Barwood Development Securities Ltd
PHEASANT OAK FARM, BALSALL COMMON

Flood Risk Assessment and Drainage Strategy

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Version Control and Approval

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Purpose

This document has been prepared for Barwood Development Securities Ltd.

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The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

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CDM

The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Barwood Development Securities Ltd, is made aware of their duties under the CDM Regulations.

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Appendices

1 Executive Summary

1.1.1 PJA has been commissioned by Barwood Development Securities Ltd to prepare a Flood Risk Assessment (FRA) and Drainage Strategy to support an outline planning application for a new residential-led development with associated green open space and infrastructure at Pheasant Oak Farm, Balsall Common.

Table 1-1: Executive Summary Table

Overview	
Site Location	Pheasant Oak Farm, Balsall Common
Development Proposal	Outline Application for Residential Development (up to 250 homes, including 40% affordable) with vehicular access off Waste Lane; demolition of existing buildings/structures; associated landscaping and new public open spaces; community growing area/orchard; and enhancements to Millennium Way through the Site
Environment Agency Flood Zone(s)	Flood Zone 1
Vulnerability Classifications(s)	More Vulnerable
Fluvial Flood Risk	Low
Tidal Flood Risk	Very Low
Surface Water Flood Risk	Low
Groundwater Flood Risk	Low
Sewer Flood Risk	Low
Artificial Flood Risk	Low
Surface Water Drainage	Surface water will be attenuated to the site-specific QBar greenfield rate for all events up to, and including, the 1 in 100 year plus 40% climate change event.
Foul Water Drainage	Foul water is proposed to discharge to the existing Severn Trent Water sewers present within the highways surrounding the Site.

2 Introduction

2.1 Terms of Reference

2.1.1 PJA were commissioned by Barwood Development Securities Ltd. to prepare a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed residential-led development at *Pheasant Oak Farm, Balsall Common* (herein referred to as 'the Site').

2.2 Scope of works

Flood Risk Assessment

2.2.1 This FRA provides information on the nature of identified potential flood risk at the Site and follows government guidance with regard to development and flood risk, largely in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

Drainage Strategy

2.2.2 The surface water drainage strategy aims to sustainably manage surface water from the Site and has been developed in accordance with current sustainable development best practices and the specific requirements of Solihull Metropolitan Borough Council as the Lead Local Flood Authority (LLFA).

2.2.3 A high-level foul water drainage strategy has also been developed for the proposed development Site.

2.3 Information Sources

2.3.1 This report comprises a review of readily available public information and other relevant information obtained from the following sources:

- Environment Agency (EA);
- British Geological Survey (BGS);
- Cranfield Soil and Agrifood Institute Soilscapes;
- Solihull Metropolitan Borough Council;
- DEFRA Magic Mapping; and
- Severn Trent Water.

3 Site Details

3.1 Site Description

3.1.1 The Site, which is the focus of this FRA, comprises agricultural land, existing commercial development and built form. There is an area of hardstanding associated with a caravan storage and built development to support the agricultural uses of the Site located in the centre and south of the Site.

3.1.2 The Site is bound to the north by Waste Lane (B4101) and to the South by Hob Lane. To the east of the Site is existing agricultural land and open space and to the west is existing residential development and Windmill Lane.

3.1.3 The Site's OS co-ordinates are; 425176 , 276243.

3.1.4 A Site location plan is available in Figure 3-1.

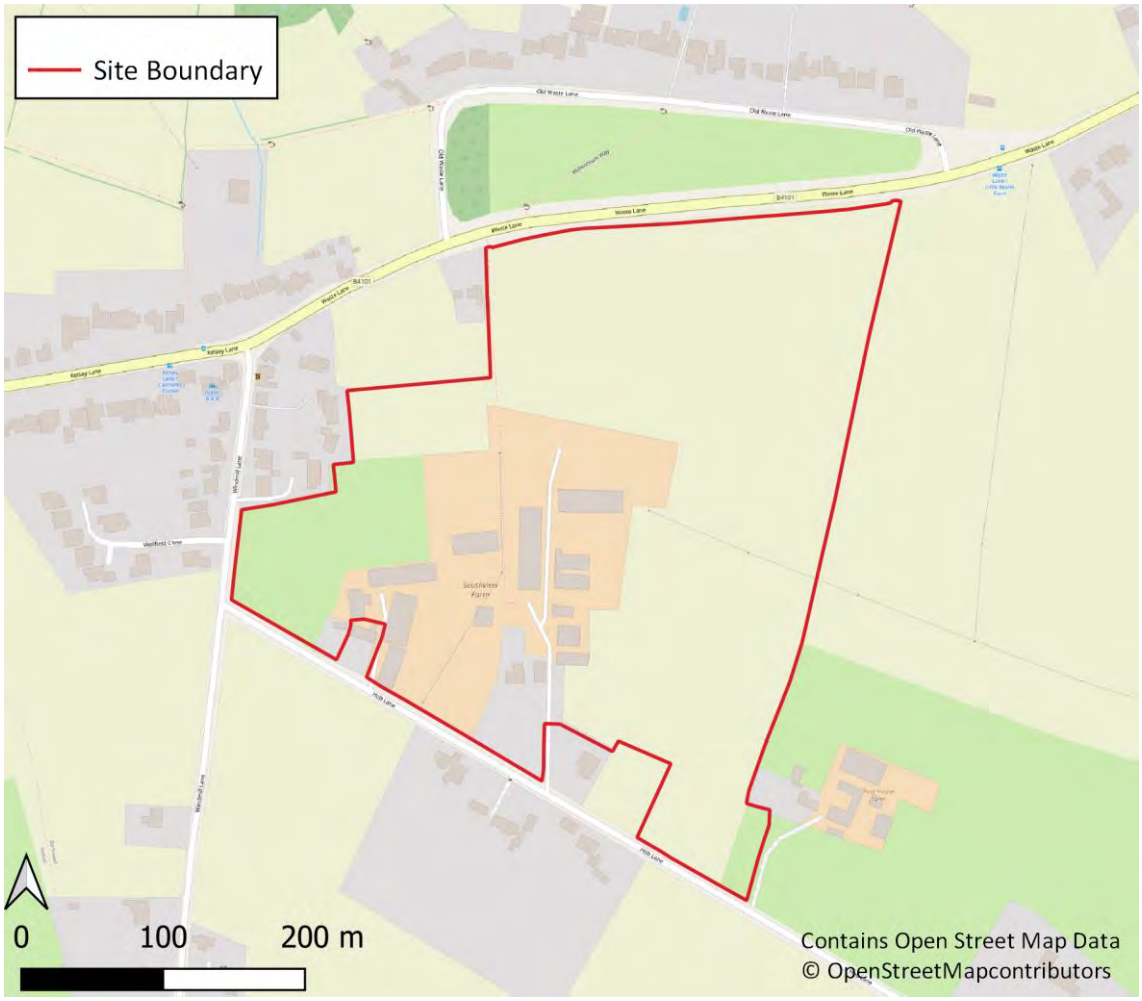

Figure 3-1 – Site Location Plan

Table 3-1: Summary of Site

Site Address	Pheasant Oak Farm, Balsall Common
Existing Land use	Agriculture, open space and hardstanding to park caravans.
Proposed Development Type	Residential
Site Area	12.67ha
OS Co-ordinates	425176 , 276243
Local Planning Authority	Solihull Metropolitan Borough Council
Lead Local Flood Authority	Solihull Metropolitan Borough Council
Local Water Authority	Severn Trent Water

3.2 Site Topography

3.2.1 The Site is predominantly comprises agricultural land, existing commercial development and built form, with an area of built development in the centre and the south of the Site.

3.2.2 From a review of the Site topographic survey, undertaken by Greenhatch Group dated 22nd March 2019, the Site's topography falls from a ridge through the centre of the south of the Site where the existing development is located at a level of 128.67mAOD.

3.2.3 From this ridge, the Site falls to a level of 122.31mAOD in the south-eastern corner of the Site, 124.08mAOD in the north-west of the Site and 125.56mAOD in the north-east of the Site.

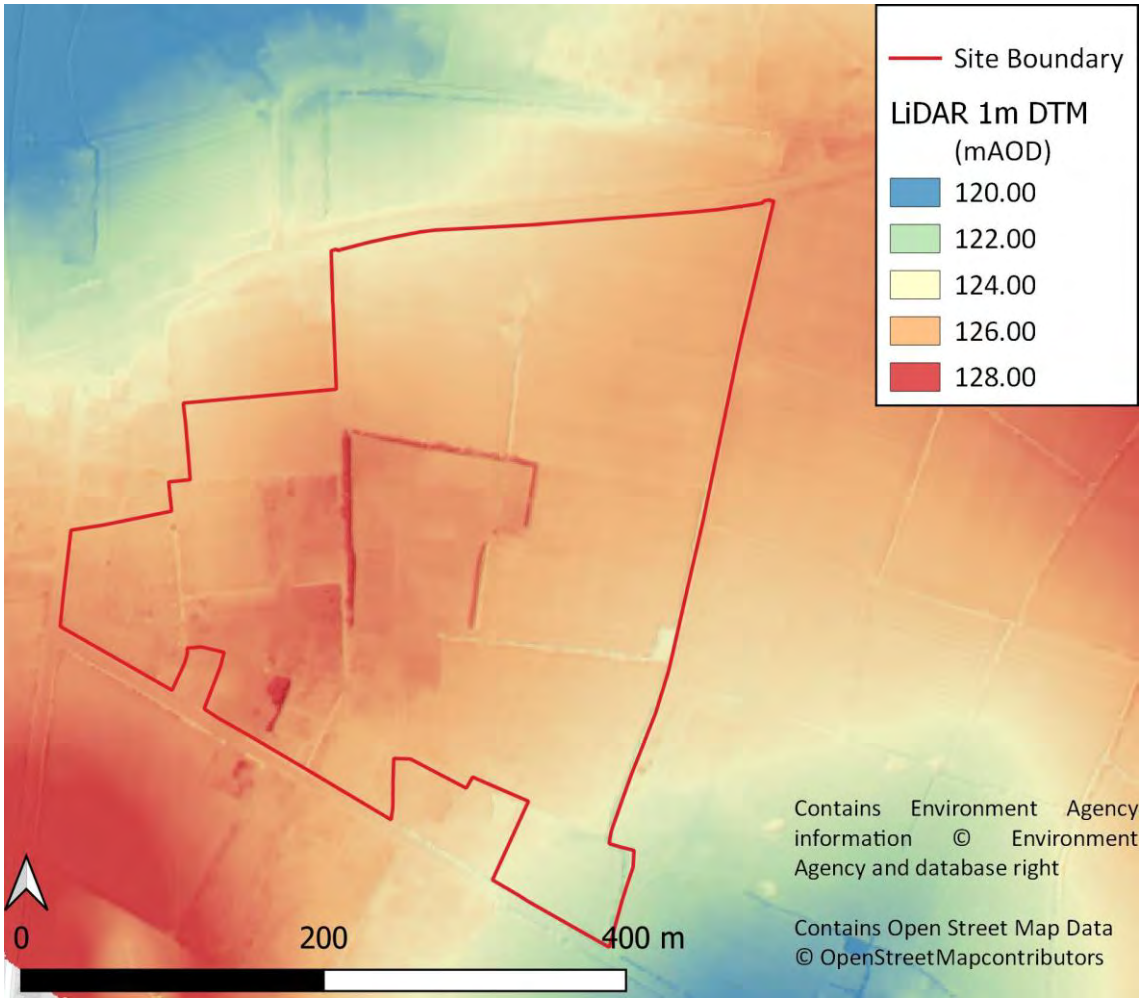

Figure 3-2 - 1m DTM LiDAR Extract

3.3 Ground Conditions

BGS Mapping

3.3.1 The British geological Survey (BGS) Geology of Britain viewer[1] was reviewed to identify the local geological conditions. This identified that the Site is underlain by a bedrock of Mercia Mudstone overlying superficial deposits of Oadby Member Diamicton in the centre and east of the Site and Glaciofluvial Deposits of Mid-Pleistocene Sand and Gravels to the west of the Site.

