vale of Aylesbury Local Plan 2013-2033

2.12 The Vale of Aylesbury Local Plan was adopted in September 2021 to provide suitable guidance and policy with Aylesbury Vale district.

2.13 Policy I4 'Flooding' outlines the requirements for Flood Risk Assessments and SuDS strategies.

"Management of flood risk:

In order to minimise the impacts of and from all forms of flood risk the following is required:

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a. Site-specific flood risk assessments (FRAs), informed by the latest version of the SFRA, where the development proposal is over 1ha in size and is in Flood Zone 1, or the development proposal includes land in Flood Zones 2 and 3 (as defined by the latest Environment Agency mapping). A site-specific FRA will also be required where a development proposal affects land in Flood Zone 1 where evidence, in particular the SFRA, indicates there are records of historic flooding or other sources of flooding, e.g. due to critical drainage problems, including from ordinary watercourses and for development sites located within 9m of any water courses (8m in the Environment Agency's Anglian Region50)

b. All development proposals must clearly demonstrate that the flood risk sequential test, as set out in the latest version of the SFRA, has been passed and be designed using a sequential approach, and

c. If the sequential test has been satisfied, development proposals, other than those allocated in this Plan, must also satisfy the exception test in all applicable situations as set out in the latest version of the SFRA.

Flood risk assessments

All development proposals requiring a Flood Risk Assessment in (a) above will assess all sources and forms of flooding, must adhere to the advice in the latest version of the SFRA and will:

d. provide level-for-level floodplain compensation, up to the 1% annual probability (1 in 100) flood extent with an appropriate allowance for climate change, and volume-for-volume compensation unless a justified reason has been submitted and agreed which may justify other forms of compensation

e. ensure no increase in flood risk on site or elsewhere, such as downstream or upstream receptors, existing development and/or adjacent land, and ensure there will be no increase in fluvial and surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event, with an allowance for climate change (the design storm event)

f. not flood from surface water up to and including the design storm event, or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site

g. explore opportunities to reduce flood risk overall, including financial contributions from the developer where appropriate

h. ensure development is safe from flooding for its lifetime (and remain operational where necessary) including an assessment of climate change impacts

i. ensure development is appropriately flood resistant, resilient and safe and does not damage flood defences but does allow for the maintenance and management of flood defences

j. take into account all sources and forms of flooding

k. ensure safe access and exits are available for development in accordance with Department for Environment, Food and Rural Affairs (DEFRA) guidance51. Access to "safe refuges" or "dry islands" are unlikely to be considered safe as this will further burden the Emergency Service in times of flood

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l. include detailed modelling of any ordinary watercourses within or adjacent to the site, where appropriate, to define in detail the area at risk of flooding and model the effect of climate change

m. provide an assessment of residual flood risk

n. provide satisfactory Evacuation Management Plans, where necessary, including consultation with the Emergency Services and Emergency Planners

Sustainable drainage systems (SuDS)

All development proposals must adhere to the advice in the latest version of the SFRA and will:

o. Ensure development layouts are informed by drainage strategies incorporating SuDS and complete site specific ground investigations to gain a more local understanding of groundwater flood risk and inform the design of sustainable drainage components

p. All development will be required to design and use sustainable drainage systems (SuDS) for the effective management of surface water run-off on site, as part of the submitted planning application and not increase flood risk elsewhere, including sewer flooding. All development should adopt exemplar source control SuDS techniques to reduce the risk of flooding due to post-development runoff. SuDS design should follow current best practice (CIRIA Manual 2015 or as replaced) and Buckinghamshire Council guidance on runoff rates and volumes to deliver wider environmental benefits. Where the final discharge point is the public sewerage network the runoff rate should be agreed with the sewerage undertaker.

q. Where site-specific FRAs are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems

r. In considering SuDS solutions, the need to protect groundwater quality must be taken into account, especially where infiltration techniques are proposed in considering a response to the presence of any contaminated land. The Environment Agency need to be consulted where infiltration is proposed in contaminated land. SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. Opportunities will be sought to enhance natural river flows and floodplains, increasing their amenity and biodiversity value and a watercourse advice note is being prepared for further guidance

s. Applicants will be required to provide a management plan to maintain SuDS in new developments, and a contribution will be required for maintenance of the scheme/SuDS

t. Onsite attenuation options should be tested to ensure that changing the timing of peak flows does not exacerbate flooding downstream, and

u. Only in exceptional circumstances will surface water connections to the combined or surface water system be permitted. Applicants will need to demonstrate in consultation with the sewerage undertaker that there is no feasible alternative and that there will be no detriment to existing users. Applicants will be required to liaise with the lead local flood authority, Internal Drainage Boards, and the Environment Agency on any known flood issues, and identify issues from the outset via discussions with statutory bodies. Climate change

v. Climate change modelling should be undertaken using the relevant allowances (February 2016) for the type of development and level of risk *w. Safe access and egress should be demonstrated in the 1 in 100 plus climate change event, and*

x. Compensation flood storage would need to be provided for the built footprint as well as any land-raising within the 1 in 100 plus appropriate climate change flood event. This compensation would need to be demonstrated within a Flood Risk Assessment (FRA).”

3 Existing Site Assessment

Site Description

3.1 The retrospective planning application is for a farm track and hardstanding area, located at Ladymead Farm, Quainton, Buckinghamshire, HP22 4AN. The site location plan and track layout are illustrated in **Appendix A**.

3.2 The site consists of agricultural fields located to the south of the existing industrial park located at Ladymead Farm.

3.3 The farm track is circa 4-5m in width with passing places and is surfaced with loosely compacted permeable road plainings.

3.4 The hardstanding is to be used for the storage of agricultural machinery and crops associated with the adjacent fields.

Local Watercourses

3.5 The Denham Brook, identified by the EA as a 'Main River' commences a short distance to the west of the proposed hardstanding area and is located along the northern boundary of proposed hardstanding.

Site Levels

3.6 The topographic survey is included in **Appendix C**. This shows that the wider site generally falls from west to east.

3.7 There is a high point on the farm track 160m to the north of the junction with The Willows at a level of 95.7mAOD, to a low point in the north-eastern corner of the hardstanding area with a level of 93.0mAOD. The base of the Denham Brook adjacent to the hardstanding area is approximately 1.2m below this level (based on measured level information a short distance to the east of the site).

Geology

3.8 The online British Geological Survey resource (www.bgs.ac.uk) shows the local area to have no superficial deposits. The bedrock layer is comprised of bedrock formation of Ampthill Clay Formation - Mudstone. No borehole logs are available within the local area to determine groundwater depths.

Existing and Proposed Drainage

3.9 The agricultural fields are anticipated to drain mostly to ground with any excess runoff likely to enter the watercourses along the northern and eastern boundaries of the wider site.

3.10 The as-built farm track has a crossfall in-line with the general fall of the land from west to east, ensuring any surface water not draining to ground will runoff onto the fields to the east, following the natural drainage patterns and will not impact upon a third party.

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4 Potential Sources of Flooding

Fluvial

4.1 The EA Flood Map for Planning shows the farm track being applied for retrospectively is mainly within Flood Zone 1, at low risk of flooding from fluvial sources. This is considered to be an area with less than 0.1% (1 in 1000) annual probability of flooding.

4.2 A short section of farm track and the hardstanding to the north of the farm track falls within Flood Zone 2. This is considered to be an area with between a 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of flooding. The EA Flood Map for Planning has been enclosed in **Appendix B**.

4.3 The nearest flood source is the Denham Brook which passes along the northern boundary of the hardstanding.

4.4 The EA flood data and mapping has been requested and it is anticipated based on an earlier application the EA will not hold flood level data for the site.

4.5 As such, the client has provided a recently completed FRA for a farm building planning application to the north of the site, prepared by Calibro Consultants Ltd. from October 2020. The FRA identifies that the Flood Zone 2 designation is a result of the EA historical flood outline from an event that occurred 6th March 1947. This reaffirms that it is unlikely that flood level data will be provided by the EA for this area.

4.6 Calibro Consultants Ltd. undertook site specific flood modelling for the site and a full copy of the FRA including the modelling report are included in **Appendix D** of this report. Figure 4.1 below illustrates an overlay of the farm track and hardstanding area with the site specific flood modelling for 0.1% (1000yr) annual probability flood event. This indicates that other than along the northern site boundary which is shared with the Denham Brook, that a large part of the hardstanding area is either not at risk of flooding or flooding is limited to below 200mm. In addition, around 65m length of the farm track is generally below 100mm.

Residual Risk- Blockages

4.7 There is a residual risk of flooding sourced from blockages within the Denham Brook. Should flows become impeded by debris in the channel, flows could be redirected across the area of hardstanding. Mitigation measures to manage this identified residual risk are detailed in below.

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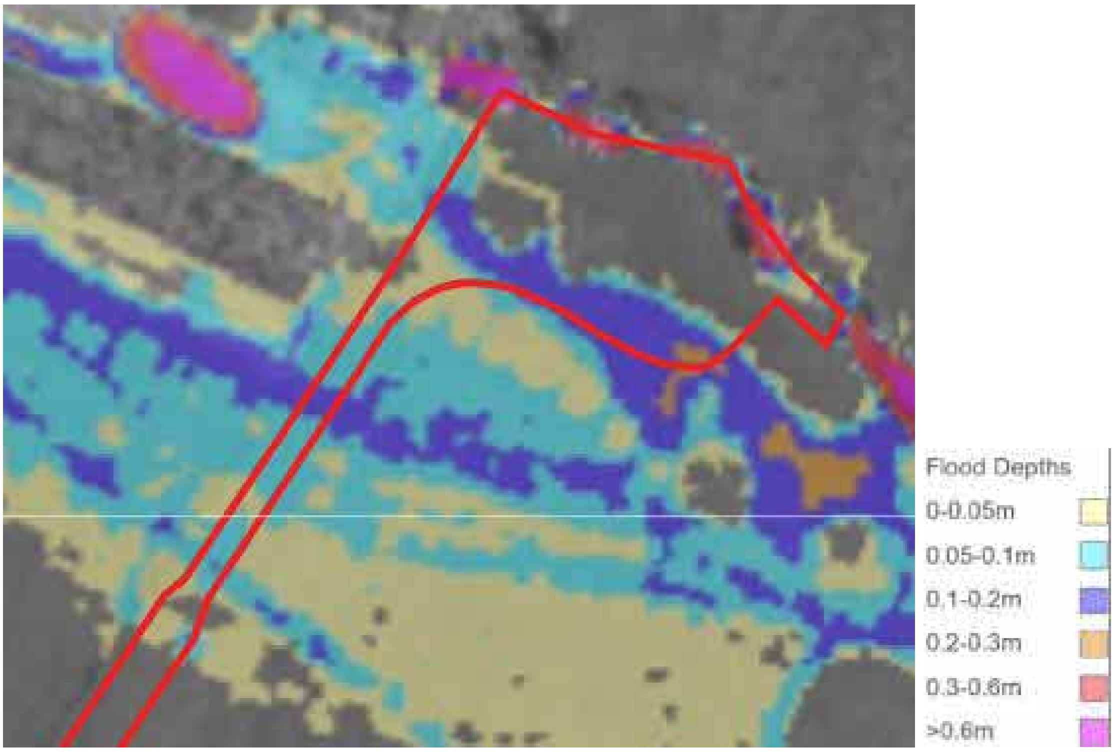

Figure 4.1 – Farm track & hardstanding overlay with Flood Modelling for 0.1% (1000yr) event

4.8 As the farm track is for use by agricultural vehicles, a flood depth of up to 200mm is unlikely to have any impact upon the vehicles, but staff working on foot in the area and stored crops could be at risk.

Surface Water

4.9 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.

4.10 The EA's surface water flood map is included in **Appendix E** (Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map). The farm track being applied for retrospectively is shown on the base OS mapping and therefore clearly visible on the EA mapping.

4.11 The very low-risk extent indicates a lower than 0.1% (1 in 1000) chance of surface water flooding each year. The majority of the farm track is shown to be at a very low-risk of flooding.

4.12 The low-risk extent indicates between a 1% and 0.1% (1 in 100 and 1 in 1000) chance of surface water flooding each year. This represents the least likely worse case modelled event. The surface water flood map included below for information, indicates a very similar flood outline to the site specific fluvial modelling and that the flood depth is likely to be below 300mm, with a flood velocity of over 0.25m/s.

4.13 A medium risk scenario indicates a probability of surface water flooding between 3.33% and 1% (1 in 30 and 1 in 100) each year. In a medium risk scenario, similar flooding is shown to but with a reduced extent and the depths are shown to be below 300mm.

4.14 A high-risk scenario indicates a greater than 3.33% (1 in 30) probability of surface water flooding each year, i.e., the most frequently occurring scenario. In a high-risk scenario a further reduction in the extent of flooding is shown, with flood depths below 300mm.

4.15 Based on the depth of flooding being below 300mm, a similar conclusion to the fluvial flooding can be reached, that as the farm track is for use by agricultural vehicles this is unlikely to have any impact upon the vehicles, but staff working on foot in the area and stored crops could be at risk.

Reservoir

4.16 The EA long term risk maps also display the risk from reservoirs. The site is not shown to be in a reservoir flood risk area.

Groundwater

4.17 The MAGIC Map website (https://magic.defra.gov.uk/MagicMap.aspx) shows that the site does not lie within any Source protection Zone. Therefore, the site will not affect any protected groundwater source.

4.18 The site is shown to be in a 'unproductive' stratum bedrock aquifer designation zone. An unproductive stratum is defined as "largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them."

4.19 The site is shown to have no superficial deposits and therefore the superficial aquifer designation zone is unproductive.