3.3.2 An extract of the BGS Mapping is available in Figure 3-3.

[1]British Geological Survey. Geology of Britain Viewer.
https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

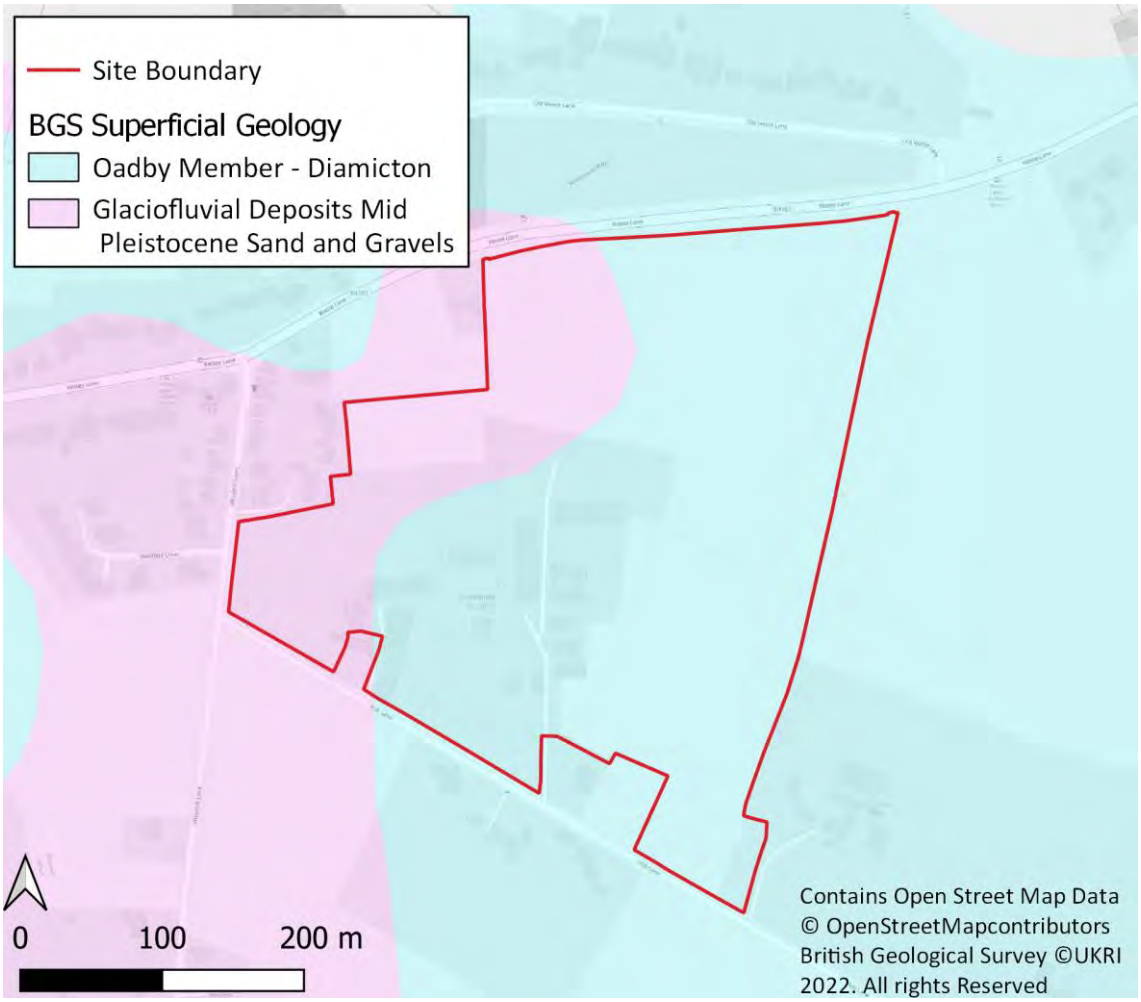

Figure 3-3 – BGS Superficial Deposits Map Extract

Cranfield Soilscape Viewer

3.3.3 The Cranfield University Soilscape viewer[2] describes the soils as "*Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils*".

Hydrogeology

3.3.4 From review of the publicly available DEFRA Magic Mapping[3], Aquifer Designation Map (Superficial Drift) the Site is underlain by a Secondary B Aquifer, that is defined as *"mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers"*.

3.3.5 The Aquifer Designation Map (Bedrock) identifies that the Site is underlain by a Secondary (undifferentiated) Aquifer. This is defined as *"aquifers where it is not possible to apply either a*

[2]Cranfield Soil and Agrifood Institute. Soilscape Viewer. http://www.landis.org.uk/soilscapes/
[3] DEFRA Magic Map https://magic.defra.gov.uk/MagicMap.aspx

Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value".

3.3.6 It is also identified that the Site is not underlain by Groundwater Source Protection Zone.

Site-Specific Ground Investigation

3.3.7 Six trial pits were excavated across the Site as part of the site-specific ground investigation. These trial pits confirmed that the underlying geology across the Site is formed of clay. Soakaway testing in all six trial pits on Site failed to produce sufficient infiltration rates. The trial pit logs and infiltration test results are available in Appendix K.

3.4 Existing Drainage Assets

3.4.1 The existing Site is currently comprises agricultural land, existing commercial development and built form. There is an area of hardstanding associated with a caravan storage and built development to support the agricultural uses of the Site located in the centre and south of the Site.

3.4.2 Surface water at the Site currently drains via a number of ditches which intercept overland flows and are located at the boundary of the Site. There are public Severn Trent Water surface water sewers located north-west of the Site in Waste Lane and west of the Site in Windmill Lane.

3.4.3 Severn Trent Water foul water sewers are identified on the Severn Trent Water mapping north-west of the Site in Waste Lane, east of the Site in Windmill Lane and south of the Site in Hob Lane. A Severn Trent Water foul pumping station and foul rising main are also located south-east of the Site in Hob Lane.

3.4.4 An extract of the Severn Trent Water sewer asset mapping is contained in Figure 3-4 and has been included in Appendix B.

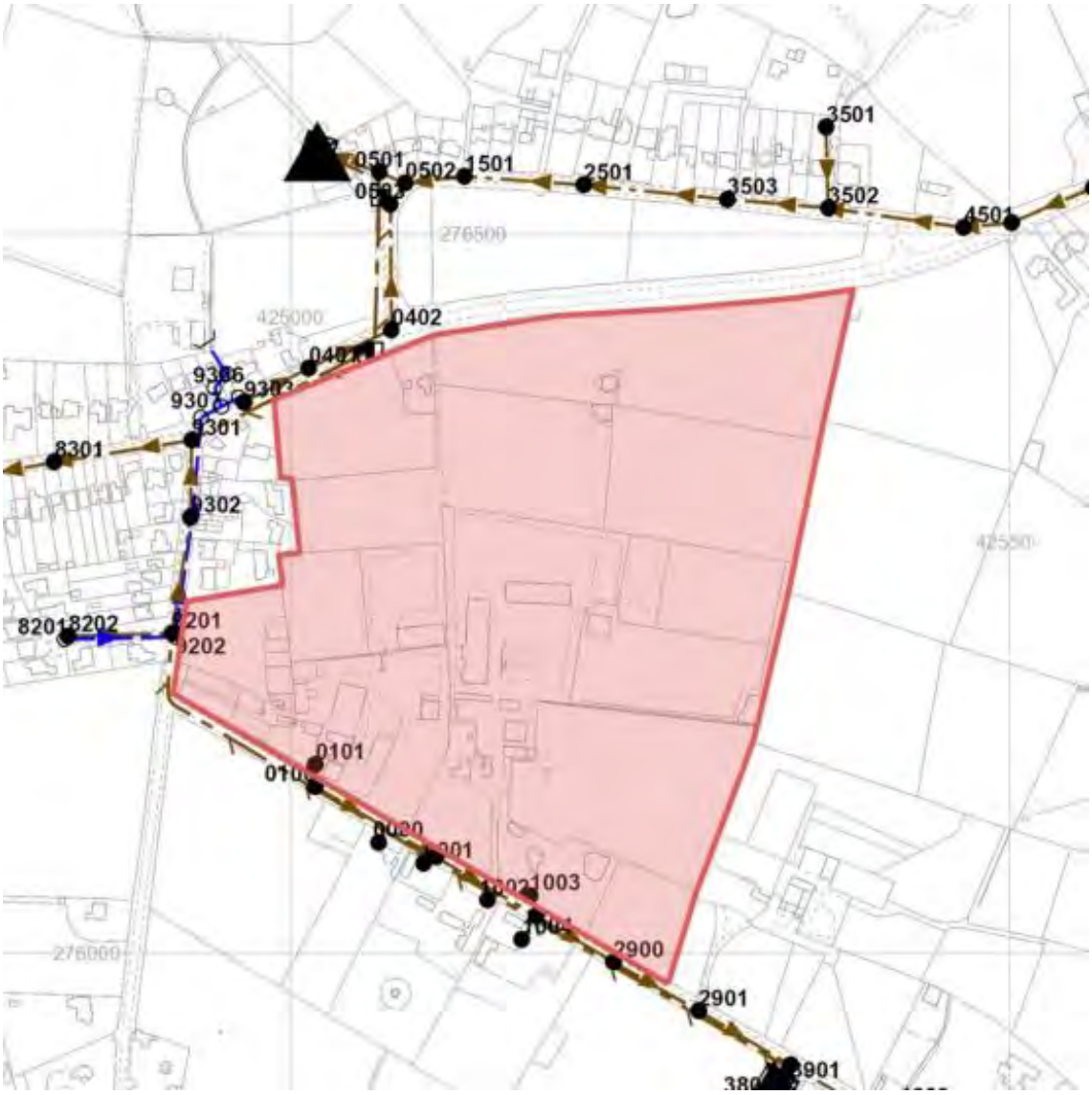

Figure 3-4 – Severn Trent Water Asset Mapping

3.5 Site Proposals

3.5.1 The Site is currently allocated for a residential-led development in the draft Solihull Local Plan (site reference BC4).This application is proposing *"Outline Application for Residential Development (up to 250 homes, including 40% affordable) with vehicular access off Waste Lane; demolition of existing buildings/structures; associated landscaping and new public open spaces; community growing area/orchard; and enhancements to Millennium Way through the Site".*

3.5.2 The illustrative masterplan is available in Appendix C and an extract is shown in Figure 3-5.

Figure 3-5 – Illustrative Masterplan

4 Planning Context

4.1 National Planning Policy Framework

4.1.1 The revised National Planning Policy Framework (NPPF) was published by the Ministry of Housing, Communities and Local Government in July 2018 and, most recently, updated in 2023. The NPPF's Planning Practice Guidance (PPG) supports the Framework and is an online resource that is frequently updated, most recently updated in August 2022.

4.1.2 The primary policy requirement is to identify the Flood Zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

4.1.3 Further to this, paragraph 169 of the NPPF sets out that major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

1 take account of advice from the lead local flood authority;
2 have appropriate proposed minimum operational standards;
3 have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
4 where possible, provide multifunctional benefits.

4.2 Local Policy & Guidance

Solihull Local Plan

4.2.1 The Solihull Metropolitan Borough Council Local Plan was adopted in December 2013 and includes policy related to flood risk and drainage.

4.2.2 Policy P11 expands on the requirements for water management within the Borough. This identifies that all new development shall incorporate Sustainable Urban Drainage (SuDS) unless it is impractical to do so. SuDS are expected to contribute towards wider sustainability for the borough including water quality control, flood alleviation and biodiversity.

4.2.3 The proposed development will utilise a variety of SuDS components across the Site to ensure that water quantity and quality are managed as well as providing amenity and biodiversity.

Solihull Local Plan Draft – October 2020

4.2.4 An update to the 2013 Solihull Local Plan has been produced, as a draft update, in October 2020.

4.2.5 The Site has been allocated in the draft Solihull Local Plan (site reference BC4) for 220 dwellings.

4.2.6 Policy P11 – Water and Flood Risk Management has also been updated within the draft Local Plan. The policy has been updated to conform with updates made by the Environment Agency to their climate change advice. Developments should now consider the actions and objectives of the relevant River Basin Management Plan, including the Rivers Blythe and Cole and their tributaries.

4.2.7 Furthermore, Policy P11 has also been expanded to note that all development must include the use of above ground sustainable drainage systems, in order to contribute towards wider sustainability considerations, including conservation of biodiversity, flood alleviation and water quality control. As such, the proposed development has included above ground SuDS as far as reasonably practicable.

Solihull Metropolitan Borough Council Level 1 Strategic Flood Risk Assessment (SFRA)

4.2.8 The Level 1 SFRA provides an overview of flood risk across the Borough. It identifies that there have been five reported incidents of flooding in the CV7 7 (Balsall Common) postal area from sewers. It also notes that Balsall Common is located in Flood Zone 1 and the small watercourses within the area are unlikely to cause fluvial flooding.

4.2.9 It notes that the majority of surface water flood risk across Balsall Common is related to dry valleys leading to the three watercourses within the area. No historic records of flooding from these sources are identified.

Solihull Metropolitan Borough Council Level 2 Strategic Flood Risk Assessment (SFRA)

4.2.10 The Level 2 SFRA: Flood Risk Assessment for Sites 2020 identifies the Site as '*Site 21: Pheasant Oak Farm, Balsall Common*', it notes that the Site contributes to surface water overland flow to the south east and will need to implement a sufficient SuDS system to ensure that flood risk is not exacerbated elsewhere.

4.2.11 As such, a sustainable surface water drainage strategy has been bought forwards which incorporates SuDS. This is available in Section 5.

Balsall Parish Neighbourhood Development Plan 2018-2033

4.2.12 Policy BE.2: Local Character and Design point k) notes that development should *"not increase the risk of flooding, including that from surface water, within the village or exacerbate any foul drainage capacity issues".*

4.2.13 Policy NE.2: Blue Infrastructure states *"Developments proposals should, where appropriate, protect the quality of the water in the River Blythe and its tributaries and, in particular, safeguard the River's SSSI and the floodplain meadows that incorporate the Temple Balsall Nature Reserve, as well as the*

other water habitats across the Neighbourhood Area. Wherever possible, development should assist the reinstatement of the natural floodplain and the de-culverting of watercourses".

4.2.14 Section 6 of this report identifies how surface water will be managed from the proposed development to ensure flood risk is not exacerbated elsewhere, whilst Section 7 of this Report identifies a foul water drainage strategy.

4.3 Consultation

Solihull Metropolitan Borough Council Lead Local Flood Authority (LLFA)

4.3.1 The LLFA were consulted with regard to the Site and noted that there has been a reported highway flood incident on Waste Lane in July 2012, which is downstream of the Site. As such, it is proposed to manage surface water flows from the proposed development Site up to the 1 in 100 year plus 40% climate change to mitigate increasing surface water flood risk.

Environment Agency

4.3.2 A Product 4 request was sought from the Environment Agency who confirmed that they hold no records of flooding for the Site and that the Site is wholly located within Flood Zone 1.

Severn Trent Water

4.3.3 Severn Trent Water were consulted and confirmed that they hold no historic records of flooding for the Site.

5 Assessment of Flood Risk

5.1.1 The potential flood risk to and from the Site has been assessed based on a review of publicly available information (e.g. Environment Agency flood data). A summary of the flood risk at the Site is provided in Table 5-1 and discussed in more detail in the chapters below.

Table 5-1: Potential Sources of Flood Risk

Source of Flooding	On Site Presence
Fluvial	×
Tidal	×
Surface Water	×
Reservoirs	×
Groundwater	×
Sewers	×

5.2 Historic Flooding

5.2.1 The Site lies outside the Historic Flood Extents identified on the Environment Agency Historic Flood Outlines Mapping. A summary of the pre-application correspondence is contained in Figure 5-2.