4.20 The Groundwater Vulnerability Map on the MAGIC Map website shows the site to be in an area labelled as 'Unproductive' with a 'Soluble Rock Risk'. Unproductive vulnerability is defined as "areas comprised of rocks that have negligible significance for water supply or baseflow to rivers, lakes and wetlands. They consist of bedrock or superficial deposits with a low permeability that naturally offer protection to any aquifers that may be present beneath."

4.21 A soluble rock risk is defined as "areas where solution features that enable rapid movement of a pollutant may be present (identified as stippled)."

4.22 Given the presence of low permeability geology the potential of flooding from groundwater is anticipated to be low.

Sewer

4.23 The sewers within the adjacent business park are located to the north of the Denham Brook and therefore unlikely to have any impact upon the farm track or hardstanding.

Mitigation Strategy

4.24 The site operators have riparian responsibilities to ensure the channel remains free of debris or litter. Should any items associated with the area of hardstanding enter the channel this must be removed. Ensuring channel capacity and removing blockages in the channel manages the residual risk of flooding posed by the Denham Brook.

4.25 As noted above, the depth of flooding is likely to have little impact upon the agricultural vehicles using the farm track, but staff working on foot in the hardstanding area and the stored crops, could be at risk from fluvial or surface water flooding.

EA Flood Warnings

4.26 The site is not located in a Flood Warning Area however, the "'River Thame and Chalgrove Brook" flood warning area is within close proximity of the site and therefore gives an indication when local river levels are high. To improve flood awareness and preparedness it is recommended the site operators subscribe to the EA flood warning service by using the link: https://www.fws.environment-agency.gov.uk/app/olr/home.

4.27 Alternatively, they can call the EA Floodline on 0345 988 1188. The EA will then send out automated warnings to a selected phone number should there be high water levels anticipated.

4.28 Upon receipt of a Flood Warning staff should remain vigilant and monitor water levels and remove any goods that could be damaged by flood waters. If possible, vehicles or any associated equipment should be moved as far from the Denham Brook as possible.

4.29 Upon receipt of a Severe Flood Warning or if high water levels or standing water is observed on site, it is recommended that the area at risk of flooding is closed to staff.

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5 Proposed Drainage Strategy

5.1 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.

5.2 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.

5.3 The farm track and hardstanding area is surfaced with loosely compacted 100mm depth of permeable road plainings laid over a permeable crushed hardcore.

5.4 The built farm track has a crossfall in-line with the general fall of the land from west to east, ensuring any surface water not draining to ground under heavier rainfall conditions, will runoff onto the fields to the east, following the natural drainage patterns.

5.5 Pollutants carried within the surface water run-off are anticipated to be filtered out as they pass through the aggregate. Once trapped they are then broken down over time; figures from the Construction Industry Research and Information Association have shown that 60-95% of suspended solids and 70-90% of hydrocarbons are removed by permeable surfaces. No further water quality improvements are therefore anticipated to be required.

5.6 In summary, the permeable surfacing and crossfall will replicate the natural drainage patterns and as such no further drainage infrastructure is deemed to be necessary.

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6 Conclusion

6.1 This Flood Risk Assessment (FRA) report has been prepared to accompany a retrospective planning application for a farm track and hardstanding area, located at Ladymead Farm, Quainton, Buckinghamshire, HP22 4AN.

6.2 The site consists of agricultural fields located to the south of the existing industrial park located at Ladymead Farm. The farm track is circa 4-5 in width with passing places and is surfaced with loosely compacted permeable road plainings.

6.3 The hardstanding is to be used for the storage of agricultural machinery and crops associated with the adjacent fields.

6.4 The Denham Brook, identified by the EA as a 'Main River' commences a short distance to the west of the proposed hardstanding area and is located along the northern boundary of proposed hardstanding.

6.5 The EA Flood Map for Planning shows the farm track being applied for retrospectively is within Flood Zone 1, at low risk of flooding from fluvial sources. This is considered to be an area with less than 0.1% (1 in 1000) annual probability of flooding.

6.6 A short section of the farm track and the hardstanding to the north of the farm track falls within Flood Zone 2. This is considered to be an area with between a 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of flooding.

6.7 Calibro Consultants Ltd. undertook site specific flood modelling for the site for a farm building planning application. This indicates that other than along the northern site boundary which is shared with the Denham Brook, that a large part of the hardstanding area is either not at risk of flooding or flooding is limited to below 200mm. In addition, around 65m length of the farm track is generally below 100mm.

6.8 The EA's surface water flood map for the low-risk extent (1 in 100 and 1 in 1000 chance of surface water flooding each year), indicates a very similar flood outline to the site specific fluvial modelling and that the flood depth is likely to be below 300mm, with a flood velocity of over 0.25m/s.

6.9 The depth of flooding is likely to have little impact upon the agricultural vehicles using the farm track, but staff working on foot in the hardstanding area and the stored crops, could be at risk from fluvial or surface water flooding.

6.10 The site is not located in a Flood Warning Area, however the "'River Thame and Chalgrove Brook" flood warning area is within close proximity of the site and therefore gives an indication when local river levels are high. To improve flood awareness and preparedness it is recommended the site operators subscribe to the EA flood warning. Upon receipt of a Flood Warning staff should remain vigilant and monitor water levels and remove any goods that could be damaged by flood waters. If possible, vehicles or any associated equipment should be moved as far from the Denham Brook as possible.

6.11 Upon receipt of a Severe Flood Warning or if high water levels or standing water is observed on site, it is recommended that the area at risk of flooding is closed to staff.

6.12 The site operators have riparian responsibilities to ensure the channel remains free of debris or litter. Should any items associated with the area of hardstanding enter the channel this must be removed. Ensuring channel capacity and removing blockages in the channel manages the residual risk of flooding posed by the Denham Brook.

6.13 The farm track and hardstanding area is surfaced with loosely compacted 100mm depth of permeable road plainings laid over a permeable crushed hardcore. The built farm track has a crossfall in-line with the general fall of the land from west to east, ensuring any surface water not draining to ground under heavier rainfall conditions, will runoff onto the fields to the east, following the natural drainage patterns.

6.14 In summary, although there is a flood risk present mainly in the area of proposed hardstanding for the storage of crops, provided pedestrians do not enter the area at times of flooding, no further mitigation measures are required to be accommodated. The permeable farm track construction replicates natural drainage patterns and as such no further drainage infrastructure is deemed to be necessary.

6.15 In conclusion the ‘less vulnerable use’ is suitable within Flood Zone 2 without the application of the exception test; and should be approved on flood risk grounds.

7 Appendices

Appendix: A – Location Plan 1
Appendix: B – EA Flood Map for Planning 2
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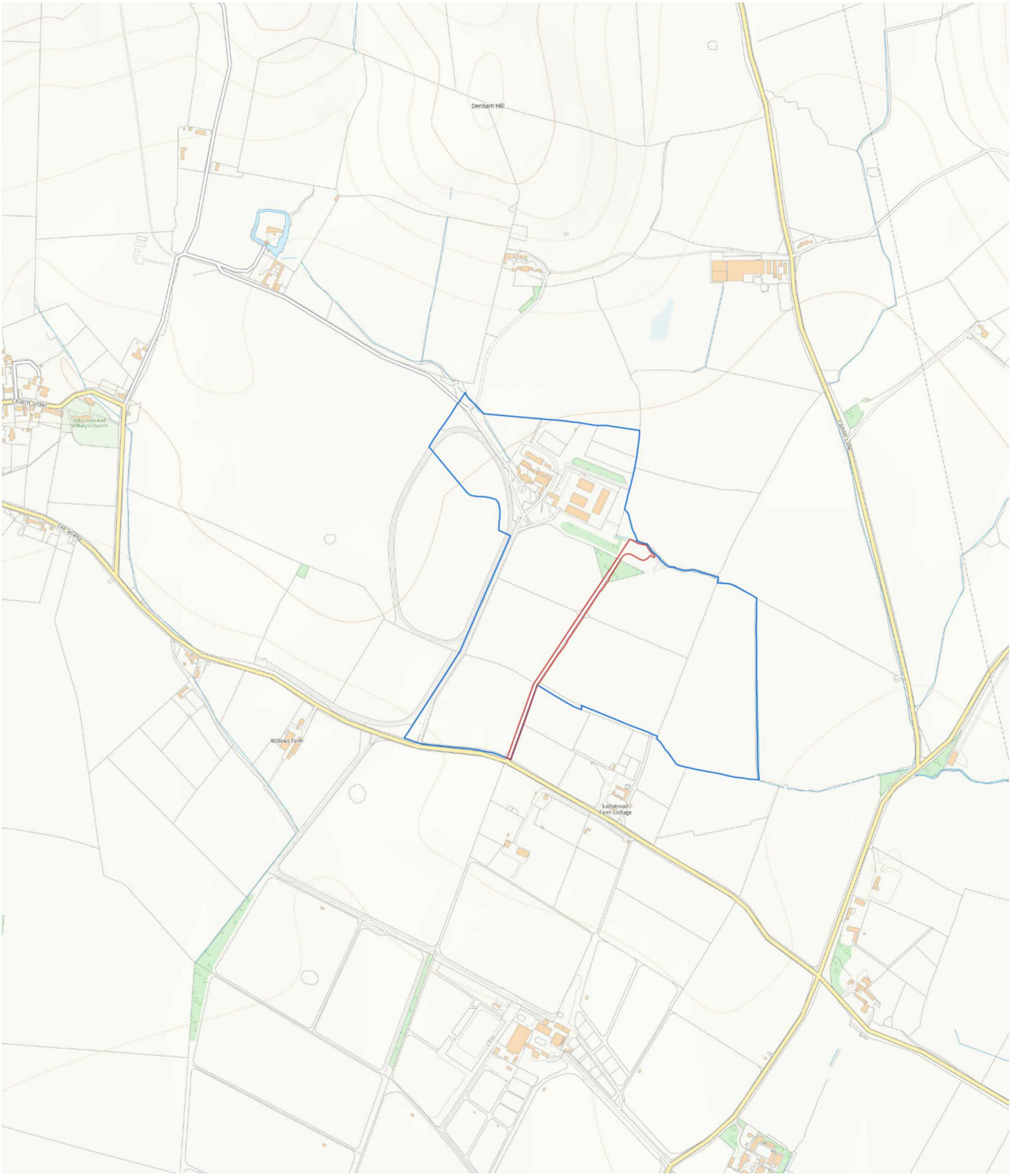
Appendix: A – Location Plan

Sherwill Drake Forbes

Location Plan
Ladymead Farm, Quainton
HP22 4AN

Land App



Produced on Feb 7, 2023.

ND/3.349/LocationPlan

200 m

Scale 1:10000 (at A4)

N

Appendix: B – EA Flood Map for Planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Ladymead	**475993/219692**	**2 Feb 2023 11:36**

Your selected location is in lood zone 2, an area with a medium probability of looding.

This means:

- you must complete a lood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a lood risk assessment (see www.gov.uk/guidance/lood-risk-assessment-standing-advice)

Notes

The lood map for planning shows river and sea looding data only. It doesn’t include other sources of looding. It is for use in development planning and lood risk assessments.

This information relates to the selected location and is not speciic to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
Ladymead

Location (easting/northing)
475993/219692

Scale
1:2500

Created
2 Feb 2023 11:36

Selected area

Flood zone 3

Flood zone 2

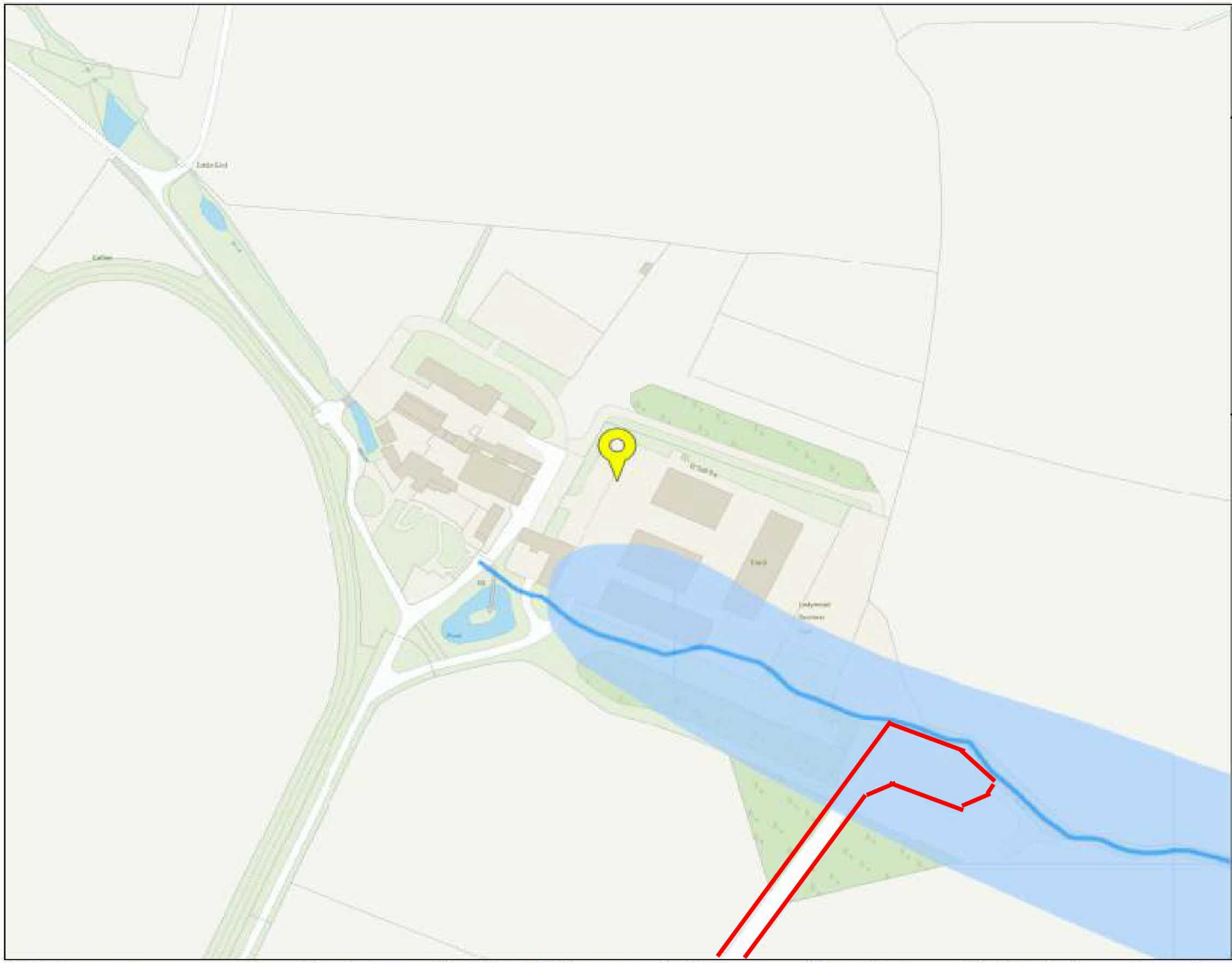
Flood zone 1

Flood defence

Main river

Water storage area

0 20 40 60m



Environment Agency

Flood map for planning

Your reference
Ladymead Farm

Location (easting/northing)
475975/220029

Scale
1:2500

Created
18 Jul 2022 17:39

Selected point

Flood zone 3

Flood zone 3: areas benefitting from flood defences

Flood zone 2

Flood zone 1

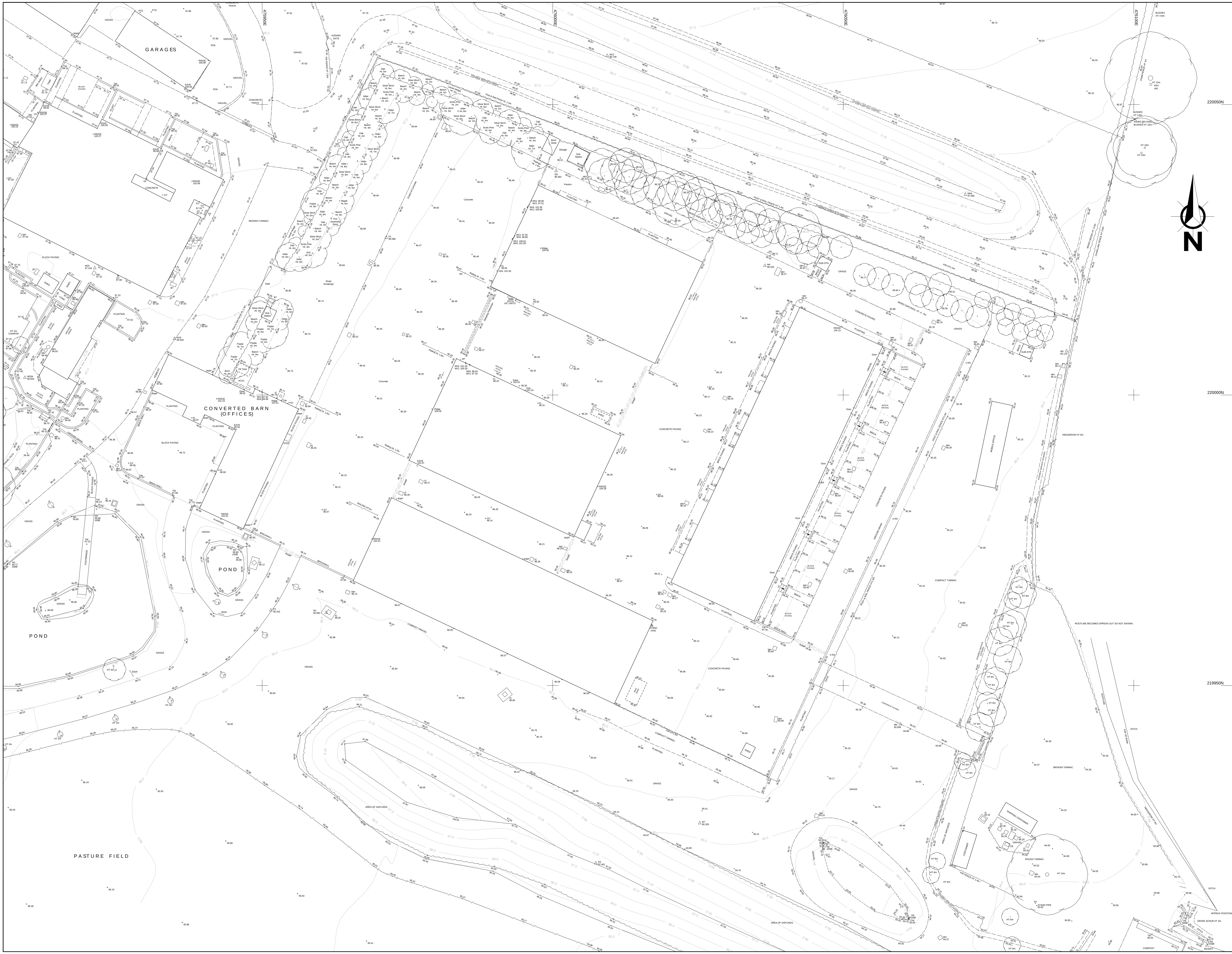
Flood defence

Main river

Water storage area

0 20 40 60m

Appendix: C – Topographic Survey



Abbreviations:

ACU	Air Conditioning Unit	P	Post
AV	Air Valve	PE	Pipe
BL	Bollard	PTG	Pipe to Ground
BH	Borehole	RE	Rodding Eye
BL	Bed Level	RL	Ridge Level
BS	Bus Stop	RP	Reflector Post
BT	British Telecom Cover	RS	Road Sign
B/RW	Brick Retaining Wall	RW	Retaining Wall
CB	Control Box	RWP	Rain Water Pipe
CTV	Cable TV Cover	ST	Stump
CCTV	Close Circuit TV	SL	Soffit Level
CL	Cover Level	SN	Sign
COL.	Column	SV	Stop Valve
CONC.	Concrete	SVP	Soil & Vent Pipe
CPS	Concrete Paving Slabs	S/RW	Stone Retaining Wall
DHL	Door Head Level	SW	Surface Water
DK	Drop Kerb	TAC	Tactile Paving
DP	Down Pipe	TCB	Telephone Call Box
EL	Eaves Level	TL	Traffic Light
ER	Earth Rod	TP	Telegraph Pole
EP	Electricity Pole	TW	Top of Wall Level
FH	Fire Hydrant	US	Underside
FL	Floor Level	UTL	Unable To Lift
F/Light	Flood Light	VP	Vent Pipe
FW	Foul Water	WCL	Window Cill Level
GD	Ground Drain	WHL	Window Head Level
GY	Gully	WO	Wash Out
GV	Gas Valve	WT	Water Tap
GP	Gate Post	Ø	Diameter
Ht.	Height		
IC	Inspection Chamber		
IL	Invert Level		
KO	Kerb Outlet		
LB	Letter Box		
LP	Lamp Post		
MH	Manhole		
MK	Marker Post		
MS	Mile Stone		
NP	Name Plate		
OSBM	Ordnance Survey Bench Mark		
OH	Overhead		

Fence Abbreviations:

B/W	Barbed Wire
C/B	Close Boarded
C/I	Corrugated Iron
C/L	Chain Link
C/P	Chestnut Paling
I/R	Iron Railing
P/R	Post & Rail
P/W	Post & Wire

General Notes:

1. Man entry to sewers has not been undertaken. Depths, pipe sizes and quantity of pipes are measured from the surface. We therefore cannot guarantee the completeness or accuracy of the sewer data which should be checked with the local authority or and/on site.
2. All tree heights and spreads are approximate. The plan position of trunks are taken at ground level. Girth measurements are taken at a 1.5m height. We have attempted to identify tree species, however if tree species are critical specialist advice should be sought.
3. This drawing has been prepared in accordance with the scope of AHP's appointment with it's client and is subject to the terms and conditions of that appointment. AHP accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
4. If received electronically it is the recipient's responsibility to print to the correct scale. Only written dimensions should be used.

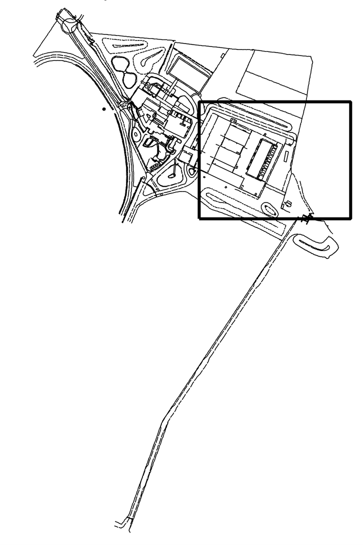
CONTROL

Name	Easting	Northing	Height	Remark
P1	475971.348	220027.082	96.598	PK Nail
P2	475951.494	219962.943	96.162	PK Nail

Notes:

Grid & Levels are related to Ordnance Survey National Grid & Datum using multiple real time GPS observations.
No scale factor has been applied.

Sheet Location Diagram:



REV NO	REV NOTE	DATE	SIGNED

Client: BARRETTS OF ASPLEY

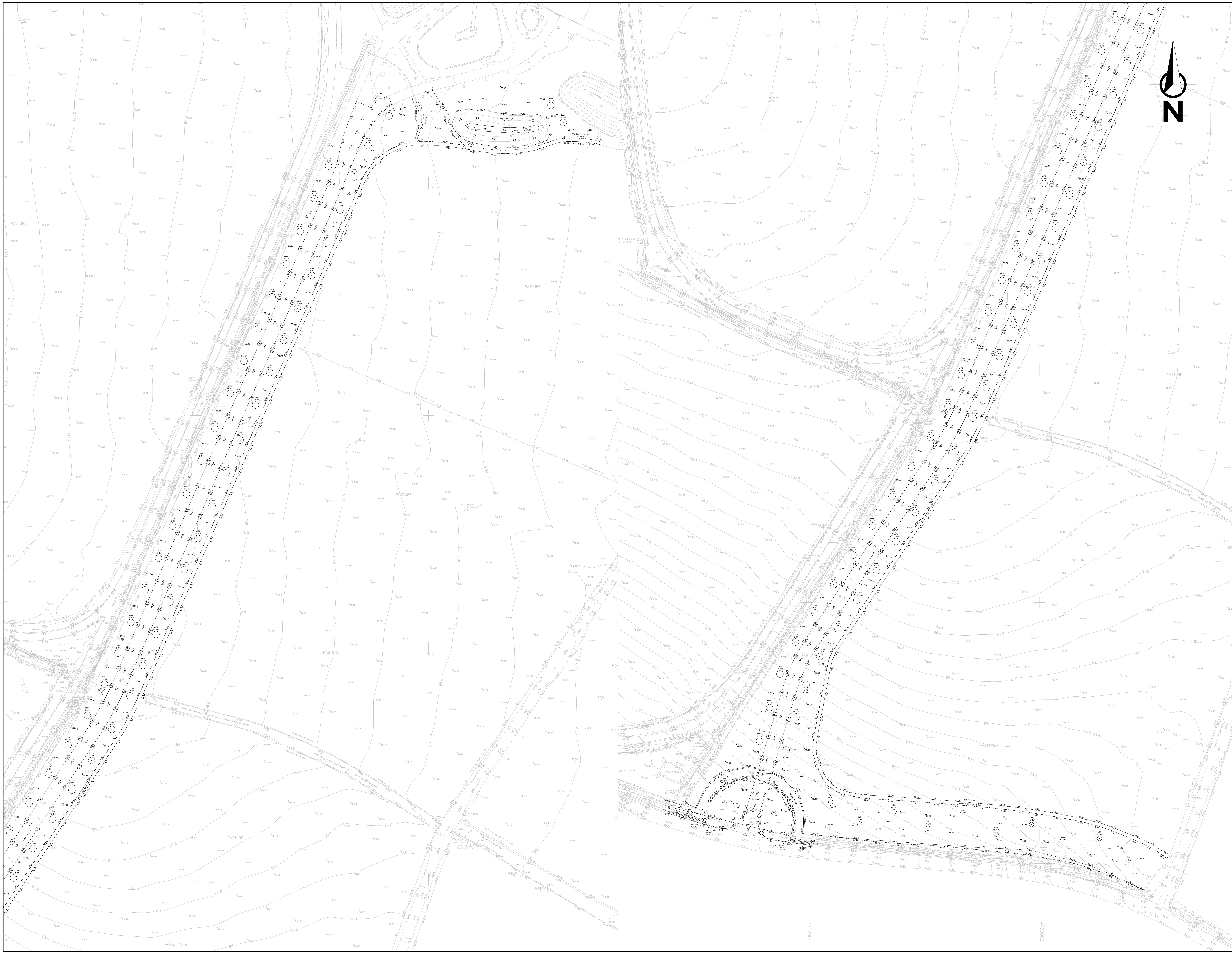
Project: LADYMEAD FARM
QUAINTON
HP22 4AN

Title: MERGED TOPOGRAPHICAL SURVEY

Dwg. No: HS1100_2 Revision: A

Date	14.03.22	Scale	1:200 @ A0
Status	FINAL	Sheet	1 of 1

AHP Surveys
90 Wolverton Road, Haversham, Bucks, MK19 7AB
Tel: 07522 540529 Email: alexis.h.pond@outlook.com



<u>Abbreviations:</u>

ACU	Air Conditioning Unit	P	Post
AV	Air Valve	PE	Pipe
BL	Bollard	PM	Parking Meter
BH	Borehole	RE	Rodding Eye
BL	Bed Level	RL	Ridge Level
BS	Bus Stop	RP	Reflector Post
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B/RW	Brick Retaining Wall	RW	Retaining Wall
CB	Control Box	RWP	Rain Water Pipe
CTV	Cable TV Cover	ST	Stump
CCTV	Close Circuit TV	SL	Soffit Level
CL	Cover Level	SN	Sign
COL.	Column	SV	Stop Valve
CONC.	Concrete	SVP	Soil & Vent Pipe
CPS	Concrete Paving Slabs	S/RW	Stone Retaining Wall
DPC	Damp Proof Course	SW	Surface Water
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DP	Down Pipe	TCB	Telephone Call Box
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FL	Floor Level	UTL	Unable To Lift
F/Light	Flood Light	VP	Vent Pipe
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GD	Ground Drain	WM	Water Meter
GY	Gully	WO	Wash Out
GV	Gas Valve	WT	Water Tap
GP	Gate Post	Ø	Diameter
Ht.	Height		
IC	Inspection Chamber		

<u>Fence Abbreviations:</u>

IL	Invert Level	B/W	Barbed Wire
KO	Kerb Outlet	C/B	Close Boarded
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MH	Manhole	I/R	Iron Railing
MK	Marker Post	P/R	Post & Rail
MS	Mile Stone	P/W	Post & Wire
NP	Name Plate		
OSBM	Ordnance Survey Bench Mark		
OH	Overhead		

<u>General Notes:</u>

1. Man entry to sewers has not been undertaken. Depths, pipe sizes and quantity of pipes are measured from the surface. We therefore cannot guarantee the completeness or accuracy of the sewer data which should be checked with the local authority or and/on site.
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4. If received electronically it is the recipient's responsibility to print to the correct scale. Only written dimensions should be used.