Table 5-2: Summary of Consultation

Source of Flooding	Date Response Received	Comments
Environment Agency	16th September 2022	No records of flooding identified.
Solihull Metropolitan Borough Council Lead Local Flood Authority	12th July 2022	The LLFA identified historic records of highway flooding on Waste Lane in June 2021.
Severn Trent Water	14th July 2022	No records of flooding identified.

5.2.2 All correspondence is available within Appendix H.

5.3 Fluvial Sources

5.3.1 The Environment Agency, through the publicly available Flood Map for Planning, categorises potential fluvial flood risk into Flood Zones, assuming no flood defences, which provides the basis for the assessment of flood risk and development suitability under the NPPF.

5.3.2 The Site is identified in the publicly available Flood Map for Planning as located wholly within Flood Zone 1, demonstrating that the fluvial flood risk is considered to have <0.1% Annual Exceedance Probability (AEP).

5.3.3 An extract of the Flood Map for Planning is contained in Figure 5-1.

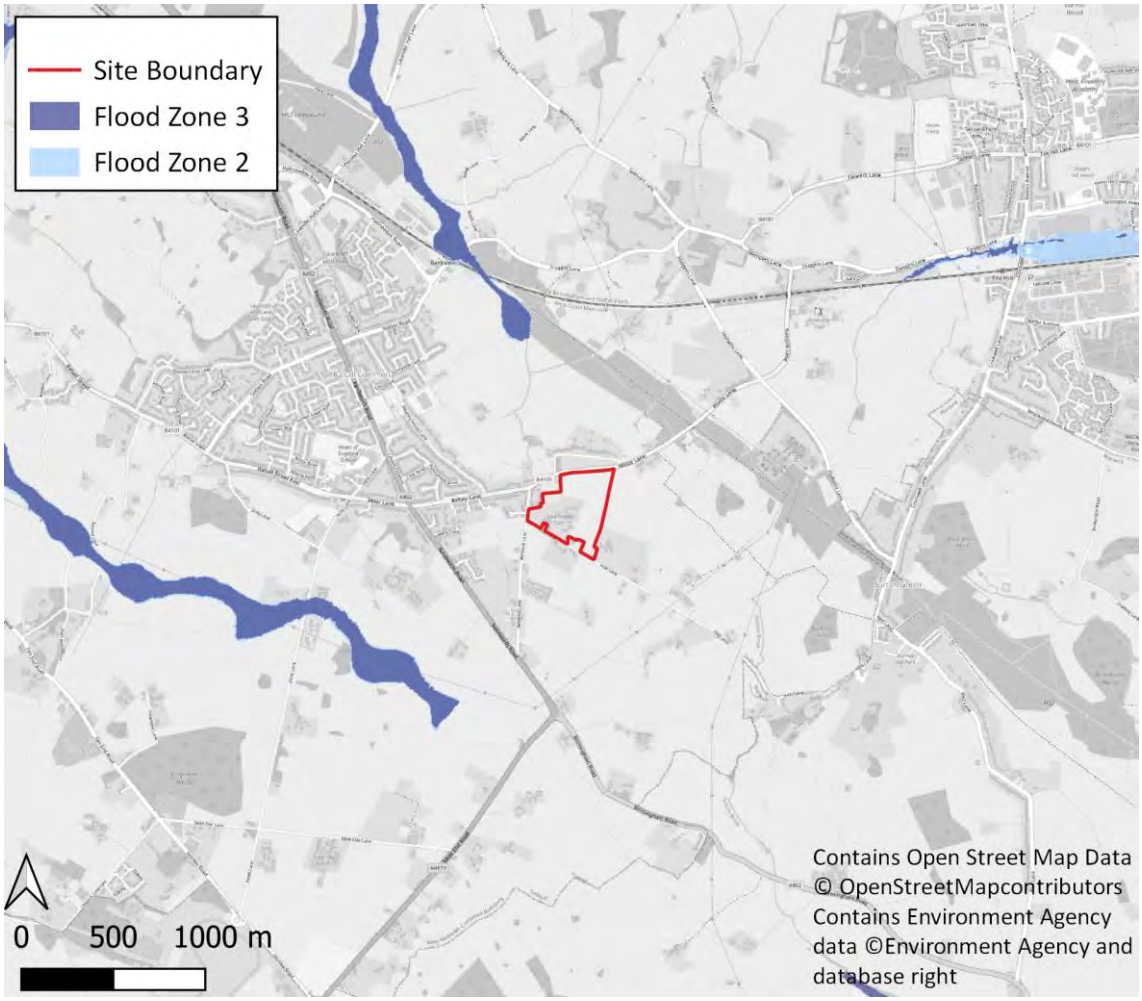

Figure 5-1 - Publicly Available Flood Map for Planning Extract

Vulnerability Classification

5.3.4 Table 2 of the NPPF, reprinted in Table 5-3, summaries the flood risk vulnerability classification for different types of development. The proposed residential development at the Site is classified as More Vulnerable development and amenity open space is classified as water-compatible development. An extract of NPPF Table 2 is provided in Table 5-4.

Table 5-3: Vulnerability Classification (Table 2 NPPF Extract)

Class	Description
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • **Buildings used for dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and Sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Water-compatible development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Navigation facilities, docks, marinas and wharves. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • **Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.** • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.
Source: Table 2, NPPF Planning Practice Guidance, Reference ID: 7-066-20140306	

Sequential and Exception Test Requirements

5.3.5 In accordance with NPPF Table 3, more vulnerable and less vulnerable development is appropriate within Flood Zone 1 as shown in Table 5-3. Given this, the proposed development meets the requirements of the Sequential Test and there is no requirement to apply the Exception Test.

Table 5-4: Vulnerability and Flood Zone criteria (NPPF)

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b	Exception Test required*	X	X	X	✓*

5.4 Surface Water Sources

5.4.1 The Long-Term Flood Risk Information, Flood Risk from Surface Water Map identifies the site to be at 'Very Low' risk from surface water flooding, with an area of low risk surface water flooding identified on Hob Lane, south-east of the Site. An extract of this mapping is provided in Figure 5-2.

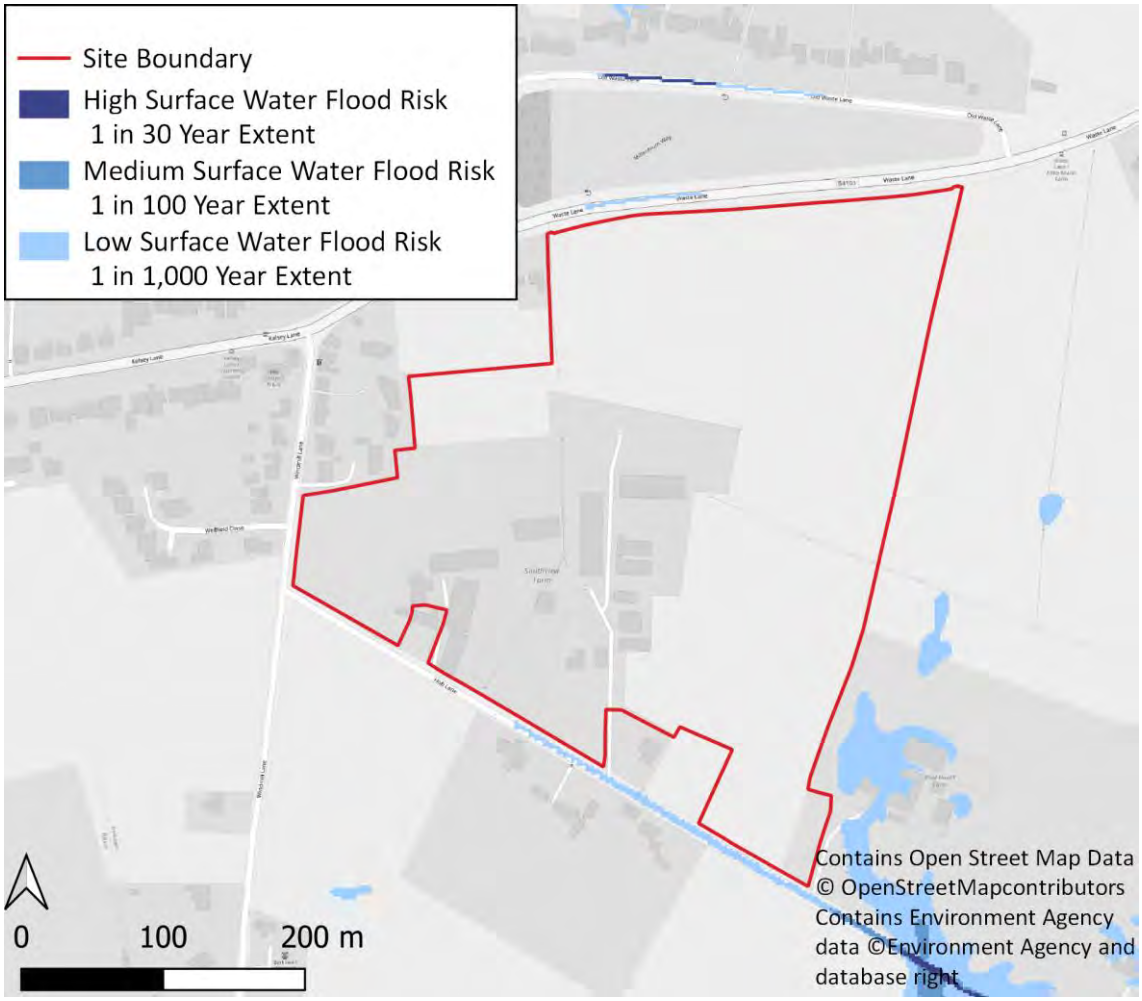

Figure 5-2 – Surface Water Flood Risk Map Extract

5.4.2 The production of this mapping has been undertaken at a national scale to provide the first publicly available generation of surface water flood risk mapping. The two previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.

5.4.3 Although this generation incorporates local estimates of the sewer infiltration loss, generally at a LLFA level along with various other refinements in runoff estimation, it does not allow for local improvements to the underlying Digital Terrain Model (DTM). This means that local features such as the adjoining highways, such as Hob Lane, are represented as determined from the LiDAR

without any consideration to surface water drainage features such as culverts or small watercourses which typically provide the associated surface water drainage.

5.4.4 As part of the final Site design, measures will be implemented to ensure there is negligible increase in surface water flood risk on- and off-Site and ensure that exceedance flows will be directed away for property.

5.4.5 Given this, flood risk from surface water sources may be considered to be low.

5.5 Tidal Sources

5.5.1 Given the in-land location of the Site, flood risk from this source is considered very low.

5.6 Groundwater Sources

5.6.1 Groundwater flooding is typically caused by high groundwater levels. It occurs where excess water emerges at the ground surface via springs or within manmade structures such as basements. The risk of groundwater flooding depends on the nature of the geological strata underlying the Site, as well as on the local topography.

5.6.2 Appendix A of the Solihull Metropolitan Borough Council SFRA Contains Mapping which includes 'Areas Susceptible to Groundwater Flooding' (AStGWF) data set shows the proposed development to have a <25% chance of being vulnerable to groundwater flooding.

5.6.3 Six trial pits were dug on Site was part of the infiltration testing undertaken. These were all to a depth of over 2m and five of the trial pits encountered no groundwater. One trial pit encountered groundwater at a depth of 2m.

5.6.4 Given this, flood risk from groundwater may be considered to be very low.

5.7 Sewer Sources

5.7.1 As set out in Section 3.4, there are no surface water sewers currently serving the Site.

5.7.2 Severn Trent Water have been consulted with regard to historic flood records and confirmed that they hold no records of flooding within the Site

5.7.3 Given this, the Site may be considered to be at low risk of sewer flooding.

5.8 Reservoir Failure

5.8.1 The publicly available Long-Term Flood Risk Information, Flood Risk from Reservoirs Mapping identifies that the Site lies outside the maximum extent of flooding from reservoirs.

5.8.2 Given this, flood risk from reservoirs may be considered to be very low.

5.9 Canal Sources

5.9.1 Flooding from canals is a much less common occurrence than fluvial flooding due to the managed nature of water levels within the artificial waterways.

5.9.2 There are no canals within the vicinity of the Site.

5.9.3 Given this, flood risk from canals may be considered to be very low.

5.10 Climate Change

5.10.1 In accordance with the NPPF and supporting Planning Practice Guidance, an FRA should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. Climate change will affect peak river flows and, consequently, the extent of fluvial flooding is likely to increase in the future.

5.10.1 On 19th February 2016, the Environment Agency released updated guidance on climate change allowances[4] to support the NPPF, which was later revised for peak river flows in 2021 and for peak rainfall intensity in 2022.

5.10.2 Further to this, peak rainfall intensities in surface water drainage design should be assessed by increasing in accordance with the Environment Agency guidance (2070s epoch from 2061 to 2125) to account for climate change.

5.10.3 The proposed development and associated surface water drainage scheme has been designed to sustainably manage the run-off from the critical 1 in 100 year storm event with a 40% allowance for climate change.

5.10.4 Consideration to the potential impact of climate change has been given in the proposed development, in particular with regard to locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing, therefore potential flood risk from climate change may be considered to be low.

[4] Flood risk assessments: climate change allowances. Environment Agency 2016. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

6 Surface Water Drainage Strategy

6.1.1 A Surface Water Drainage Strategy outlining the means of surface water management and disposal from the Site has been produced largely in line with the latest guidance as follows:

- CIRIA C753 "The SuDS Manual", November 2015;
- CIRIA document C522 Sustainable Drainage Systems – design manual for England and Wales;
- CIRIA document C635 Designing for exceedance in urban drainage;
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013);
- Severn Trent Water guidance notes relating to disposals of surface water;
- Environment Agency's pollution prevention guidelines (PPGs); and
- Sewerage Sector Guidance – Design & Construction Guidance v2 (Water UK, March 2020).