<u>Notes:</u>

Grid & Levels are related to Ordnance Survey National Grid & Datum using real time GPS.
No scale factor has been applied.
3d information is on a frozen layer called "triangles".

REV NO	REV NOTE	DATE	SIGNED

Client: BARRETTS OF ASPLEY

Project: LADYMEAD FARM
THE WILLOWS
QUAINTON, HP22 4AN

Title: AS BUILT SURVEY OF DRIVE & ENTRANCE

Dwg. No: HS1100_3 Revision: A

Date	09.05.22	Scale	1:500 @ A0
Status	FINAL	Sheet	1 of 1

AHP Surveys
90 Wolverton Road, Haversham, Bucks, MK19 7AB
Tel: 07522 540529 Email: alexis.h.pond@outlook.com

Appendix D – Flood Modelling Report

Modelling Report

Ladymead Farm, Quainton, Aylesbury

Job Ref:	20-332
Revision:	00
Issue Date:	12th September 2020

calibro

Control Sheet

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Prepared By:	Signature	Date
Lucy Ginn BSc MSc Graduate Flood Risk Consultant	[redacted]	11.09.20

Reviewed By:	Signature	Date
Alex Bearne BSc MSc Head of Flood Risk & Hydrology	[redacted]	122.09.20

Approved for Issue:	Signature	Date
Alex Bearne BSc MSc Head of Flood Risk & Hydrology	[redacted]	12.09.20

Revision	Prepared By	Reviewed By	Date	Description
00	LG	AB	12.09.20	First Issue

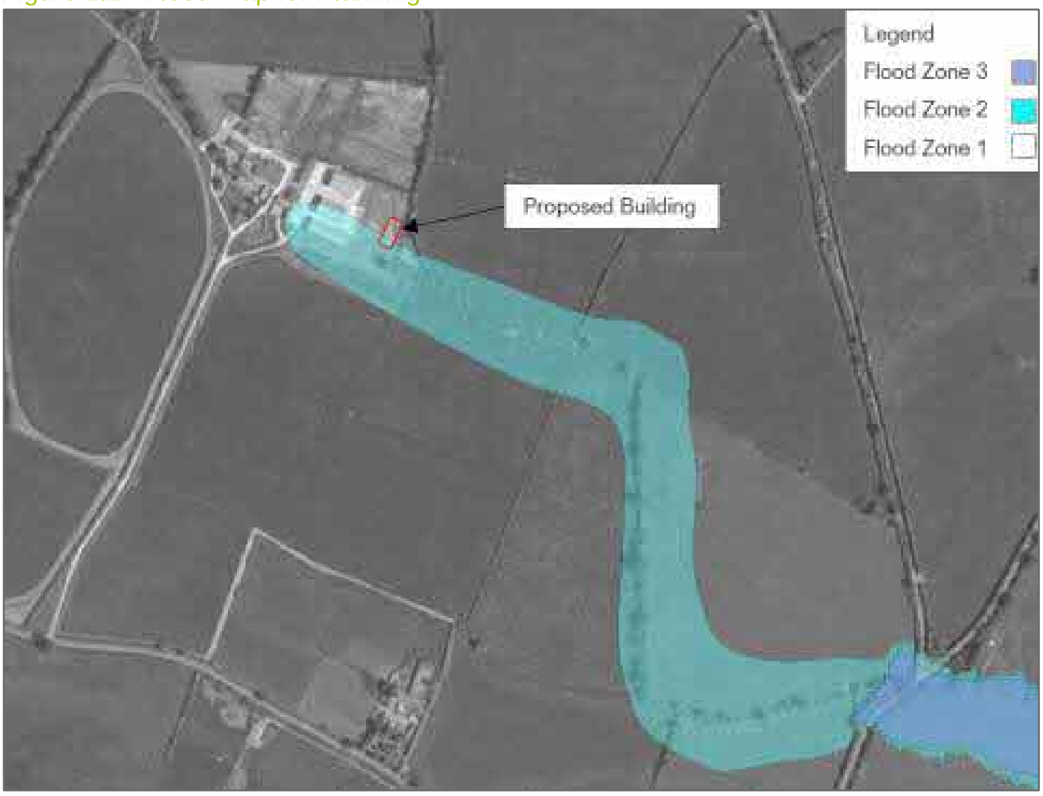
1. Introduction

1.1.1 Calibro has been appointed by *Sherwill Drake Forbes* to undertake a Hydraulic Modelling to assess the risk of flooding to a proposed development at Ladymead Farm, Quainton, Ayesbury, HP22 4AN.

1.1.2 The approximate co-ordinates for the centre of the site are 476000, 219950, and the postcode is HP22 4AN. The proposed new building is 0.054ha located within and area of an existing development.

1.1.3 The Flood Map for Planning shows part of the proposed development site to fall within Flood Zone 2 on the basis of a recorded flood event in March 1947 (see Figures 1.1 and 1.2).

Figure 1.1 –Flood Map for Planning



1.1.4 The recorded flood outline appears to be fairly broadscale in nature and there have since been changes in the area, notably the new development in the western part of the Ladymead site and presumably the culvert to the south of the new development.

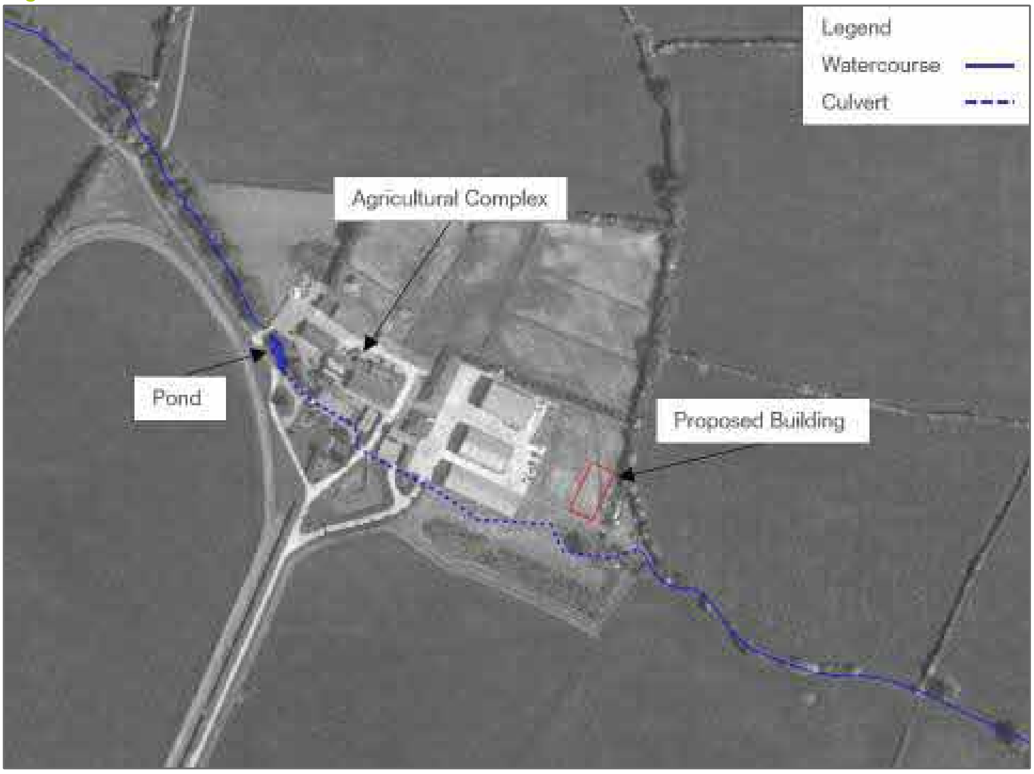
Figure 1.2 - Environment Agency Recorded Flood Outline

1.1.5 In order to assess the risk to the site a hydraulic model of the watercourse that flows through Ladymead has been constructed.

2. Hydrology

2.1.1 There is a watercourse located close to proposed development site (Figure 1.1). It flows in a southeasterly direction through a channel 1-3m wide and 1-2m deep, which sits within a subtle valley, before reaching a pond at the eastern edge of the Ladymead development.

Figure 2.1 - Watercourse located close to site



2.1.2 This pond is drained by a 0.4m culvert approximately 280m long before discharging to the open channel to the east of the proposed building. The open channel is this location is approximately 2m wide and 2m deep sitting within a well-defined valley approcimately 7m wide and 3.5m deep.

2.1.3 Photographs of the watercourse and pond are included as Figure 2.2 and Figure 2.3, respectively.

2.1.4 The watercourse just downstream of the site drains a total catchment area of 0.98km^2 according to data extracted from the FEH Webservice as shown in Figure 2.4.

Figure 2.2 - View of the watercourse just upstream of the pond, looking upstream

Figure 2.3 –Ornamental Pond at the end of open channel section

Figure 2.4 –FEH Catchment Boundary

2.1.5 The catchment is essentially rural. A review of topographic data confirmed the catchment boundary was a reasonable approximation as were the catchment descriptors relating to soil and geology types.

2.1.6 Flows were calculated for the catchment using the ReFH2.3 model. This is considered to be the most accurate methodology for calculating flows from small catchments ungagued catchments.

2.1.7 The calculated values were marginally higher than those used in a study by UK Flood Risk Consultants to support an adjacent application (17/03253/APP) as shown in Table 3.1. Statistical method QBAR (1 in 2.3) year rate was calculated as being 0.26m^3/s.

Table 2.1 –ReFH Method Full Catchment Flows

Event	Calculated Flows (m^3/s)	Previous Study (m^3/s)
1 in 2 year	0.35	0.38
1 in 5 year	0.59	0.51
1 in 10 year	0.72	0.62
1 in 50 year	1.05	0.90
1 in 100 year	1.21	1.06
1 in 1000 year	2.06	1.98

3. Hydraulic Modelling

3.1 Baseline Model

3.1.1 An ESTRY-TUFLOW model of the watercourse in the vicinity of the site was created using a combination of LiDAR and topographical survey data. As the watercourse is culverted underneath the existing Ladymead development defining flow through the culvert was considered to be the key element of the modelling work.

3.1.2 The 2D domain is modelled with a 2m horizontal grid based on LiDAR and improved in places with information from topographic survey. The 2D timestep is 1 second and the 1d timestep is 0.5 second.

3.1.3 The upstream channel was modelled in 2D by defining a Gully type ZLN using invert levels recorded in the survey data.

3.1.4 A ZTIN layer was used to define the pond and surrounding walls. Another ZTIN layer was used to define the proposed development site and the existing surface water drainage basin on the site which were not accurately represented in the LiDAR data.

3.1.5 ZSH layers were used to define the decks above culverts and to raise levels where buildings are by 0.15m.

3.1.6 This culvert under the Ladymead development and the two culverts further upstream where there are access roads crossing the watercourse were defined in 1D using information from the topographical survey. The culverts are connected to the 2D domain using SX connections.

3.1.7 The channel immediately downstream of the long culvert was also modelled in 1D using three channel sections taken from survey data, in order to increase confidence in the water levels downstream of the culvert.

3.1.8 This short section of open channel discharges to the 2D domain using an SX connection. Downstream of this point a Gully type ZLN was used to define the channel using LiDAR data beyond the limit of the topographic survey.

3.1.9 Inflows were added to the head of the modelled reach. This is an inherently conservative approach as a portion of the catchment would not drain to the channel upstream of the culvert.

3.1.10 The downstream boundary is defined with a 2d_bc with a head-discharge relationship derived from an assumed water surface gradient of 1:100 based on the ground surface slope. The downstream boundary is located approximately 200m from the development.

3.1.11 Manning's roughness values for the 2D domain are as follows:

Buildings –0.3

Roads and hardstanding –0.15

Channel –0.08

Natural ground –0.04

3.1.12 Manning's roughness for the 1D element are as follows:

Open Channel –0.035

Culverts –0.015

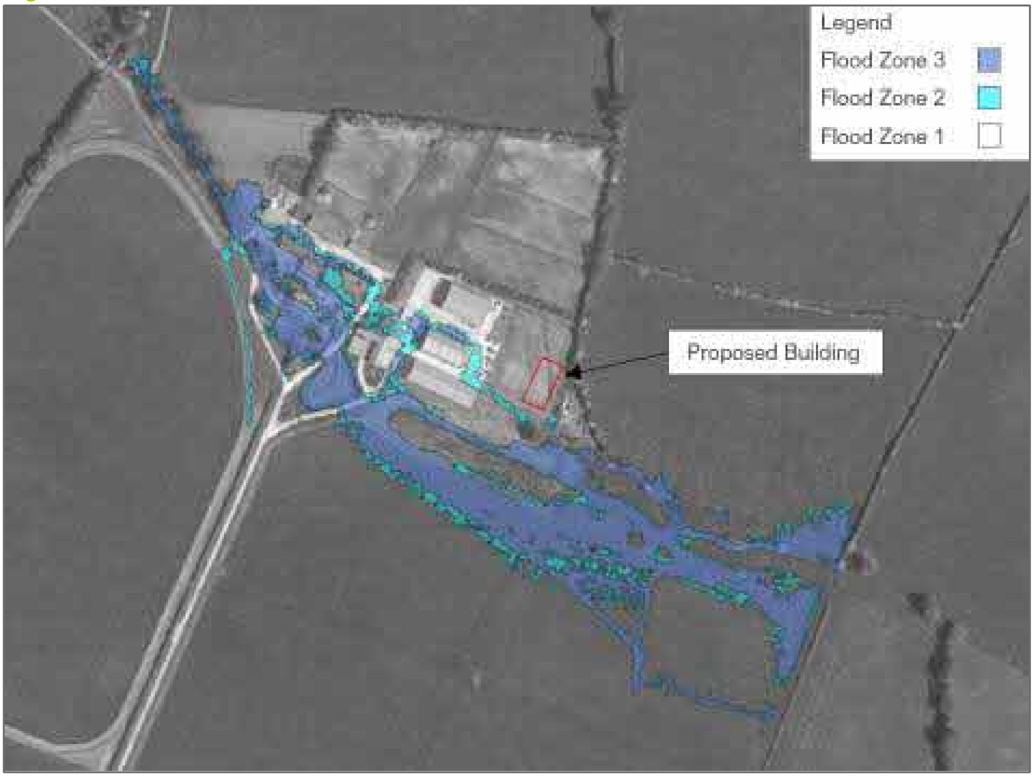
Figure 3.1 –Model Schematisation

3.2 Results

3.2.1 In the existing situation water backs up behind the culvert draining the pond and water flows overland predominantly to the south of the buildings. A small amount of water flows between buildings to the north of the pond. Resulting in shallow flooding within the existing development.

3.2.2 The flooding is not predicted to affect the development site but flooding of the existing surface water drainage basin is predicted. Baseline flood outlines are shown in Figure 3.2 and Appendix A.

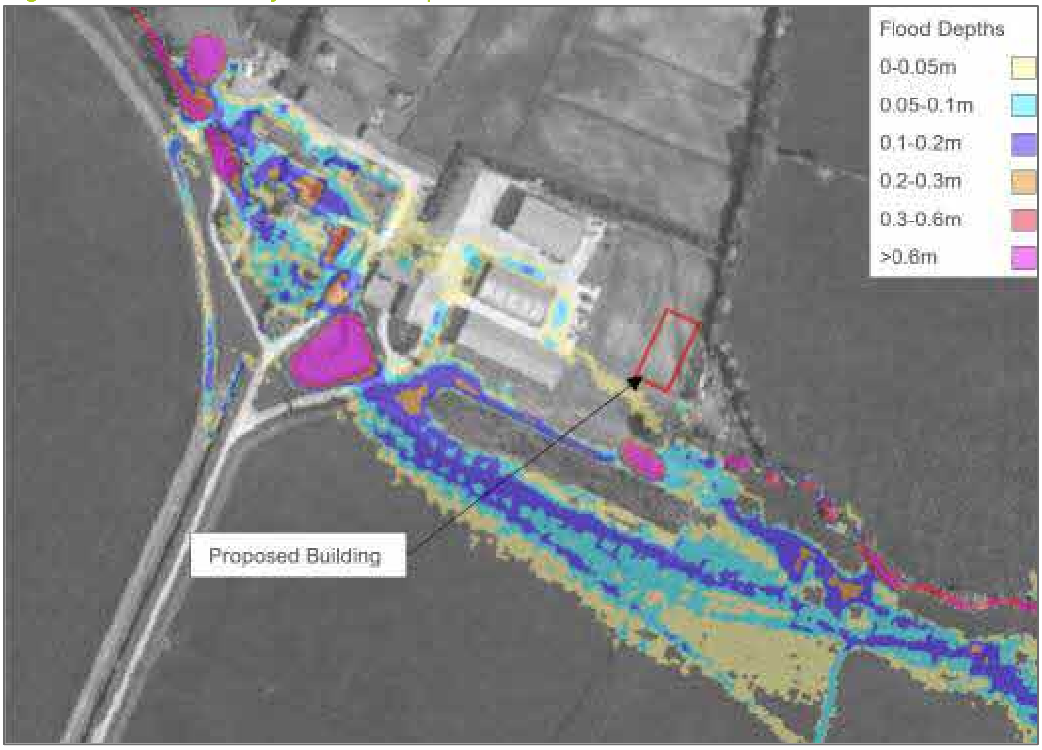
Figure 3.2 –Baseline Flood Outlines



3.2.3 To assess the residual risk a simulation of a 90% blockage during the 1 in 1,000 year was carried out. This results in similar flood outlines and depths with no flooding of the site predicted. The access into the site is not flood to depths in excess of 0.2m so safe site access/egress would not be precluded. Blockage flood depths are shown in Figure 3.3 and Appendix A.

3.2.4 Sensitivity tests were carried out by slackening the downstream boundary gradient to 1 in 200 and increasing Manning's in both the 1D and 2D domains by 25%. Flood levels changed by less than 10mm confirming that the results are not particularly sensitive to assumptions about roughness or downstream boundary.

Figure 3.4 –1 in 1,000 year flood depths



3.3 Proposals Modelling

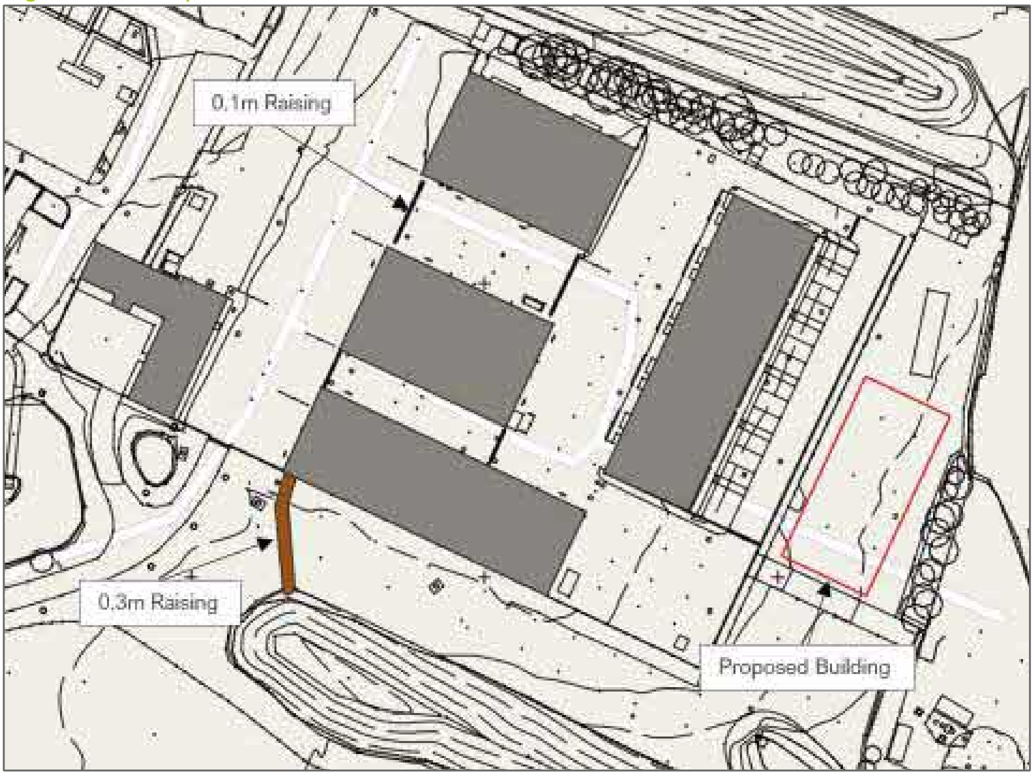
3.3.1 In order to prevent overland flow affecting the area to the south of the proposed development, where there is an existing surface water drainage basin which will be enlarged to manage runoff from the proposals. Two minor ground level changes are proposed:

Minor raising of hardstanding between existing buildings is proposed to a minimum height of 0.1m.

An earth bund with a minimum height of 0.3m is proposed to prevent water flowing between and existing boundary wall and an earth banks

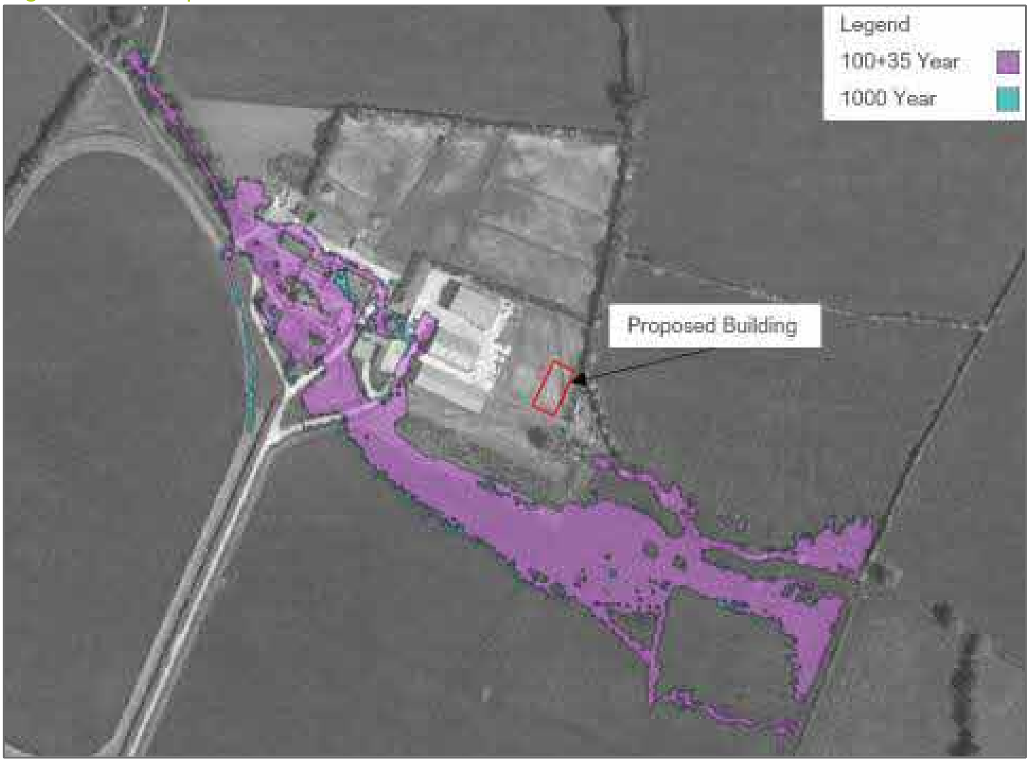
3.3.2 The proposals are shown in Figure 3.5

3.3.3 Figure 3.5 - Proposed features



3.3.4 The proposed mitigation works divert water to the south of the existing bund and prevent flooding of the surface water drainage basin. During the 1 in 100 year +35% climate change event, flood levels to the west of the proposed earth bund increase by 50mm. Elsewhere in the model flood level increases are less than 20mm.

Figure 3.6 –Proposed scenario flood outlines



hello@calibro-consultants.com
www.calibro-consultants.com

81 Whiteladies Road I Bristol I BS8 2NT

4. Conclusions

4.1.1 Hydraulic modelling was carried out to assess the risk of flooding to the proposed development at Ladymead. The modelling conservatively assumed that the full study catchment flows drain to the watercourse upstream of the culvert underneath the existing Ladymead development is not sufficient to convey flood flows.

4.1.2 During extreme flood events the culvert under Ladymead is overwhelmed and shallow flooding occurs across wide areas of the site.

4.1.3 Flooding does not the proposed development, which should be classified as falling with Flood Zone 1.

4.1.4 Simulation of 90% blockage of the culvert under the Ladymead development reveals that the proposed development site is not at residual risk of flooding. During this event flooding would not preclude safe access/egress to the development.

4.1.5 Proposals modelling reveals that minor modifications to the existing topography would prevent flooding of the existing surface water attenuation basin. The effect on flood levels elsewhere would be insignificant.

4.1.6 Sensitivity testing reveals that the model is not particularly sensitive to the Manning's roughness definition or the downstream boundary definition.