6.1.2 The proposed Surface Water Drainage Strategy aims to sustainably manage surface water runoff without increasing flood risk to on- or off-Site, nor adversely impacting on water quality through the use of Sustainable Drainage Systems (SuDS).

6.1.3 SuDS aim to mimic the natural processes of surface water drainage by allowing water to flow along natural flow routes ensuring that runoff rates and volumes during storm events are not increased above the Greenfield values. SuDS also aim to provide water treatment, biodiversity and amenity benefits within blue and green corridors.

6.1.4 There are typically three design storm events which should be considered when designing the SuDS system and managing flows and volumes:

- 1 in 1 year storm event, on sloping Sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30 year storm event, where surface water flooding of the site does not occur at this frequency.
- 1 in 100 year storm event with allowances for future climate change, where runoff from the site should be controlled to the greenfield rate using SuDS attenuation features to manage flows and volumes within the extents of the development Site.

6.1.5 Further to this, dedicated overland flow routes should be identified through the development to convey any exceedance flows in events greater than the 1 in 100-year plus climate change event or in the event of system failure.

6.2 Existing Surface Water Drainage Features

6.2.1 The Site is currently comprises agricultural land, existing commercial development and built form. There is an area of hardstanding associated with a caravan storage and built development to support the existing agricultural uses of the Site located in the centre and south of the Site.

6.2.2 Surface water at the Site currently drains via a number of ditches which intercept overland flows and are located at the boundary of the Site. There are public Severn Trent Water surface water sewers located north-west of the Site in Waste Lane and west of the Site in Windmill Lane. An extract of the Severn Trent Water mapping is contained in Appendix B.

6.3 Discharge Hierarchy

6.3.1 In accordance with SuDS guidance, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.

Table 6-1 – Drainage Hierarchy

Discharge Location	Suitability	Comments
Collect for Re-Use	✓ / ×	Water butts and rainwater harvesting systems can collect rainwater for non-potable uses e.g. within gardens and other non-potable uses. The potential to incorporate rainwater harvesting and re-use measures may be assessed during the detailed design stage.
Infiltration	×	Infiltration testing was undertaken at a number of locations across the Site and found to be unviable. Test results are available in Appendix K.
Watercourse	✓	There are a number of ditech present at the field boundaries that cross the Site and at the perimeter of the Site.
Surface Water Sewer	✓	There are Severn Trent Water surface water sewers north-west of the Site in Waste Lane and west of the Site in Windmill Lane.
Combined Sewer	×	There are no combined sewers within the vicinity of the Site.

6.3.2 In accordance with the above search sequence, it is proposed to predominantly discharge surface water runoff to the existing ditches within the Site and at the Site boundary. Given this, the topography of the Site means that the north-eastern catchments cannot drain under gravity to these watercourses.

6.3.3 As such, a connection into the Severn Trent Water surface water sewer network at manhole SP24769305 has been proposed. Severn Trent Water have confirmed that this sewer may not have the capacity to take the proposed QBar flows from the Site at the current time. This is subject to hydraulic modelling of the surface water sewer network to confirm the capacity availability which will only be undertaken following the outline planning permission being granted. Severn Trent Water have advised, if there is not sufficient capacity network, either upgrades to the existing network to enable a discharge into the sewer or Severn Trent Water can undertake a sewer requisition to the watercourse north of Waste Lane are also available options to enable the development to come forwards.

6.3.4 The pre-development enquiry and correspondence with Severn Trent Water is contained in Appendix I.

6.4 Pre-Development Surface Water Run-Off Rates

6.4.1 Greenfield run-off rates for the Site have been calculated utilising HR Wallingford FEH greenfield runoff calculator for the Site which are contained in Appendix G and available in Table 6-2.

Table 6-2: Greenfield Runoff Rates

Event	1ha
1 in 1 Year	3.33
QBar	4.02
1 in 30 Year	8.03
1 in 100 Year	10.32

6.4.2 Based on Site topography, the Site has been split into seven catchments. The greenfield runoff estimate from each catchment has been provided in Table 6-3. In accordance with Solihull Metropolitan Borough Council local guidance, the Site should limit discharge to no greater than the QBar discharge rate up to the 1 in 100 year plus 40% climate change event.

Table 6-3 – Proposed Discharge Rates

Catchment	Proposed Developable Area [ha]	Proposed Discharge Rate (QBAR) [l/s]
A1	0.67	2.69
A2	1.00	4.02
D	2.00	8.03
E	0.46	1.9
F	1.00	4.02
G	2.05	8.20
Total	**7.18**	**28.9**

6.4.3 As previously noted, infiltration testing has been undertaken on Site, the results of which are contained in Appendix K. This testing demonstrates that infiltration is not a viable means of surface water disposal for the Site, with all of the infiltration tests failing.

6.5 Climate Change Impact

6.5.1 In line with the climate change allowances recommended by the Environment Agency in their February 2016 guidance, updated May 2022, the impact of climate change on the peak rainfall intensities in urban drainage designs should be assessed by Management Catchment and increased accordingly.

6.5.2 The peak rainfall intensity allowances for the Tame Anker and Mease Management Catchment has therefore been reviewed, as detailed for the 1% annual exceedance rainfall event in Table 6-4.

Table 6-4 – Peak Rainfall Allowances for the Tame Anker and Mease Management Catchment

	Central Allowances	Upper End Allowances
2050s	20%	40%
2070s	25%	40%

6.5.3 The proposed development and associated surface water drainage scheme has been designed to sustainably manage the run-off from the critical 1 in 100 year storm event with a 40% allowance for climate change.

6.5.4 We have also tested the 35% climate change allowance for the 1 in 30 year event, as required by the Environment Agency Climate Change Allowances for the Tame Anker and Mease Management Catchment.

6.5.5 Consideration to the potential impact of climate change has been given in the proposed development, in particular with regard to locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing.

6.6 Proposed Surface Water Drainage Strategy

6.6.1 The proposed Surface Water Drainage Strategy is shown on the Indicative Surface Water Drainage Strategy drawing (Ref. 05655-B-0500), included in Appendix E.

6.6.2 In accordance with the drainage hierarchy, as indicated previously, infiltration is not a viable means of surface water discharge from the Site and therefore discharge should be at greenfield QBar rates, ensuring that it will have a likely, negligible impact on downstream flood risk.

6.6.3 The discharge locations will be split between the ditch network which runs along the southern and eastern boundary of the Site and the Severn Trent Water sewer north-west of the Site.

6.6.4 The proposed Surface Water Drainage Strategy implements SuDS in the form of attenuation basins, ponds and conveyance features at this stage, with further source control SuDS (e.g. permeable paving and rain gardens) to be explored at the detailed design stage. A summary of the selection of SuDS features has been provided in Table 6-5.

Table 6-5: Summary of SuDS Feature Selection

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	× Due to the proposed residential nature of the development, green roofs have not been proposed.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / × Filter strips may be incorporated at the next stage of design.
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	✓ / × Permeable paving for driveways and private access roads may be incorporated at the next stage of design.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	✓ / × The exact nature of the proposed conveyance features within the Site will be confirmed at the next design stage.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	× Infiltration basins have not been proposed as the soakaway testing on Site identified that infiltration was not a viable means of surface water disposal from the Site.
Basins / Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment whereas basins are usually dry for a larger period of time outside storm events. They provide temporary storage for storm runoff. .These features may provide amenity and wildlife benefits.	✓ Attenuation basins with wetted pools have been proposed for use on Site. The exact wet / dry nature will be confirmed during the next phase of design.
Underground Attenuation	Underground attenuation structures are below-ground attenuation features. These are typically formed using crates which provide a high void space for attenuation and water quantity control.	× Underground attenuation is not proposed for use within this Site.
Bio-retention / raingardens	Bioretention systems are areas of vegetation into which rainwater and runoff can be directed. These are particularly affected at providing water quality improvements.	✓ / × Rain garden may be incorporated at the next stage of design.

6.6.1 To ensure maximum peak discharge is maintained at greenfield runoff rates, on-Site attenuation will be required. The required storage volume for the attenuation of the 1 in 100 year event plus 40% climate change event has been calculated for each land parcel and discharge location, assuming a proportion of impermeable surfacing based on the illustrative masterplan; the

estimated contributing areas, proposed attenuation basins are shown together with their required capacity on the Indicative Surface Water Drainage Strategy drawing in Appendix E. A summary table for the proposed attenuation is provided in Table 6-6 which also identifies the impermeable area which has assumed each development parcel is 60% impermeable.

Table 6-6: SuDS Summary

Assumed Catchment	Proposed Discharge Rate (l/s)	Proposed Impermeable Area [ha]	Proposed Attenuation Volume Required [m^3]
A1	2.7	0.40	410
A2	4.0	0.60	370
D	8.0	1.20	870
E	1.9	0.28	190
F	4.0	0.60	420
G	8.2	1.23	885
TOTAL	**28.9**	**4.31**	**3,145**

6.6.2 The proposed attenuation basins have been mostly designed as dry features at this stage however, some may be designed to have a permanently wetted pool below the existing drainage invert level, at the next stage of design. The proposed attenuation features are located at the natural low points of the Site and sized to provide the necessary attenuation and treatment.

6.6.3 The SuDS features will aim to provide multiple functions as amenity and biodiversity assets, which may include additional proposed permanent wet features, particularly if such features are required to improve the Biodiversity Net Gain (BNG) scoring of the development and to provide a carbon store.

6.6.4 Water butts may be made available for all households to provide an opportunity for water re-use. Nonetheless, as the attenuation capacity for the water butts cannot be guaranteed during a rainfall event, these have not been accounted for within the attenuation calculations.

6.6.5 Surface water run-off from roofs and hard surfaces across the development will drain to a new surface water drainage network incorporating SuDS components to control discharge to the receiving ditch and sewer network, provide attenuation storage on-Site and provide treatment to run-off. The surface water drainage system will be designed to convey the run-off from the critical 1 in 100 year (+40% climate change allowance) storm event without flooding. The proposed attenuation areas are located at the natural low points of the proposed Site and sized to provide the required attenuation and treatment.

6.6.6 Vortex flow controls, such as a Hydrobrakes, will restrict the rate of discharge downstream to the greenfield QBar run-off rate at the discharge points.

6.6.7 The proposed SuDS features have been sized in Causeway Flow to ensure that the proposed system will be capable of conveying run-off from the design storm event without flooding. Refer to Appendix H for the calculations.

6.6.8 The design calculations confirm that the proposed surface water drainage system is capable of attenuating, and discharging in a controlled manner, the run-off from the design 1 in 100 year storm with a 40% allowance for climate change without flooding of the development.

6.6.9 The surface water drainage strategy is based upon the site masterplanning details at the time of production. Changes to the site development profile, impermeable areas across the site or other such aspects of the scheme will result in the need to revise the calculations.

6.7 Development Creep

6.7.1 Over the lifetime of a development, it is possible that the overall impermeable area within the Site could increase by as much as 10% through the house buyers undertaking activities such as property extensions and introducing paved gardens.

6.7.2 Table 6-7 identifies the potential increase in impermeable area as a result of urban creep over the lifetime of the development.

Table 6-7 - Development Creep Assessment

Catchment	Impermeable Area (ha)	10% Creep (ha)	Total Impermeable Area (ha)
A1	0.40	0.040	0.442
A2	0.60	0.060	0.660
D	1.20	0.120	1.320
E	0.28	0.028	0.308
F	0.60	0.060	0.660
G	1.23	0.123	1.353
TOTAL	**4.31**	**0.431**	**4.743**

6.8 Water Quality

Principles of Water Quality Assessment

6.8.1 The general principles are to mitigate against adverse impacts on water quality in the receiving water environment is described in the CIRIA C753 "The SuDS Manual" (2015). This document recommends the following steps to determine the required water quality management for discharges to surface waters and groundwaters based on the risk posed:

1 Interception: Prevent runoff and associated pollutants from the Site to receiving surface waters for the majority of small rainfall events (e.g. <5mm rainfall events);

2 Determine the pollution hazard level associated with the given type of development;

3 Select a risk assessment approach based on receiving water environment and the pollution hazard level; and
4 Undertake a detailed risk assessment for each outfall or discharge point taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

6.8.2 The extent of the treatment required will depend on the water quality status of receiving watercourses, land use, the level of pollution prevention in the catchment and for groundwater, the natural protection afforded by underlying soil layers. The pollution hazard level of the development type should be identified.

6.8.3 Residential roofs are noted as having 'very low' pollution hazard level and require removal of gross solids and sediments only. Residential car parks, access roads, driveways and non-residential car parking with infrequent change (e.g. schools) are shown to present 'low' pollution hazard level.

6.8.4 Low pollution hazard levels require application of a 'simple index approach' for water quality risk assessment for discharges to surface and ground waters.

Existing Water Quality of the Proposed Receiving Watercourses

6.8.5 The proposed works fall into the Environment Agency's Humber River Basin District which covers an area of 26,100km^2 and extends from the West Midlands in the south, northwards to North Yorkshire and from Staffordshire in the west to parts of Lincolnshire and the Humber Estuary in the East[5].

6.8.6 The Humber River Basin has been divided into 18 Management Catchments, of which the site falls into the Tame Anker and Mease Management Catchment and within this, the Blythe Rivers Operational Catchment.

6.8.7 Within the Blythe Rivers Operational Catchment, the Site falls into the catchment for the Blythe from Temple Balsall Brook to Patrick Bridge Water Body. This is identified as a not designated artificial or heavily modified waterbody. The 2019 Cycle identifies it has a 'Moderate' ecological status and a 'Fail' chemical status.

6.8.8 Reasons for not achieving 'good' status include:

- Poor livestock management; and
- Septic Tanks.