Appendix A
Flood Model Output

Legend

- 1000 Year
- 100 Year

REV:	DESCRIPTION:	BY:	DATE:
01	FIRST ISSUE	LG	05.08.2020

STATUS: FOR INFORMATION

CLIENT: SHERWILL DRAKE FORBES

SITE: LADYMEAD FARM

TITLE: EXISITNG FLOOD OUTLINES

calibro

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:1000	05.08.2020	LG	AB
PROJECT NO: 20-332		DRAWING NO: HYD01	REVISION: 01

Legend

Flood Depths (m)

- 0-0.05
- 0.05-0.1
- 0.1-0.2
- 0.2-0.3
- 0.3-0.6
- >0.6

REV:	DESCRIPTION:	BY:	DATE:
02	SECOND ISSUE	LG	11.09.2020
01	FIRST ISSUE	LG	05.08.2020

STATUS: FOR INFORMATION

CLIENT: SHERWILL DRAKE FORBES

SITE: LADYMEAD FARM

TITLE: 90% BLOCKAGE 1 in 1000 YEAR FLOOD DEPTHS

calibro

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:1000	11.09.2020	LG	AB
PROJECT NO:		DRAWING NO:	REVISION:
20-332		HYD02	02

Legend

- 100+35 Year
- 1000 Year

REV:	DESCRIPTION:	BY:	DATE:
01	FIRST ISSUE	LG	05.08.2020

STATUS: FOR INFORMATION

CLIENT: SHERWILL DRAKE FORBES

SITE: LADYMEAD FARM

TITLE: PROPOSED SCENARIO FLOOD OUTLINES

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SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:1000	05.08.2020	LG	AB

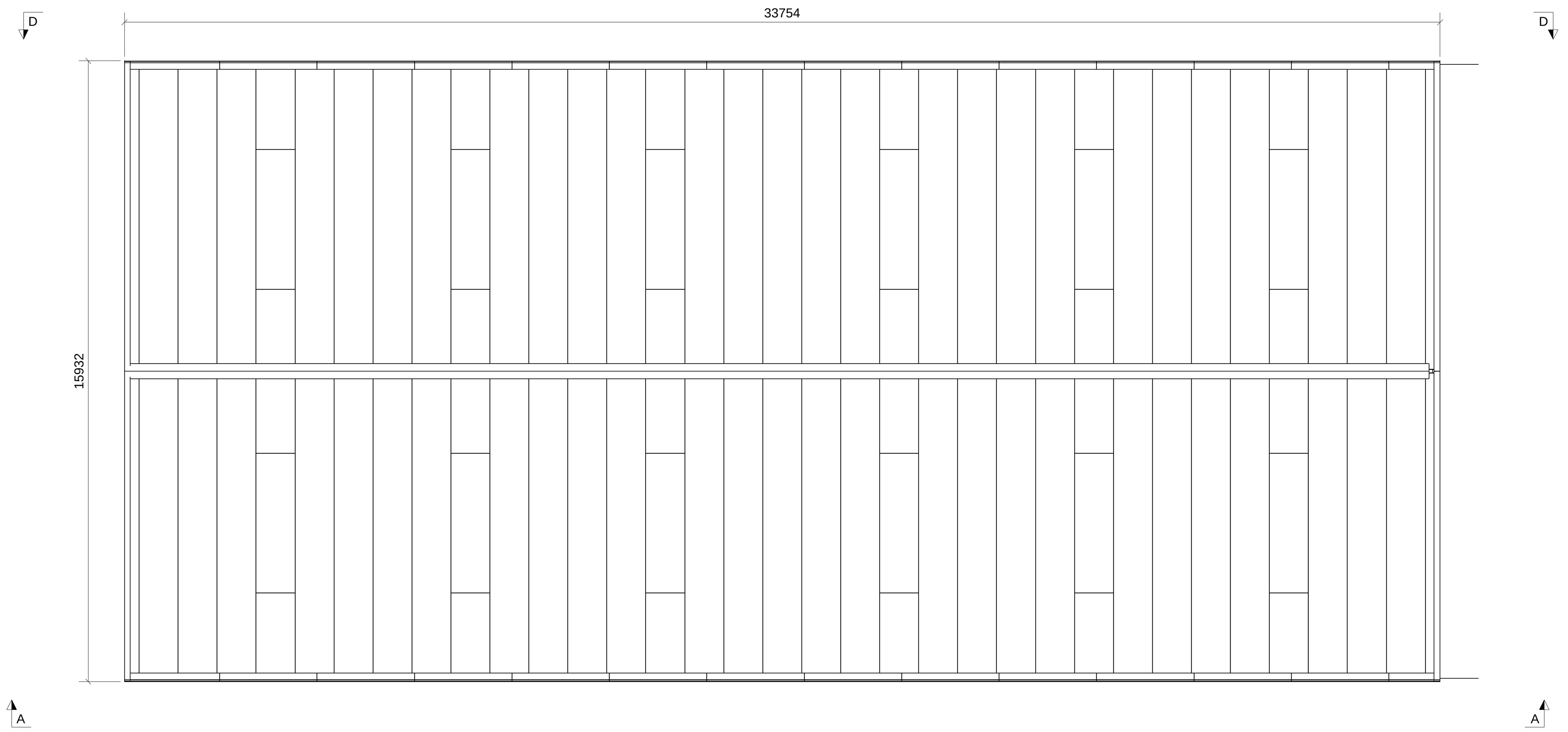
PROJECT NO:	DRAWING NO:	REVISION:
20-332	HYD03	01

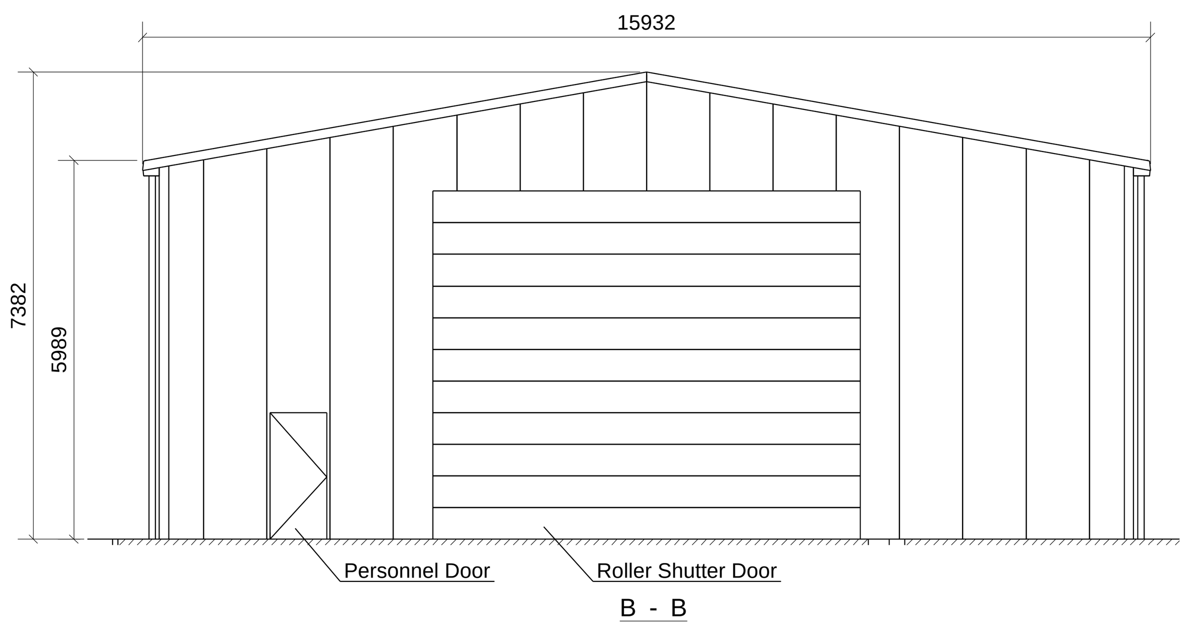
Appendix B
Site Proposals

Roof Cladding - Profiled metal sheeting
Colour - Merlin Grey

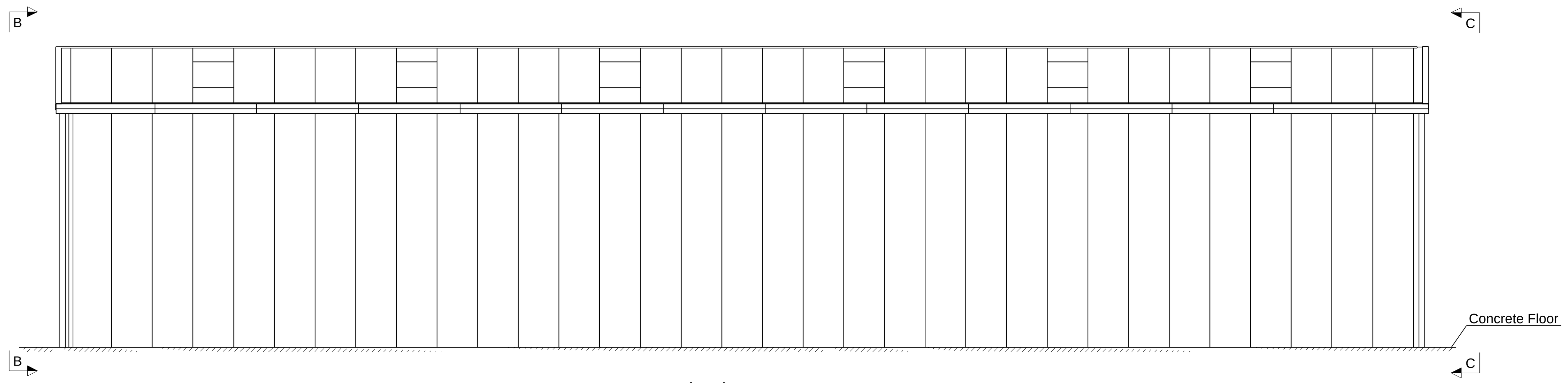
Roof Lights - Profiled clear sheeting
15% of roof area

Side Cladding - Profiled metal sheeting
Colour - Black

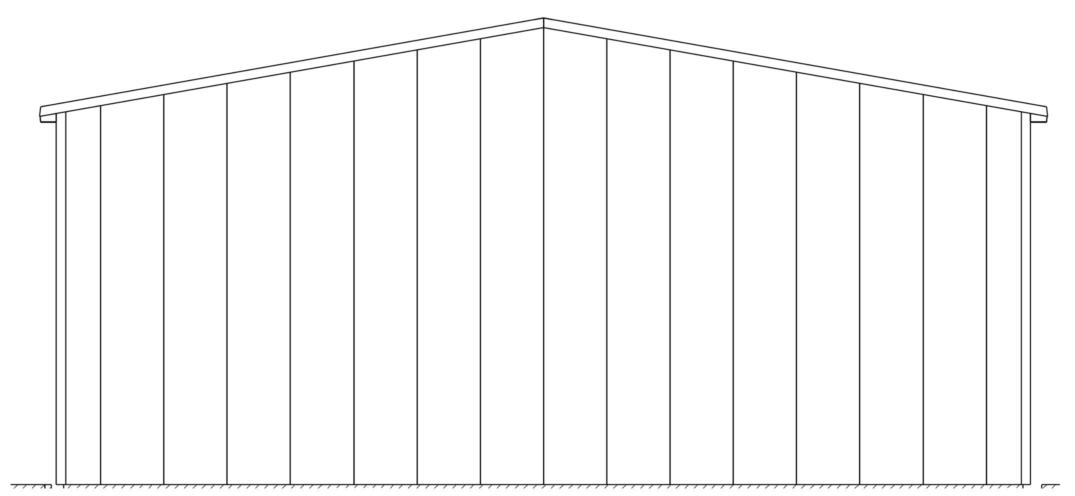




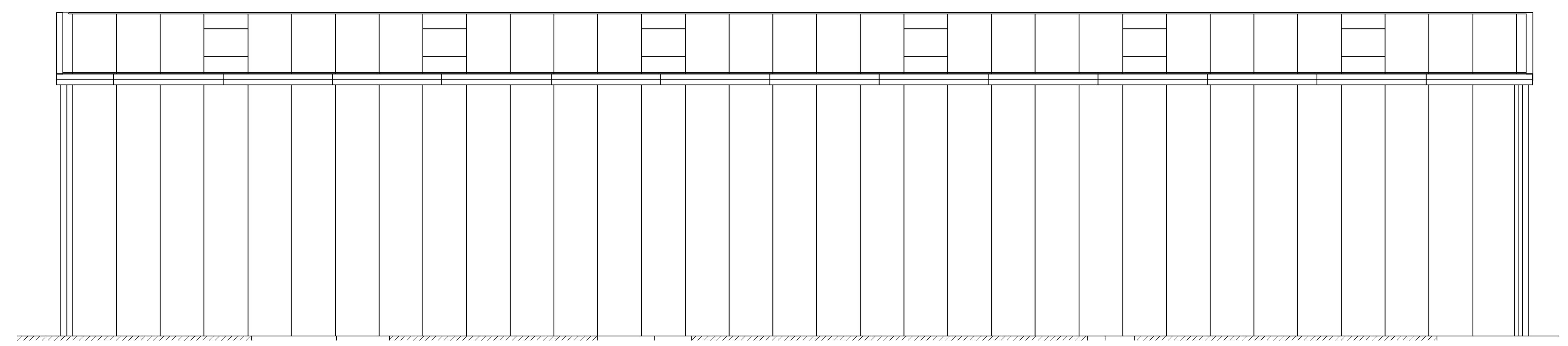
B - B



A - A



C - C



D - D

0 5 10 15 20

Tekla Structures

General Notes

Component Characteristics

Tolerances of dimension and shape
EN 1090-2 Tolerance class 1

Weldability
EN 10025-2, S275 / S355

Fracture toughness / impact resistance
S275JR (27J@20°C)
S355 (35J@20°C)
Stainless 304 / 316

Load Bearing Capacity
Designed to BS5950 / EN 1993

Steel Specification
National Structural Steelwork Specification for Building Construction 6th Edition CE Marking

Welds
All welds to comply to BoA Welding Procedure Specifications (WPS)

Steel Grades
All steel grades to be in accordance with BoA Material Grade Specification. If in doubt, please ask.