5 Humber_RBD_Part_1_river_basin_management_plan.pdf (publishing.service.gov.uk)

6.8.9 As such the Environment Agency will be seeking improvements to the water quality of the local watercourse system to achieve a status of Good by 2027.

6.8.10 The principles of the SuDS Management Train should be incorporated into the proposed surface water drainage schemes for new development, to reduce the risk of further pollutants entering watercourses via run-off from roofs and paved areas.

6.8.11 SuDS components can reduce pollution in run-off through filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. Suitable components could include:

- permeable paving;
- filter drains;
- swales;
- attenuation basins;
- wetlands; and
- proprietary treatment systems.

6.8.12 To protect biodiversity and amenity assets, polluted surface water run-off should not be discharged directly into permanent ponds but treated through an appropriate treatment train. Where possible, interception storage should be included as part of the treatment train to manage pollutants at source. Later stages of treatment in the train should incrementally reduce the level of pollution in run-off before discharge to the receiving water body.

6.9 Contamination and Water Quality

6.9.1 The proposed development will utilise SuDS Management Trains across each network to ensure treatment of run-off and removal of pollutants prior to discharge.

6.9.2 This is likely to include a mixture of components across the Site, specified according to the opportunities/constraints presented by:

- the likely pollution hazard of the run-off;
- the available surface space; and
- the proposed ground levels/falls across areas of hardstanding.

6.9.3 Treatment components within each SuDS Management Train may include:

- permeable pavement (for car parking areas);
- channel drains;
- catchpits;
- trapped gullies;
- attenuation basins incorporating pre-treatment (such as a sediment forebay) and low flow channels;

- bioretention areas in greenspace around the Site;
- swales and linear wetlands;
- filter drains bordering paved areas such as roads and yards; and
- proprietary treatment systems (such as downstream defenders).

6.9.4 The arrangement and composition of each management train will be confirmed at the detailed design stage.

6.9.5 The proposed uses at the Site will comprise residential roofs and individual driveways. Roofs are classified as a 'very low' pollution risk and individual driveways are classed as a 'low' pollution risk level in Table 26.2 of CIRIA C753 The SuDS Manual. 'Low' hazard pollution levels require application of a 'simple index approach' for water quality risk assessment for discharge to surface and groundwaters. The "pollution hazard indices" for a low pollution hazard Site are given in Table 6-8 below.

Table 6-8 - Pollution Hazard Indices for a Low Pollution Hazard Site

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

6.9.6 The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of the receiving waterbodies.

6.9.7 Table 6-9 provides the indicative SuDS mitigation indices for the proposed SuDS features for the Site. It demonstrates that the mitigation index for the basins or ponds are greater than the "*pollution hazard index*" for each pollutant type. Therefore, the strategy is deemed to comply with the water quality requirements of the SuDS standards.

Table 6-9 - Indicative SuDS Mitigation Indices

SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Ponds	0.7	0.7	0.5
Swale	0.5	0.6	0.6

6.10 Designing for Exceedance

6.10.1 During a rainfall event with a return period well in excess of that for which the surface water drainage system was designed (in this case a 1 in 100 year plus 40% climate change allowance), or in the event of a blockage, the capacity of the surface water drainage system may be exceeded, resulting in localised flooding in the areas affected. This is considered to be a residual risk.

6.10.2 The layout and landscaping of the proposed development should be designed and will be developed to ensure that exceedance flood flow paths are routed away from vulnerable

development and toward landscaped areas, areas of open attenuation or surrounding green infrastructure.

6.10.3 In line with Building Regulations, the finished floor levels of the properties will be set at least 150mm above the surrounding ground levels to prevent surface water ingress through doorways. Location of buildings in ground depressions will be avoided to prevent water ponding around dwellings.

6.10.4 Minor modifications to topography, the profile of the access road, footpath or kerb and strategically placed green infrastructure will be developed to ensure that exceedance flood flows are managed and there is little or no risk of property flooding or unacceptable ponding within the highway.

7 Foul Water Drainage Strategy

7.1.1 Existing Severn Trent Water foul water sewers are identified on the Severn Trent Water mapping north-west of the Site in Waste Lane, east of the Site in Windmill Lane and south of the Site in Hob Lane. An existing Severn Trent Water foul pumping station and foul rising main are also located south-east of the Site in Hob Lane.

7.1.2 An extract of the Severn Trent Water sewer asset mapping is contained in Figure 3-4 and has been included in Appendix B.

7.1.3 Severn Trent Water have been consulted through a pre-development enquiry to provide comments on the development proposals and aid in identifying the most appropriate future connection for foul water drainage.

7.1.4 Through the Severn Trent Water pre-development enquiry, it was advised that the majority of the Site will be able to discharge to the 150mm diameter foul sewer on Hob Lane at manhole SP25752900; however, once the outline planning permission has been granted, hydraulic modelling will be required to be undertaken by Severn Trent Water to confirm if they are required to provide network upgrades to accommodate the requirements of the development proposals.

7.1.5 Under Section 94 of the Water Industry Act 1991, sewerage undertakers have a duty to provide sewerage and treat wastewater arising from new domestic developments.

7.1.6 Following consultation with Severn Trent Water, it was confirmed that it may be possible to split the flows by connecting into Waste Lane (preferred Severn Trent Water Manhole SP25760402), subject to modelling results. A strategy which implements two separate foul connections from the Site is therefore shown in the Indicative Foul Drainage drawing in Appendix E.

7.1.7 The pre-development enquiry and correspondence with Severn Trent Water following this is available in Appendix I.

8 Adoption & Management

8.1 Surface Water Drainage System

8.1.1 Responsibility for the maintenance of the main surface water drainage networks and SuDS features may be offered to Severn Trent Water for adoption under S104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

8.1.2 Alternatively, it is common for SuDS features to be operated and maintained by a third-party private maintenance company. Should this be necessary, a third-party management company would be established to maintain the features in perpetuity and an adoption agreement between the final Site developer and Maintenance Company would be largely based upon the CIRIA ICoP MA2 SuDS Maintenance Framework Agreement.

8.1.3 Drainage serving new roads to be offered for adoption by the Local Highway Authority will become highway drains, adopted as part of Section 38 agreements (Highways Act 1980).

8.1.4 In England it also appears increasingly likely that Schedule 3 of the Flood and Water Management Act will be enacted in England, with DEFRA currently recommending implementation of this in 2024. This legislation, when enacted, will require SuDS Approval Bodies (SABs) to be formed in England who will review the design of SuDS and will likely be responsible for the future operation and maintenance. As the layout of the development evolves it is recommended that the surface water drainage design seeks to comply with this legislation when it comes forward ensuring that the SuDS proposed are designed and built in accordance with the SAB's requirements and may be offered for adoption to the SAB if required.

8.1.5 A typical maintenance schedule of the attenuation basins, swales and flow control devices proposed on Site are shown in the following tables:

Table 8-1: Flow Control (e.g. Hydrobrake) Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation)
Six Monthly	• Inspect and identified ant area that are not operating correctly. If required, take remedial actions. • Remove sediment from any pre-treatment structures.
Annually	• N/A
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return the feature to full working order.

Table 8-2 – Attenuation Basin / Pond Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation
Annually	• Remove all dead growth prior to the start of growing season • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife • Remove sediment from inlets, outlets and forebay • Manage wetland plants, where required
As Required	• Prune and trim trees and remove cuttings • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% • Repair erosion or other damage by re-turfing or reseeding • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-3 – Swale Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation
Annually	• Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Repair erosion or other damage by re-turfing, reseeding or replacing filter materials. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 8-4 – Headwall Indicative Maintenance Schedule

FRQUENCY	ACTION
Monthly	• Inspect surface structures removing obstructions and silt as necessary • Check there is no physical damage • Trim vegetation 1m minimum. Surrounding structure and keep hard aprons free from silt and debris
As Required	• Check topsoil levels are 20mm above edges of baskets and chambers to avoid mower damage • Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

8.1.6 The proposed maintenance regimes for the devices should be largely in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime.

8.1.7 Further details will be provided on the maintenance requirements of the proposed SuDS components across the development as the detailed design is developed. The details of the party responsible for maintenance of each feature should be confirmed prior to occupation of the proposed development.

8.2 Foul Water Drainage System

8.2.1 It is anticipated that the proposed foul sewer network may be offered to Severn Trent Water for adoption under Section 104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June2022).

9 Conclusion & Recommendations

9.1 Conclusion

9.1.1 PJA has been commissioned by Barwood Development Securities Ltd to prepare a Flood Risk Assessment and Drainage Strategy for the proposed residential development at '*Pheasant Oak Farm, Balsall Common'*.

9.1.2 This Flood Risk Assessment has been undertaken in accordance with current national and local food risk policy requirements. This report assesses the existing and future potential flood risk at the Site, including an assessment of the potential effects of the proposed development on flood risk on- and off-Site.

9.1.3 The assessment concludes that the Site is considered at either very low or low risk of flooding from the sources assessed (fluvial, tidal, reservoirs, canals, surface water, groundwater and sewers).

9.1.4 In addition to the NPPF, the proposed surface water drainage strategy complies with local policy and Site-specific requirements.

9.1.5 A Surface Water Drainage Strategy has been prepared to demonstrate that a sustainable drainage solution can be provided for the proposed development. The Surface Water Drainage Strategy has been designed largely in accordance with current sustainable development best practice and meets the requirements of Solihull Metropolitan Borough Council (as the LLFA).

9.1.6 The proposed surface water drainage systems aim to mimic the hydrological regime of the existing Site by discharging run-off to the existing ditches present on-Site or the Severn Trent Water surface water sewer north-east of the Site. Discharge from each proposed catchment will be controlled to the equivalent greenfield QBar rate by vortex flow control devices. Attenuation storage will be provided in the form of open SuDS features such as attenuation basins and ponds. Water butts may be used to store water for re-use within feasible locations, but these have not been included within attenuation calculations as the capacity availability cannot be guaranteed.

9.1.7 SuDS Management Trains will provide suitable treatment of run-off by removing pollutants prior to discharge.

9.1.8 Foul flows from the proposed development will discharge via new connection(s) to the existing Severn Trent Water foul sewers north and south of the development Site.

9.1.9 Safe access and egress will be available to and from the Site for events up to and including the 1 in 100 year plus climate change (40%) rainfall events.

9.1.10 The responsibility for the operation and maintenance of each SuDS feature will be confirmed prior to the commencement of construction. The SuDS used on Site should be maintained in accordance

with manufacturer's recommendations and current best practice and guidelines to ensure routine operation.

9.1.11 This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the Site or to any third-party land in line with NPPF requirements.

Appendix A Topographic Survey

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
W1	425178.407	276026.866	124.784
W2	425019.238	276119.699	126.499
W3	424911.543	276181.867	126.656
W4	424932.502	276364.906	123.521
W5	425054.354	276429.132	124.355
W6	425194.070	276458.300	124.552
W7	425316.229	276468.177	125.618
W7A	425386.273	276466.382	126.329
W8	425287.929	276372.053	126.078
W9	425222.603	276243.409	127.239
A1	425183.013	276231.279	126.461
A2	425138.322	276220.171	126.786
A3	425140.795	276178.332	126.629
A4	425139.405	276143.112	126.372

OS Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings	Overhead Cable	IC	Inspection chamber	Bo	Bollard
Wall	Concrete edge	PInv	Pipe invert	IB	Illuminated bollard
Kerb line	Tarmac edge	Gy	Gully	Bin	Rubbish bin
Line marking	Grass verge	Bg	Back gully	Vp	Vent pipe
Drop kerb	Canopy/Overhang	Dp	Down pipe	Grl	Ground light
Centre line	Verge	Pipe	Pipe above ground	Lbox	Letter box
Top of bank	Bottom of bank	MH	Manhole	Stmp	Tree Stump
1	Station and Name	WL	Water level	Sty	Stile
100.000	Station Level	Fl	Flood light	IFL	Internal floor level
		Lp	Lamp post	THL	Threshold level
Bush Sap	Tree / Bush / Sapling	Tp	Telegraph post	Sp	Sign post
	Area of Undergrowth	Ep	Electricity post	TH	Trialhole
	Woodland	Tl	Traffic light	BH	Borehole
		Bus	Bus stop	ELC	Electric
R:	Ridge Level	Sv	Stop valve	BT	British Telecom
E:	Eaves Level	St	Stop tap	C'box	Control box
F:	Flat Roof Level	Er	Earth rod	TT	Tactile
	Gate	Wm	Water meter	BP	Brick paved
Fence types:		Gas	Gas valve	CPS	Concrete paving slabs
I\W	Interwoven	Av	Air valve	CVR	Cover
I\R	Iron Railings	ICU	Unidentified inspection	R/wall	Retaining wall
W\M	Wire Mesh	Wo	Wash out	TWL	Top of Wall Level
P\R	Post & Rail	Re	Rodding eye	TCL	Tree canopy level
P\W	Post & Wire	BB	Belisha beacon	G:	Girth
C\L	Chain Link	CTV	Cable tv	MG	Multi girth
W\P	Wooden Panels	Mkr	Marker post	IC	Inspection chamber
C\B	Close Boarded	Gmkr	Gas marker post	CL:	Cover level
S\P	Steel Palisade	So	Soffit	IL:	Invert level
		Fh	Fire hydrant	UTL	Unable to lift

Rev	Date	Description	Drawn	Q. Ref

greenhatch group

- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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Amethyst Road
Newcastle Bus. Park
Newcastle-U-Tyne
NE4 7YL
t. (01912) 736391

London
27, Cornwall Terrace Mews
Regents Park
London
NW1 5LL
t. (02072) 241806

CLIENT

Peter Brett Associates

PROJECT

Pheasant Oak Farm, Balsall Common, Coventry

TITLE

Topographical Survey

SCALE	DATE
A1@ 1: 1000	22.03.19
DRAWN	QUALITY REF
WA	GH4737

Level datum	See note
Grid orientation	See note
Job number	32958

Drawing No.	Rev.
32958_T	0

Comments

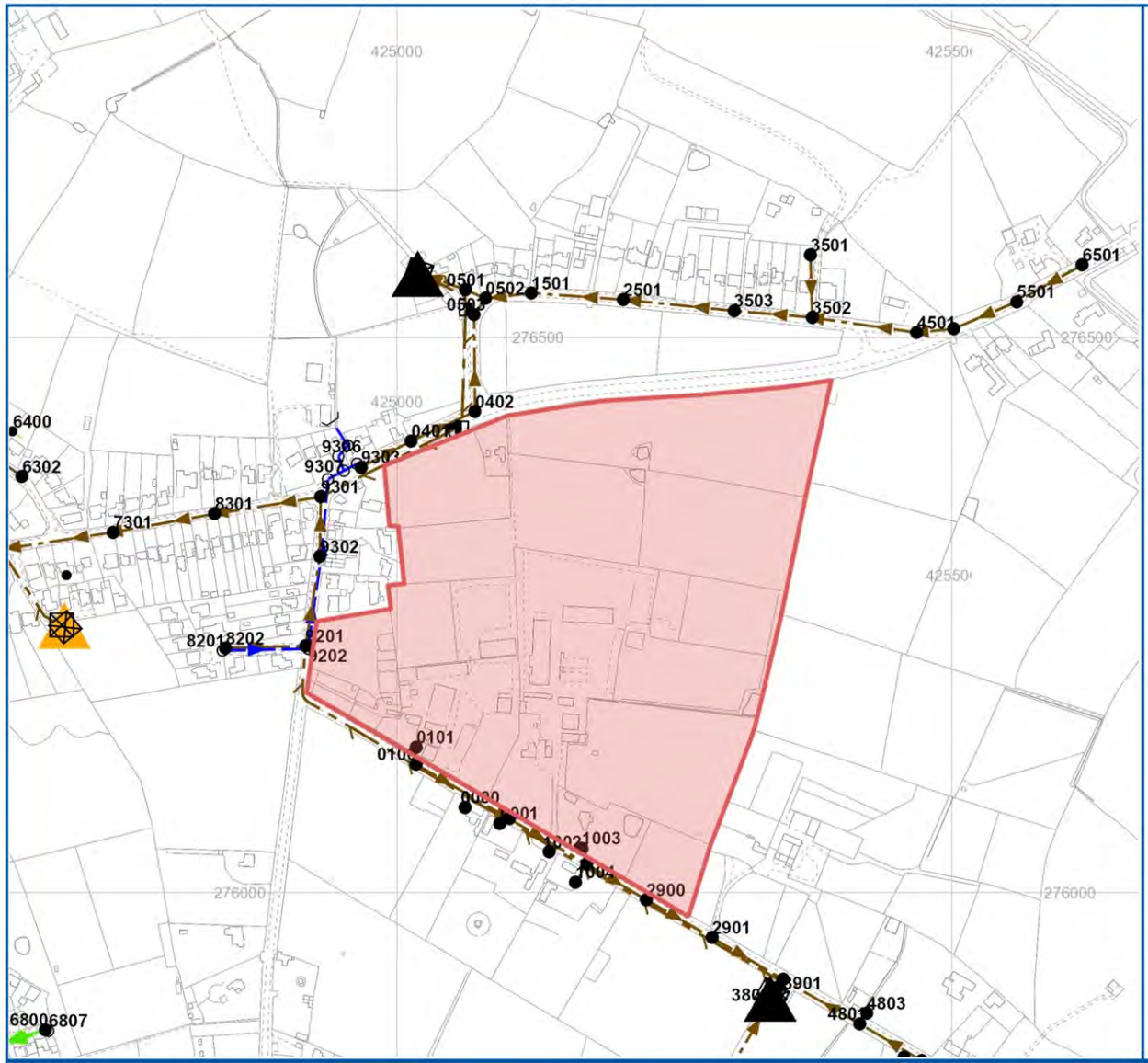
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

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

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

Appendix B Severn Trent Water Asset Mapping



Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SP24769305	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769307	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769202	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769304	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769402	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24768201	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769306	0	0	0	S	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP24769303	123.4499	121.31	120.79	F	VC	C	150	<UNK>	97.19	31/12/1899 00:00:00
SP25760402	124.16	120.28	119.86	F	VC	C	150	<UNK>	214.29	31/12/1899 00:00:00
SP24767301	124.0899	121.1	<UNK>	F	CO	C	375	<UNK>	0	31/12/1899 00:00:00
SP25760501	121.23	119.15	<UNK>	F	VC	C	100	<UNK>	0	31/12/1899 00:00:00
SP25760503	122.51	119.85	119.29	F	VC	C	150	<UNK>	32.93	31/12/1899 00:00:00
SP25765502	126.3199	122.28	122.01	F	VC	C	150	<UNK>	123.11	31/12/1899 00:00:00
SP24768202	0	0	0	F	<UNK>	<UNK>	0	0	0	31/12/1899 00:00:00
SP25760502	121.79	119.25	119.23	F	VC	C	150	<UNK>	1077	31/12/1899 00:00:00
SP25763502	126.05	121.06	120.42	F	VC	C	150	<UNK>	109.78	31/12/1899 00:00:00
SP24769201	126.2699	124.24	122.85	F	VC	C	225	<UNK>	66.24	31/12/1899 00:00:00
SP25763501	125.15	122.73	121.06	F	VC	C	150	<UNK>	34.18	31/12/1899 00:00:00
SP25764501	126.4899	122	121.08	F	VC	C	150	<UNK>	103	31/12/1899 00:00:00
SP25762501	122.69	119.51	119.31	F	VC	C	150	<UNK>	416.1	31/12/1899 00:00:00
SP24766302	123.7799	122.32	121.91	F	VC	C	150	<UNK>	185.44	31/12/1899 00:00:00
SP25763503	124.2699	120.42	119.52	F	VC	C	150	<UNK>	111.67	31/12/1899 00:00:00
SP24768301	124.12	121.47	121.12	F	CO	C	375	<UNK>	264.49	31/12/1899 00:00:00
SP24769301	123.6999	121.85	121.48	F	CO	C	375	<UNK>	263.03	31/12/1899 00:00:00
SP25765501	125.7099	123.02	122.34	F	VC	C	150	<UNK>	90.4	31/12/1899 00:00:00
SP25766501	125.97	123.66	123.04	F	VC	C	150	<UNK>	109.03	31/12/1899 00:00:00
SP25760401	123.87	120.79	120.3	F	VC	C	150	<UNK>	129.71	31/12/1899 00:00:00
SP25761501	122.3799	119.29	119.26	F	VC	C	150	<UNK>	1373	31/12/1899 00:00:00
SP24769302	124.72	122.85	121.91	F	VC	C	225	<UNK>	57.49	31/12/1899 00:00:00

LEGEND

Ancillary
- Balancing Lagoon
- Grease Trap
- Interceptor
- Screen

Chamber
- Flushing Chamber
- Scalaway
- Overflow

Fitting
- Blind Shaft
- Facility Connector
- Head Node
- Lamphole
- Sewerage Air Valve
- Sewerage Chemical Injection Point
- Sewerage Hatch Box
- Sewerage Pressure Washout
- Vent Column
- Waste Water Outfall

Control Valve
- Hydrobrake
- Penstock
- Sewerage Isolation Valve
- Sewerage Non Return Valve

Manhole
- Foul Bifurcation Manhole
- Combined Bifurcation Manhole
- Surface Water Bifurcation Manhole
- Dual Manhole
- Foul Single Manhole
- Combined Single Manhole
- Surface Water Single Manhole
- Twin Manhole
- Foul Adopted Manhole
- Combined Adopted Manhole
- Surface Adopted Manhole
- Transferred Manhole
- Unsurveyed Manhole

Operational Site

Waste Water Pump
- Transferred Asset
- S24
- S104
- S102
- Null Private
- Null
- None
- Highway Drain
- Adopted Sewer

Storage
- Disposal Site
- Off-Line Waste Water Storage
- On-Line Waste Water Storage
- Wet Well

Waste Water Process Structure
- Sewage Treatment Point
- Sewage Treatment Structure
- Sludge Treatment Point
- Sludge Treatment Structure

Gravity Sewer Pipe
- Foul Gravity Sewer
- Combined Gravity Sewer
- Surface Water Gravity Sewer
- S104 Surface Water Gravity Sewer
- S104 Combined Gravity Sewer
- S104 Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Surface Water Unsurveyed Pipe
- Combined Unsurveyed Pipe
- Foul Unsurveyed Pipe
- Transferred Surface Water Sewer
- Transferred Combined Sewer
- Transferred Foul Sewer
- Disposal Pipe
- Overflow Pipe
- Culverted Water Course
- Waste Internal Site Pipe
- Sewer Service Connection
- Gravity Sewer Others

Pressure Sewer Pipe
- Surface Water Pressure Sewer
- Combined Pressure Sewer
- Foul Pressure Sewer
- Surface Water Pressure Sewer
- S104 Combined Pressure Sewer
- S104 Foul Pressure Sewer
- Private Surface Water Pressure Sewer
- Private Combined Pressure Sewer
- Private Foul Pressure Sewer
- Surface Water Vacuum Sewer
- Foul Vacuum Sewer
- Combined Vacuum Sewer
- S104 Surface Water Vacuum Sewer
- S104 Combined Vacuum Sewer
- S104 Foul Vacuum Sewer
- Private Surface Water Vaccum Sewer
- Private Combined Vacuum Sewer
- Private Foul Vacuum Sewer
- Surface Water Siphon
- Combined Siphon
- Foul Siphon
- Private Surface Water Siphon
- Private Combined Siphon
- Private Foul Siphon
- S104 Surface Water Siphon
- S104 Combined Siphon
- S104 Foul Siphon
- Surface Water Unsurveyed Pipe
- Combined Unsurveyed Pipe
- Foul Unsurveyed Pipe
- Disposal Pipe

Service Pipe
- Surface Water Lateral Drain
- Combined Lateral Drain
- Foul Lateral Drain
- S104 Surface Water Lateral Drain
- S104 Combined Lateral Drain
- S104 Foul Lateral Drain
- Private Surface Water Lateral Drain
- Private Combined Lateral Drain
- Private Foul Lateral Drain
- Transfered Surface Water Lateral Dra
- Transfered Combined Lateral Drain
- Transfered Foul Lateral Drain

Print500mLine

MATERIALS

-	- NONE
AC	- ASBESTOS CEME
BR	- BRICK
CC	- CONCRETE BOX CULVERT
CI	- CAST IRON
CO	- CONCRETE
CSB	CONCRETE SEGMENTS (BOLTED)
CSU	- CONCRETE SEGMENTS (UNBOLTED)
DI	- DUCTILE IRON
GRP	- GLASS REINFORCED PLASTIC
MAC	- MASONRY IN REGULAR COURSES
MAR	- MASONRY RANDOMLY COURSED
PE	- POLYETHLENE
PF	- PITCH
PP	- POLYPROPYLENE
PSC	- PLASTIC STEEL COMPOSITE
PVC	- POLYVINYL CHLORIDE
RPM	- REINFORCED PLASTIC MATRIX
SI	- SPUN (GREY) IRON
ST	- STEEL
U	- UNKNOWN
VC	- VITRIFIED CLAY
XXX	- OTHER

CATEGORIES

W	- WEIR
C	- CASCADE
DB	- DAMBOARD
SE	- SIDE ENTRY
FV	- FLAP VALVE
BD	- BACK DROP
S	- SIPHON
D	- HIGHWAY DRAIN
S104	- SECTION 104

SHAPE

C	- CIRCULAR
E	- EGG SHAPED
O	- OTHER
R	- RECTANGLE
S	- SQUARE
T	- TRAPEZOIDAL
U	- UNKNOWN

PURPOSE

C	- COMBINED
E	- FINAL EFFLUENT
F	- FOUL
L	- SLUDGE
S	- SURFACE WATER

N W E S

SEVERN TRENT

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD (Tabular)

O/S Map Scale: 1:5,000

This map is centred upon:

Date of Issue: 13-09-22

X: 425159.32 **Y:** 276323.74

Disclaimer Statement:

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3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