Rev	Revision Details	Date	By
A	CLADDING SPEC AMENDED	19/08/20	AJB

Welded Structural Components Execution Class 2 BS EN 1090

Ladymead Farm
Quainton
BoA

Client
BoA

Project Number : C2462
Drawing creation date : 15.03.2019
Scale @ A1 : 1:100
Drawn By : AJB
Checked By : AB
BoA Issue check by :
Status :
BoA PM : AB

Drawing Title :
General Purpose Farm Building

Drawing Number: C2462 - G[180]
Revision: A

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MK43 ONN
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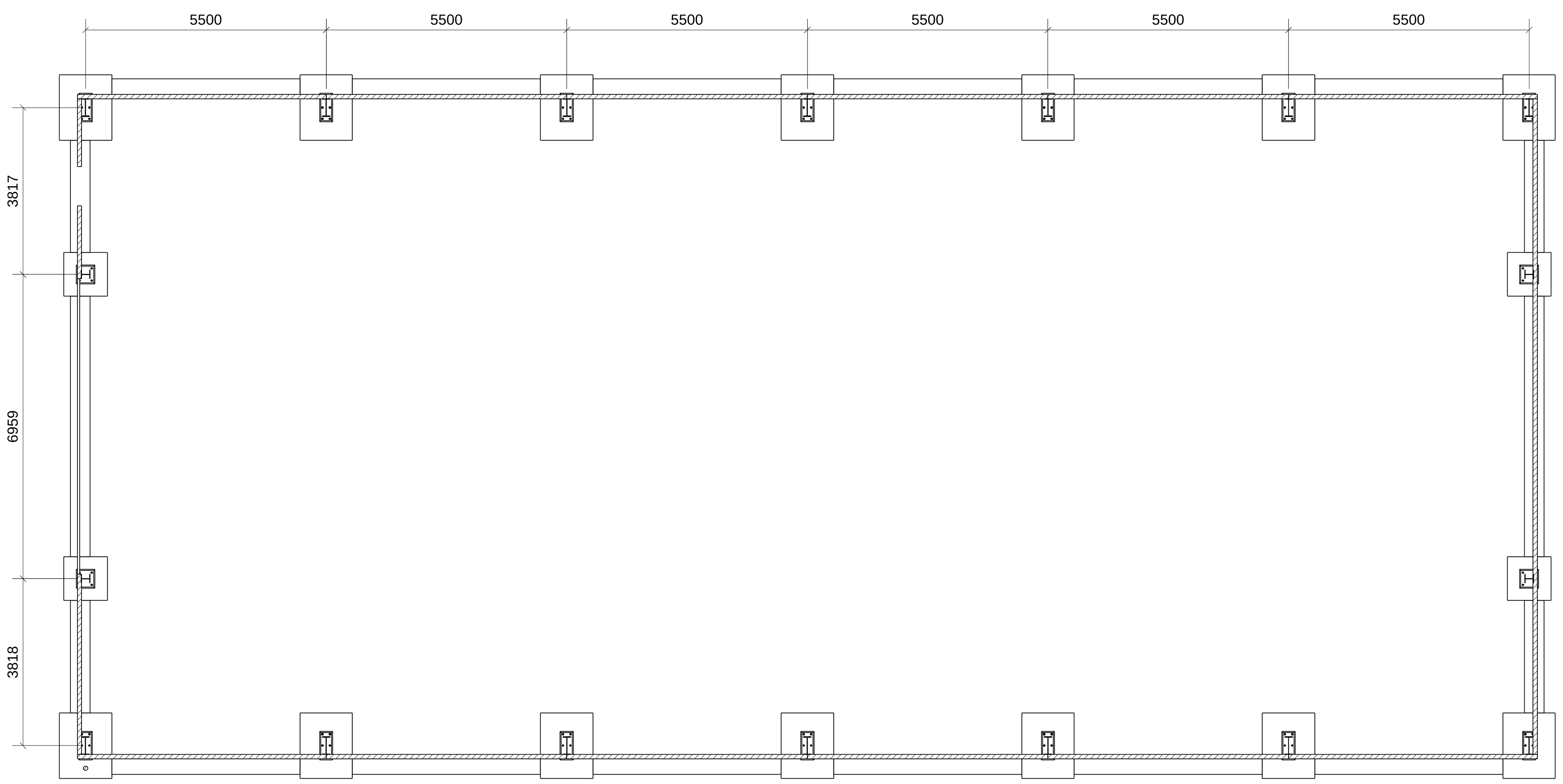

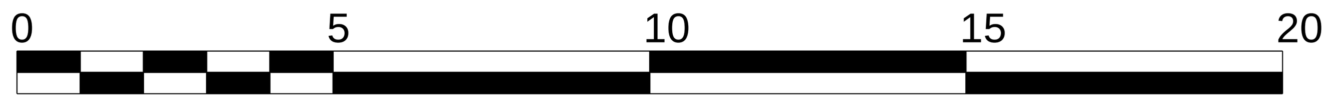

General Notes

Component Characteristics

Tolerances of dimension and shape
EN 1090-2 Tolerance class 1

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EN 10025-2, S275 / S355

Fracture toughness / impact resistance
S275JR (27J@20°C)
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Rev	Revision Details	Date	By

Welded Structural Components Execution Class 2 BS EN 1090

Ladymead Farm
Quainton
BoA

Client
BoA

Project Number : C2462
Drawing creation date : 15.03.2019
Scale @ A1 : 1:100
Drawn By : AJB
Checked By : AB BoA Issue check by
Status : BoA PM AB
Drawing Title :

General Purpose Farm Building - Floorplan

Drawing Number Revision
C2462 - G [181]

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Specialists in Architectural Metalwork & Structural Steelwork

Production Control Certificate 1224-CPR-0541

Tekla Structures

Appendix C
Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	650	Urban	0.000
Area (ha)	0.054	Soil	0.450	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.7
Q1 year	0.2
Q30 years	0.5
Q100 years	0.7

Appendix D
Drainage Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	93.942	0.442	1.9	40.5	Flood Risk
30 min Summer	94.010	0.510	1.9	51.9	Flood Risk
60 min Summer	94.064	0.564	2.0	62.0	Flood Risk
120 min Summer	94.100	0.600	2.0	69.3	Flood Risk
180 min Summer	94.107	0.607	2.0	70.8	Flood Risk
240 min Summer	94.102	0.602	2.0	69.8	Flood Risk
360 min Summer	94.082	0.582	2.0	65.7	Flood Risk
480 min Summer	94.068	0.568	2.0	62.7	Flood Risk
600 min Summer	94.055	0.555	2.0	60.2	Flood Risk
720 min Summer	94.043	0.543	1.9	57.9	Flood Risk
960 min Summer	94.020	0.520	1.9	53.6	Flood Risk
1440 min Summer	93.974	0.474	1.9	45.6	Flood Risk
2160 min Summer	93.904	0.404	1.9	34.9	Flood Risk
2880 min Summer	93.836	0.336	1.9	25.7	O K
4320 min Summer	93.706	0.206	1.9	11.9	O K
5760 min Summer	93.556	0.056	1.9	1.5	O K
7200 min Summer	93.500	0.000	1.7	0.0	O K
8640 min Summer	93.500	0.000	1.4	0.0	O K
10080 min Summer	93.500	0.000	1.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.942	0.0	42.5	19
30 min Summer	91.303	0.0	55.5	33
60 min Summer	56.713	0.0	68.9	62
120 min Summer	34.038	0.0	82.7	122
180 min Summer	24.922	0.0	90.8	182
240 min Summer	19.863	0.0	96.6	240
360 min Summer	14.376	0.0	104.8	306
480 min Summer	11.430	0.0	111.2	368
600 min Summer	9.562	0.0	116.1	432
720 min Summer	8.260	0.0	120.5	498
960 min Summer	6.553	0.0	127.4	636
1440 min Summer	4.721	0.0	137.8	908
2160 min Summer	3.397	0.0	148.5	1300
2880 min Summer	2.686	0.0	156.7	1676
4320 min Summer	1.927	0.0	168.5	2420
5760 min Summer	1.522	0.0	177.4	3000
7200 min Summer	1.266	0.0	184.6	0
8640 min Summer	1.089	0.0	190.5	0
10080 min Summer	0.959	0.0	195.7	0

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	93.974	0.474	1.9	45.6	Flood Risk
30 min Winter	94.047	0.547	1.9	58.6	Flood Risk
60 min Winter	94.105	0.605	2.0	70.4	Flood Risk
120 min Winter	94.146	0.646	2.0	79.4	Flood Risk
180 min Winter	94.157	0.657	2.0	82.1	Flood Risk
240 min Winter	94.157	0.657	2.0	82.0	Flood Risk
360 min Winter	94.143	0.643	2.0	78.8	Flood Risk
480 min Winter	94.123	0.623	2.0	74.2	Flood Risk
600 min Winter	94.107	0.607	2.0	70.9	Flood Risk
720 min Winter	94.093	0.593	2.0	67.8	Flood Risk
960 min Winter	94.062	0.562	2.0	61.6	Flood Risk
1440 min Winter	93.997	0.497	1.9	49.5	Flood Risk
2160 min Winter	93.896	0.396	1.9	33.6	O K
2880 min Winter	93.792	0.292	1.9	20.6	O K
4320 min Winter	93.500	0.000	1.8	0.0	O K
5760 min Winter	93.500	0.000	1.5	0.0	O K
7200 min Winter	93.500	0.000	1.2	0.0	O K
8640 min Winter	93.500	0.000	1.0	0.0	O K
10080 min Winter	93.500	0.000	0.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	139.942	0.0	47.6	18
30 min Winter	91.303	0.0	62.1	33
60 min Winter	56.713	0.0	77.3	62
120 min Winter	34.038	0.0	92.6	120
180 min Winter	24.922	0.0	101.7	178
240 min Winter	19.863	0.0	108.1	234
360 min Winter	14.376	0.0	117.3	340
480 min Winter	11.430	0.0	124.4	390
600 min Winter	9.562	0.0	130.1	464
720 min Winter	8.260	0.0	134.8	542
960 min Winter	6.553	0.0	142.7	692
1440 min Winter	4.721	0.0	154.2	982
2160 min Winter	3.397	0.0	166.3	1388
2880 min Winter	2.686	0.0	175.3	1784
4320 min Winter	1.927	0.0	188.9	0
5760 min Winter	1.522	0.0	198.8	0
7200 min Winter	1.266	0.0	206.7	0
8640 min Winter	1.089	0.0	213.4	0
10080 min Winter	0.959	0.0	219.2	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.415	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.162

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.162

Model Details

Storage is Online Cover Level (m) 94.200

Tank or Pond Structure

Invert Level (m) 93.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	14.6	0.100	65.9	0.500	174.5	0.700	251.1

Hydro-Brake® Optimum Outflow Control

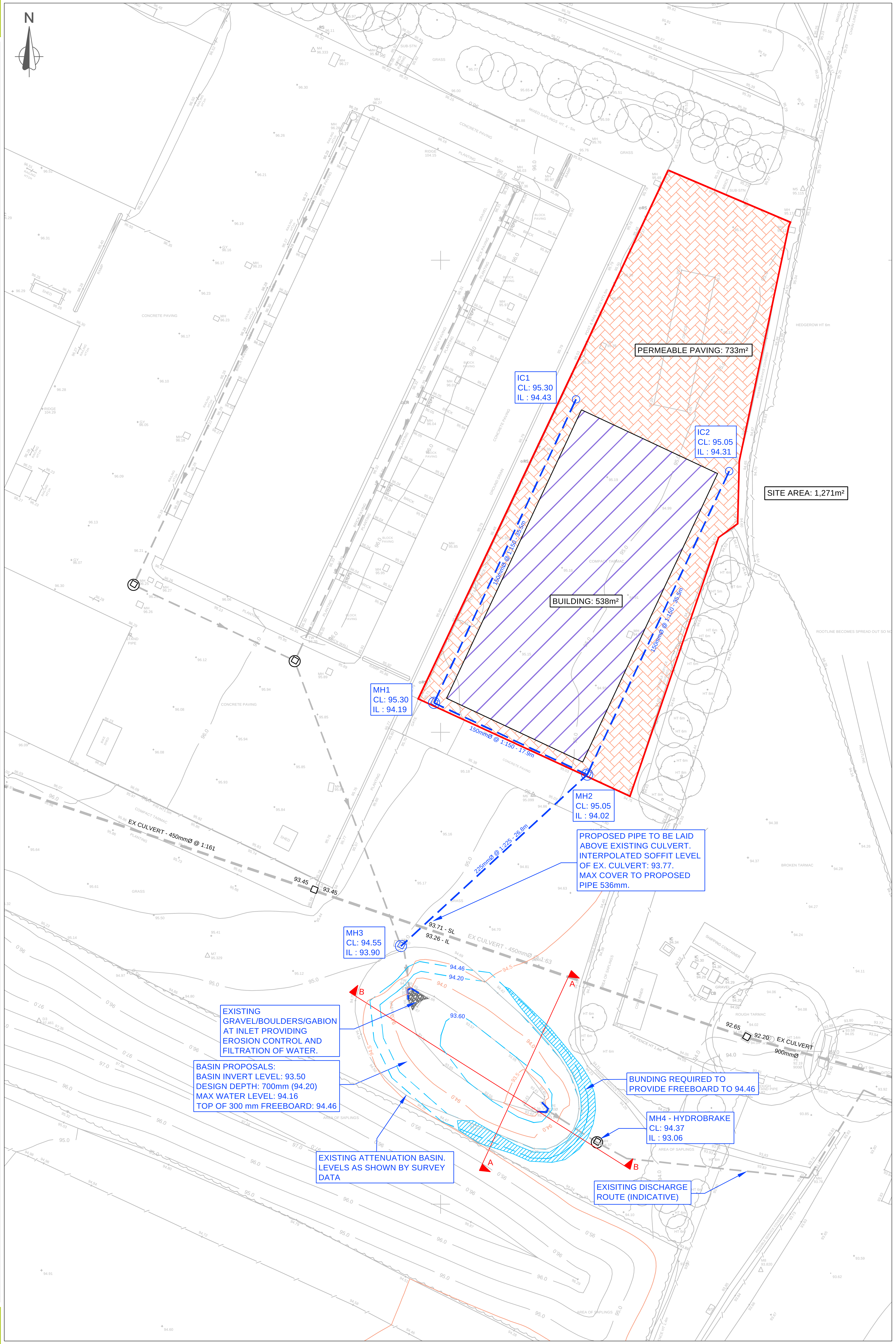
Unit Reference	MD-SHE-0066-2000-1040-2000
Design Head (m)	1.040
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	93.060
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