5 Ordnance Survey licence number: **100031673**

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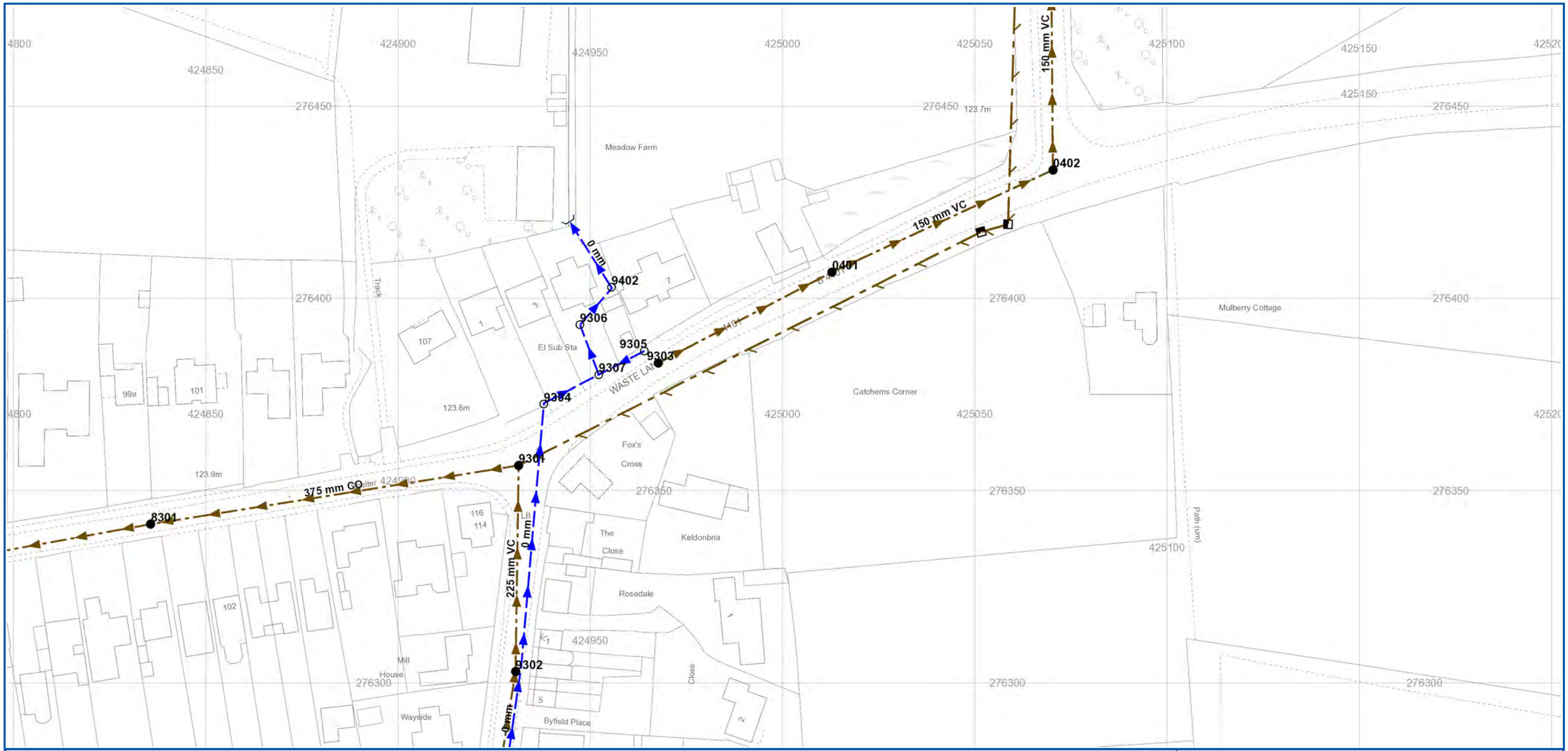

LEGEND

Ancillary
- Balancing Lagoon
- Grease Trap
- Interceptor
- Screen

Chamber
- Flushing Chamber
- Soakaway
- Overflow

Connector
- Sewer Junctions
- SewerLine Connection Node

Fitting
- Blind Shaft
- Facility Connector
- Head Node
- Lamphole
- Sewerage Air Valve
- Sewerage Chemical Injection Point
- Sewerage Hatch Box
- Sewerage Pressure Washout
- Vent Column
- Waste Water Outfall

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- Sewerage Non Return Valve

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- Combined Adopted Manhole
- Surface Adopted Manhole
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Waste Water Pump

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- S24
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- S104 Foul Gravity Sewer
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- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Surface Water Unsurveyed Pipe
- Combined Unsurveyed Pipe
- Foul Unsurveyed Pipe
- Transferred Surface Water Sewer
- Transferred Combined Sewer
- Transferred Foul Sewer
- Disposal Pipe
- Overflow Pipe
- Culverted Water Course
- Waste Internal Site Pipe
- Sewer Service Connection
- Gravity Sewer Others

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- Combined Pressure Sewer
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- S104 Combined Pressure Sewer
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- S104 Foul Vacuum Sewer
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- Private Combined Vacuum Sewer
- Private Foul Vacuum Sewer
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- Combined Siphon
- Foul Siphon
- Private Surface Water Siphon
- Private Combined Siphon
- Private Foul Siphon

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- S104 Combined Siphon
- S104 Foul Siphon
- Surface Water Unsurveyed Pipe
- Combined Unsurveyed Pipe
- Foul Unsurveyed Pipe
- Disposal Pipe

Service Pipe
- Surface Water Lateral Drain
- Combined Lateral Drain
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- S104 Surface Water Lateral Drain
- S104 Combined Lateral Drain
- S104 Foul Lateral Drain
- Private Surface Water Lateral Drain
- Private Combined Lateral Drain
- Private Foul Lateral Drain
- Transferred Surface Water Lateral D
- Transferred Combined Lateral Drain
- Transferred Foul Lateral Drain

LandlineSymbol
- Culvert Symbol
- Direction Of Flow Symbol
- Boundary Half Mereing Symbol
- Bench Mark Symbol
- Railway Switch Symbol
- Road Related Flow Symbol
- Print50mLine

MATERIALS

-	- NONE
AC	- ASBESTOS CEME
BR	- BRICK
CC	- CONCRETE BOX CULVERT
CI	- CAST IRON
CO	- CONCRETE
CSB	CONCRETE SEGMENTS (BOLTED)
CSU	- CONCRETE SEGMENTS (UNBOLTED)
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MAC	- MASONRY IN REGULAR COURSES
MAR	- MASONRY RANDOMLY COURSED
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PF	- PITCH
PP	- POLYPROPYLENE
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SI	- SPUN (GREY) IRON
ST	- STEEL
U	- UNKNOWN
VC	- VITRIFIED CLAY
XXX	- OTHER

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W	- WEIR
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D	- HIGHWAY DRAIN
S104	- SECTION 104

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E	- EGG SHAPED
O	- OTHER
R	- RECTANGLE
S	- SQUARE
T	- TRAPEZOIDAL
U	- UNKNOWN

PURPOSE

C	- COMBINED
E	- FINAL EFFLUENT
F	- FOUL
L	- SLUDGE
S	- SURFACE WATER

N W E S

SEVERN TRENT

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD

O/S Map Scale: 1:1,000 **This map is centred upon:**

Date of Issue: 05-10-22 **X:** 425000.37 **Y:** 276379.50

Disclaimer Statement:

1 Do not scale off this Map.

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

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5 Ordnance Survey licence number:**100031673**

Appendix C Proposed Masterplan

Safety Health and Environmental Information A1

The following risks are identified as unusual or unfamiliar to a competent contractor

CONSTRUCTION RISKS
There are no significant or unfamiliar risks

DEMOLITION RISKS (FUTURE)
There are no significant or unfamiliar risks

It is assumed that all work will be carried out by a competent contractor working, where appropriate, to an approved method statement

Notes:

REV	DETAILS	DATE	CHECKED

brownhill hayward brown
chartered architects
01543 254357 - mail@bhbarchitects.co.uk

Land at Pheasant Oak Farm, Balsall Common
Illustrative Masterplan
Barwood Land

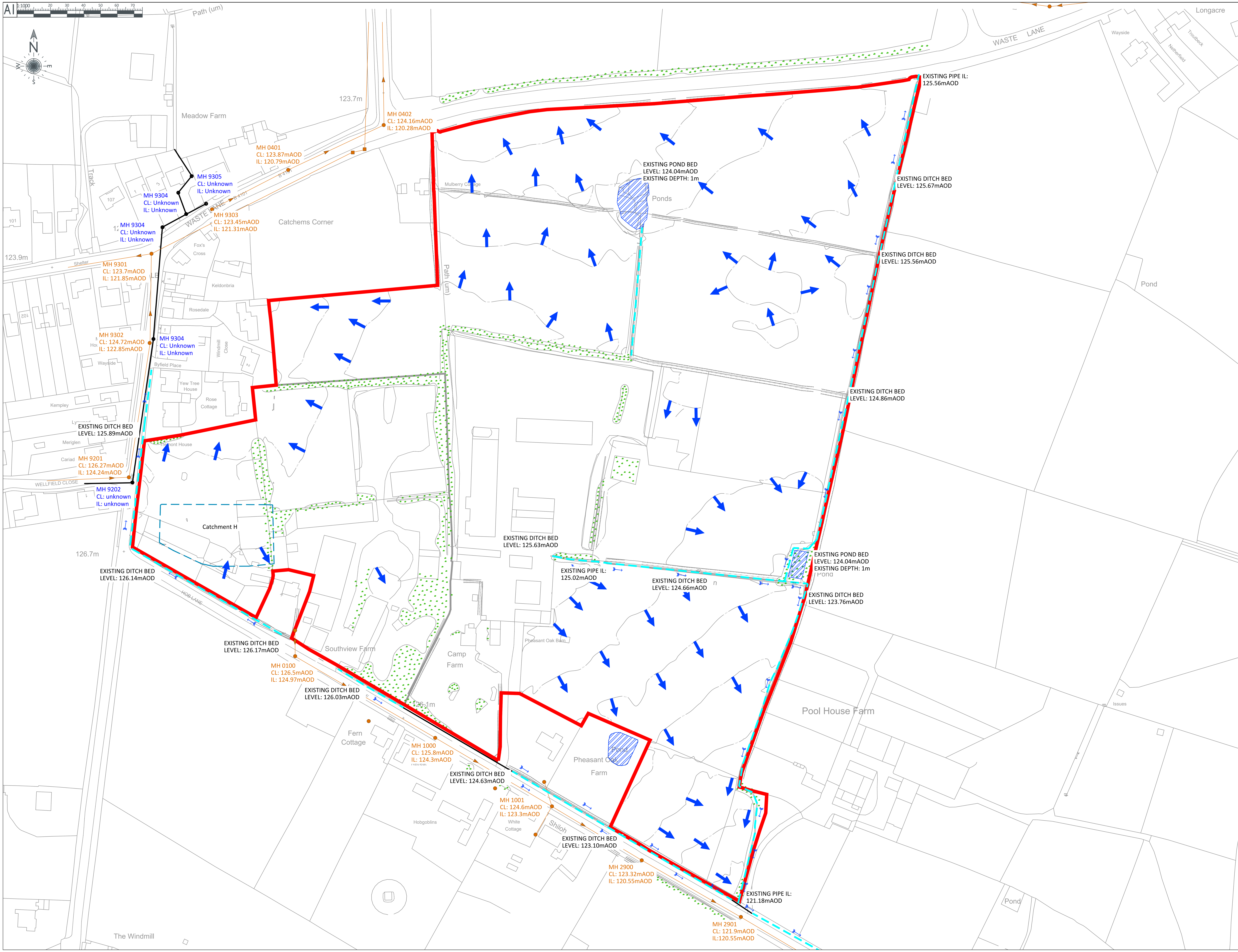
DRAWING NO. 3444 - 04
REV O
DATE Aug '22

PLANNING | DRAWN MJM | CHECKED MW | SCALE 1:1250@ A1

ISO 9001 REGISTERED FIRM | ISO 14001 REGISTERED FIRM

PART OF bhb architects

Appendix D Existing Drainage Features Plan



A1
1:1000
N
Path (um)
Meadow Farm
123.7m
123.9m
126.7m
Catchems Corner
WASTE LANE
Longacre
Wayside
Pond
Ponds
Mulberry Cottage
Keldonbria
Rosedale
Byfield Place
Yew Tree House
Rose Cottage
Kempley
Meriglen
WELLFIELD CLOSE
Catchment H
HOB LANE
Southview Farm
Camp Farm
Pheasant Oak Barn
Pheasant Oak Farm
Pool House Farm
Fern Cottage
Hobgoblins
White Cottage
Shiloh
The Windmill
MH 0402
CL: 124.16mAOD
IL: 120.28mAOD
MH 0401
CL: 123.87mAOD
IL: 120.79mAOD
MH 9305
CL: Unknown
IL: Unknown
MH 9304
CL: Unknown
IL: Unknown
MH 9303
CL: 123.45mAOD
IL: 121.31mAOD
MH 9304
CL: Unknown
IL: Unknown
MH 9301
CL: 123.7mAOD
IL: 121.85mAOD
MH 9302
CL: 124.72mAOD
IL: 122.85mAOD
MH 9304
CL: Unknown
IL: Unknown
EXISTING DITCH BED
LEVEL: 125.89mAOD
MH 9201
CL: 126.27mAOD
IL: 124.24mAOD
MH 9202
CL: unknown
IL: unknown
EXISTING DITCH BED
LEVEL: 126.14mAOD
EXISTING DITCH BED
LEVEL: 126.17mAOD
MH 0100
CL: 126.5mAOD
IL: 124.97mAOD
EXISTING DITCH BED
LEVEL: 126.03mAOD
MH 1000
CL: 125.8mAOD
IL: 124.3mAOD
EXISTING DITCH BED
LEVEL: 124.63mAOD
MH 1001
CL: 124.6mAOD
IL: 123.3mAOD
EXISTING DITCH BED
LEVEL: 123.10mAOD
MH 2900
CL: 123.32mAOD
IL: 120.55mAOD
MH 2901
CL: 121.9mAOD
IL:120.55mAOD
EXISTING PIPE IL:
121.18mAOD
EXISTING PIPE IL:
125.56mAOD
EXISTING POND BED
LEVEL: 124.04mAOD
EXISTING DEPTH: 1m
EXISTING DITCH BED
LEVEL: 125.67mAOD
EXISTING DITCH BED
LEVEL: 125.56mAOD
EXISTING DITCH BED
LEVEL: 124.86mAOD
EXISTING DITCH BED
LEVEL: 125.63mAOD
EXISTING PIPE IL:
125.02mAOD
EXISTING DITCH BED
LEVEL: 124.66mAOD
EXISTING POND BED
LEVEL: 124.04mAOD
EXISTING DEPTH: 1m
EXISTING DITCH BED
LEVEL: 123.76mAOD

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. These drawings should be read in conjunction with all relevant documentation, drawings and standard details.
2. PJA accept no liability for the accuracy of third party data.
3. All dimensions in meters unless otherwise stated. Do not scale from this drawing.

KEY:

- Site Boundary
- Existing Ponds
- Indicative Location of Drainage Ditches
- Existing Surface Water Flow Route
- Existing Severn Trent Water Surface Water Sewer
- Existing Severn Trent Water Foul Water Sewer

Risk Item 1: Investigation into outfall required. To be confirmed by Site walkover and Severn Trent Water Asset Mapping.