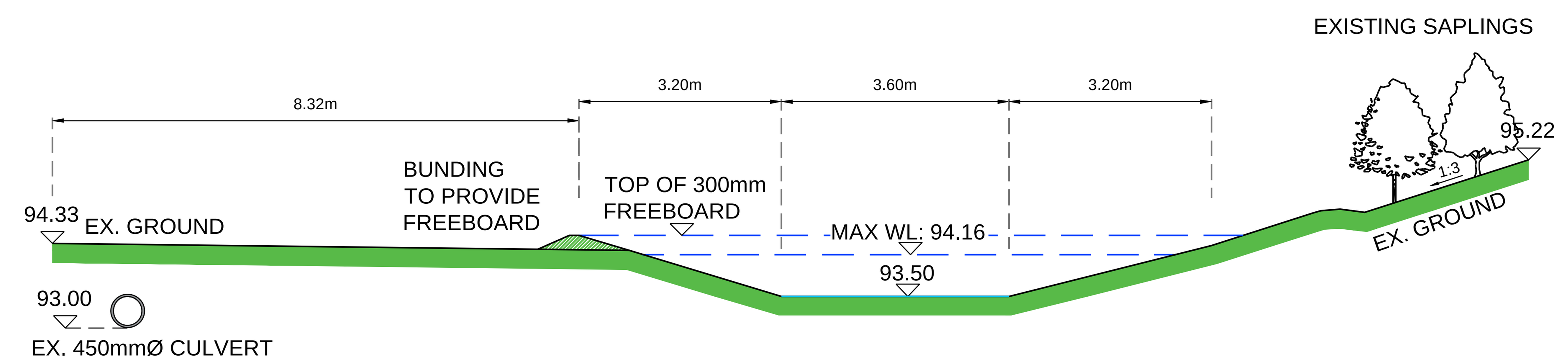
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.040	2.0	Kick-Flo®	0.595	1.6
Flush-Flo™	0.293	1.9	Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

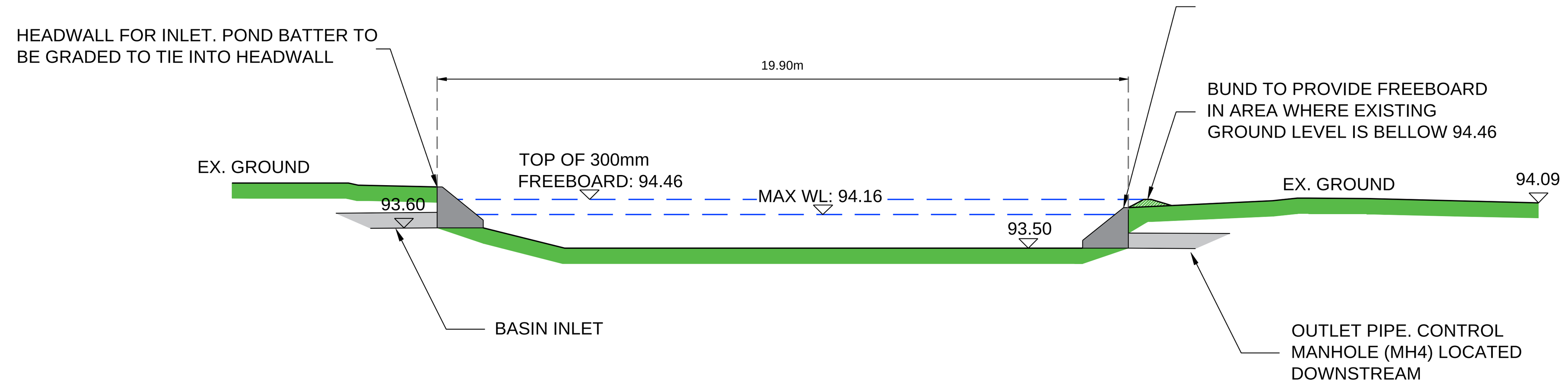
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	2.1	3.000	3.2	7.000	4.8
0.200	1.9	1.400	2.3	3.500	3.5	7.500	5.0
0.300	1.9	1.600	2.4	4.000	3.7	8.000	5.1
0.400	1.9	1.800	2.6	4.500	3.9	8.500	5.3
0.500	1.8	2.000	2.7	5.000	4.1	9.000	5.4
0.600	1.6	2.200	2.8	5.500	4.3	9.500	5.6
0.800	1.8	2.400	2.9	6.000	4.5		
1.000	2.0	2.600	3.0	6.500	4.7		

Appendix E
Proposed Drainage Strategy

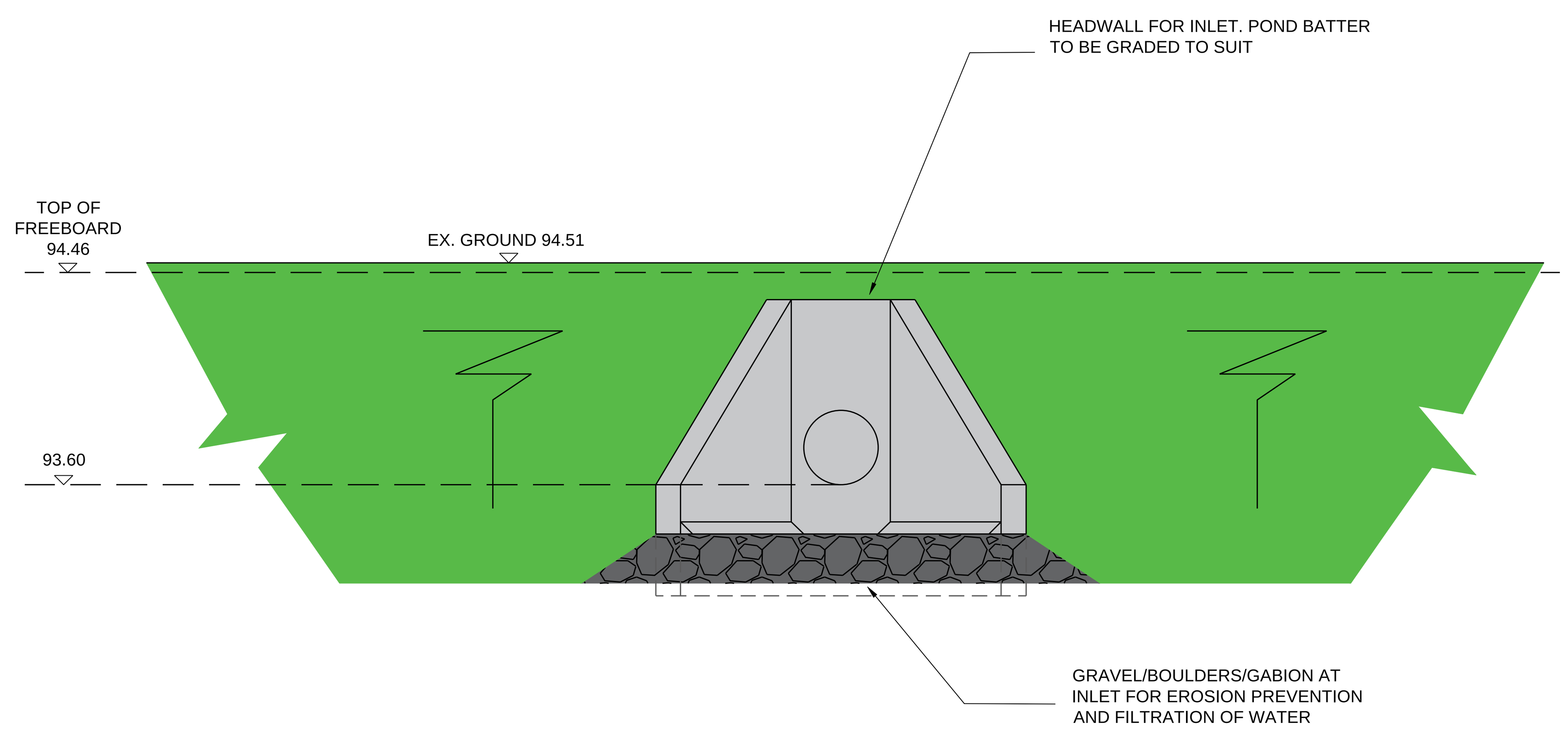




PROPOSED ATTENUATION BASIN
SECTION A-A
N.T.S.



PROPOSED ATTENUATION BASIN
SECTION B-B
N.T.S.



PROPOSED ATTENUATION BASIN
INLET HEADWALL
N.T.S.

NOTES:

1. DO NOT SCALE FROM THIS DRAWING
2. ALL PRIVATE DRAINAGE SHALL BE IN ACCORDANCE WITH BS8301 AND RELEVANT SECTIONS OF APPROVED DOCUMENT H OF THE BUILDING REGULATIONS
3. THE CONTRACTOR IS TO CHECK THE LEVEL OF EXISTING SEWERS BEING USED AS OUTFALLS OR CROSSING PROPOSED DRAINAGE RUNS PRIOR TO LAYING ANY PIPES. ANY DISCREPENCIES ARE TO BE REPORTED TO THE ENGINEER
4. ALL CONNECTIONS FOR DRAINAGE SHALL BE 100MM UNLESS NOTED OTHERWISE. ALL CONNECTIONS WHEN LAID SHALL BE PLUGGED, PROTECTED AS NECESSARY AND MARKED WITH A STAKE FOR FUTURE USE.
5. FOR PRIVATE DRAINS WHERE COVER TO PIPES IS LESS THAN 900MM IN VEHICULAR AREAS OR 600MM IN OTHER AREAS PROTECTION IN THE FORM OF TYPE Z BEDDING SHALL BE USED.
6. WHERE PIPES PASS THROUGH SCREEN WALLS, FOOTINGS OR RETAINING WALLS LINTELS ARE TO BE PROVIDED OVER. UNDER BUILDINGS PIPES SHALL BE SURROUNDED WITH 150MM THICKNESS OF GRANULAR MATERIAL. WHERE DRAINS PASS WITHIN 1M OF BUILDINGS THE WALL FOUNDATION SHALL BE TAKEN DOWN BELOW THE INVERT OF THE PIPE.
7. ALL GULLIES AND RAINWATER DOWNPIPES CONNECTED DIRECTLY TO DRAINS ARE TO BE RODDABLE.
8. ALL DRAINAGE SHALL BE LAID UPSTREAM AND EACH RUN BETWEEN MANHOLES SHALL BE LAID COMPLETE PRIOR TO BACKFILLING. WHERE THIS IS NOT PRACTICAL TRIAL HOLES OR OTHER MEANS OF IDENTIFYING THE LINE AND LEVEL OF SERVICES SHALL BE CARRIED OUT PRIOR TO WORKS COMMENCING.
9. INTERNAL DRAINAGE TO BE LAID AT A MINIMUM GRADIENT OF 1 IN 40 IN ACCORDANCE WITH BS8301.

KEY:

DRAINAGE
- SURFACE WATER SEWER
- BASIN PROPOSED CONTOUR
- BUNDING FOR BASIN FREEBOARD
- MANHOLE
- INSPECTION CHAMBER
- ALTHON H3C HEADWALL OR SIMILAR APPROVED
- ALTHON AH4CA LH HEADWALL OR SIMILAR APPROVED
- EXISTING CULVERT
- EXISTING CONTOUR

PROPOSED IMPERMEABLE AREA
- BUILDING = 0.054ha

REV:	DESCRIPTION:	BY:	DATE:
A	LEVELS ADJUSTED	TLB	09/10/20
-	FIRST ISSUE	TLB	09/09/20

STATUS: FOR INFORMATION

CLIENT: SHERWILL DRAKE FORBES

SITE: LADYMEAD FARM, QUAINTON

TITLE: PROPOSED DRAINAGE STRATEGY AND AREAS PLAN

calibro
transport, highway & infrastructure consultants
t: 0117 2441 970   www.calibro-consultants.com

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:250	09/09/20	TLB	AB
PROJECT NO:		DRAWING NO:	REVISION:
20-332		001	A

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Appendix E – Surface Water Maps

Flood risk

Extent of flooding

Location

Enter a place or postcode

Extent of flooding from surface water

High Medium Low Very low Location you selected

Flood risk

High risk: depth

Location

Enter a place or postcode

Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

Over 900mm · 300 to 900mm · Below 300mm · Location you selected

Flood risk

Medium risk: depth

Location

Enter a place or postcode

Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

Over 900mm · 300 to 900mm · Below 300mm · Location you selected

Flood risk

Low risk: depth

Location

Enter a place or postcode

Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm · 300 to 900mm · Below 300mm · Location you selected

Flood risk

Low risk: velocity

Location

Enter a place or postcode

Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)

Over 0.25 m/s · Less than 0.25 m/s · Direction of water flow · Location you selected