Risk Item 2: Investigation into location, Site condition, and capacity of on-Site watercourses required. Further information on downstream connectivity required.

REV	DATE	REVISION NOTE	BY
P01	08/11/2022	DRAFT FOR COMMENT	PR

PJA
Seven House · High Street
Longbridge · Birmingham
B31 2UQ · Tel: 0121 475 0234
Birmingham · Bristol
Exeter · London · Reading
pja.co.uk

CLIENT
Barwood Development Securities Ltd

PROJECT
Pheasant Oak Farm
Balsall Common

DRAWING TITLE
Existing Drainage
Features Plan

DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05655	A	0501	P1

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@1,000	PR	AC	NOV 2022

Appendix E Drainage Strategy Drawings

Catchment	Proposed Developable Area (ha)	Proposed Impermeable Area (ha)	Proposed Qbar (l/s)	Indicative Attenuation Volume (cubm)
A1	0.67	0.40	2.7	410
A2	1.00	0.60	4.0	370
D	2.00	1.20	8.0	870
E	0.46	0.28	1.9	190
F	1.00	0.60	4.0	420
G	2.05	1.23	8.2	885
Total	7.18	4.31	28.9	3145

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. These drawings should be read in conjunction with all relevant documentation, drawings and standard details.
2. PJA accept no liability for the accuracy of third party data.
3. All dimensions in meters unless otherwise stated. Do not scale from this drawing.
4. Surface water drainage design based on:
   - 4.1. Topographic survey, Greenhatch Group March 2019.
   - 4.2. Parameters Plan, BHB Architects provided August 2023.
   - 4.3. OS Mapping Provided by Barwood Land (June 2022).
   - 4.4. Severn Trent Water sewer asset mapping dated 14th July 2022.
   - 4.5. Tree Constraints Plan provided by EDP dated 22nd July 2022.
5. Further survey will be required to confirm exact depth of STW sewers and downstream connectivity of proposed ditch outfalls.
6. No assessment of earthworks has been undertaken. This will be required to delineate the footprint of the proposed attenuation features.
7. Ground raising and earthworks may be required to ensure a gravity led surface water drainage system can be implemented across the Site. The exact nature of these earthworks is to be confirmed at a later design stage.
8. Drainage Strategy is indicative and subject to LLFA and Severn Trent Water review and approval.
9. No hydraulic modeling has been undertaken at this stage to understand the impacts of watercourse within the Site and may impact on basin location.
10. No assessment of surcharged outfall has been undertaken at this stage.
11. Indicative surface water drainage strategy based on:
    - 11.1. Causeway Flow Source Control Calculations.
    - 11.2. Attenuation provided up to the 1 in 100 year plus 40% climate change event.
    - 11.3. Impermeable Areas assumed to be 60%.
    - 11.4. Basins assumed 1.0m deep with 1:3 side slopes or Basins assumed 1.5m deep with 1:4 side slopes. Depths indicated do not include for permanently wetted areas below inlet / outlet pipes.
    - 11.5. FEH Rainfall Data.
    - 11.6. Permanently wetted areas shown 0.5m below identified basin invert level.

KEY:

- Site Boundary
- Existing Drainage Ditches
- Existing STW Surface Water Sewer
- Existing STW Foul Water Sewer
- Existing Pond
- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Indicative Location of Attenuation Basins
- Indicative Location of Conveyance Feature
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- Indicative Location of Proposed Headwall
- Indicative Location of Proposed Surface Water Sewer
- Indicative Location of Proposed Vortex Control
- Indicative Proposed Surface Water Flow Route
- Indicative Location of Proposed Permanently Wet Pool

REV	DATE	REVISION NOTE	BY
P7	14/08/2023	UPDATED MASTERPLAN	AB
P6	28/11/2022	PERMANENTLY WETTED BASIN AREAS UPDATED	PR
P5	11/10/2022	UPDATED MASTERPLAN	PR
P4	16/08/2022	UPDATED MASTERPLAN	PR
P3	29/07/2022	REVISED FOLLOWING RECEIPT OF TREE SURVEY	PR
P2	19/07/2022	REVISED FOLLOWING SITE WALKOVER	PR
P1	30/06/2022	DRAFT FOR COMMENT	CT

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PROJECT
Pheasant Oak Farm
Balsall Common

DRAWING TITLE
Indicative Surface Water Drainage Strategy

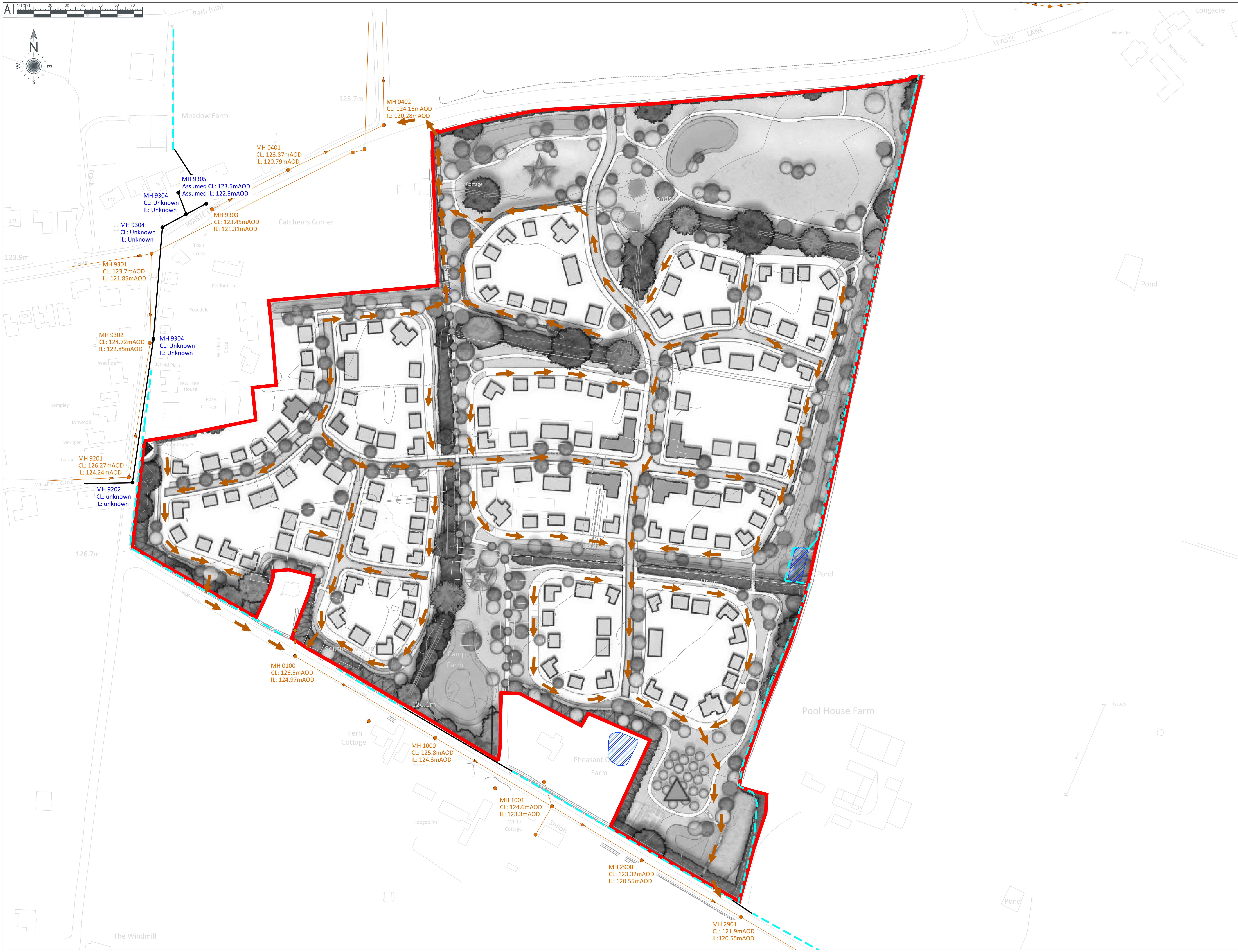
DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05655	-WR -	0500	- P7

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@1,000	CT	PR	August 2023



NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. These drawings should be read in conjunction with all relevant documentation, drawings and standard details.
2. PJA accept no liability for the accuracy of third party data.
3. All dimensions in meters unless otherwise stated. Do not scale from this drawing.
4. Surface water drainage design based on:
   - 4.1. Concept Masterplan, BHB Architects provided August 2023.
   - 4.2. OS Mapping Provided by Barwood Land (June 2022).
   - 4.3. Severn Trent Water sewer asset mapping dated 14th July 2022.
   - 4.4. Tree Constraints Plan provided by EDP dated 22nd July 2022.
5. Further survey will be required to confirm exact depth of STW sewers and downstream connectivity of proposed ditch outfalls.
6. No assessment of earthworks has been undertaken. This will be required to determine any pumping station requirements.
7. Ground raising and earthworks may be required to ensure a gravity led foul water drainage system can be implemented across the Site. The exact nature of these earthworks is to be confirmed at a later design stage.
8. Drainage Strategy is indicative and subject to Severn Trent Water review and approval.

KEY:

- Site Boundary
- Existing Drainage Ditches
- Existing STW Surface Water Sewer
- Existing STW Foul Water Sewer
- Indicative Location of Proposed Foul Route

REV	DATE	REVISION NOTE	BY
P2	14/08/2023	REVISED MASTERPLAN	AB
P1	08/11/2022	DRAFT FOR COMMENT	PR

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DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05655	WR	0502	P2

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@1,000	PR	AC	Aug 2023

Appendix F Exceedance Flow Route Plan

A1 1:1000 20 30 40 50 60 70

BASIN A1
Indicative CL: 124.5mAOD
Indicative IL: 123.5mAOD
Indicative Vol: 410m³

Indicative Flow Control
Q: 6.7l/s

Orifice Flow Control

EXISTING PIPE IL:
125.56mAOD

MH 0402
CL: 124.16mAOD
IL: 120.28mAOD

MH 0401
CL: 123.87mAOD
IL: 120.79mAOD

BASIN A2
Indicative CL: 125.0mAOD
Indicative IL: 124.2mAOD
Indicative Vol: 370m³

MH 9305
Assumed CL: 123.5mAOD
Assumed IL: 122.3mAOD

MH 9304
CL: Unknown
IL: Unknown

MH 9303
CL: 123.45mAOD
IL: 121.31mAOD

Potential overflow from SuDS to Existing Pond - to be confirmed at next design stage

MH 9304
CL: Unknown
IL: Unknown

Indicative Flow Control
Q: 1.9l/s

BASIN E
Indicative CL: 126.0mAOD
Indicative IL: 125.0mAOD
Indicative Vol: 190m³

MH 9301
CL: 123.7mAOD
IL: 121.85mAOD

Catchment A1

Catchment A2

MH 9302
CL: 124.72mAOD
IL: 122.85mAOD

MH 9304
CL: Unknown
IL: Unknown

Catchment E

EXISTING DITCH BED
LEVEL: 125.89mAOD

Catchment D

MH 9201
CL: 126.27mAOD
IL: 124.24mAOD

MH 9202
CL: unknown
IL: unknown

Catchment G

BASIN D
Indicative CL: 125.5mAOD
Indicative IL: 124.5mAOD
Indicative Vol: 870m³

EXISTING DITCH BED
LEVEL: 126.14mAOD

EXISTING DITCH BED
LEVEL: 123.76mAOD

Indicative Flow Control
Q: 8.0l/s

Catchment F

EXISTING DITCH BED
LEVEL: 126.17mAOD

MH 0100
CL: 126.5mAOD
IL: 124.97mAOD

EXISTING DITCH BED
LEVEL: 126.03mAOD

BASIN G
Indicative CL: 126.0mAOD
Indicative IL: 125.0mAOD
Indicative Vol: 885m³

Indicative Flow Control
Q: 8.2l/s

MH 1000
CL: 125.8mAOD
IL: 124.3mAOD

EXISTING DITCH BED
LEVEL: 124.63mAOD

MH 1001
CL: 124.6mAOD
IL: 123.3mAOD

BASIN F
Indicative CL: 123.0mAOD
Indicative IL: 121.5mAOD
Indicative Vol: 420m³

EXISTING DITCH BED
LEVEL: 123.10mAOD

MH 2900
CL: 1
IL: 1

Indicative Flow Control
Q: 4.0l/s

EXISTING PIPE IL:
121.18mAOD

MH 2901
CL: 121.9mAOD
IL:120.55mAOD

Meadow Farm
Catchems Corner
Keldonbria
Rosedale
Kempley
Meriglen
Wayside
Byfield Place
Yew Tree House
Rose Cottage
Windmill Close
Fox's Cross
Fern Cottage
Hobgoblins
White Cottage
Shiloh
Pheasant Oak Farm
Pool House Farm
The Windmill
Longacre
Waywside
Troutbeck
Netherfield
Pond
WASTE LANE
WELLFIELD CLOSE
HOB LANE
Path (um)
Track
123.7m
123.9m
126.7m

NOTES

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1. These drawings should be read in conjunction with all relevant documentation, drawings and standard details.
2. PJA accept no liability for the accuracy of third party data.
3. All dimensions in meters unless otherwise stated. Do not scale from this drawing.
4. Surface water drainage design based on:
   - 4.1. Topographic survey, Greenhatch Group March 2019.
   - 4.2. Parameters Plan, BHB Architects provided August 2023.
   - 4.3. OS Mapping Provided by Barwood Land (June 2022).
   - 4.4. Severn Trent Water sewer asset mapping dated 14th July 2022.
   - 4.5. Tree Constraints Plan provided by EDP dated 22nd July 2022.
5. Further survey will be required to confirm exact depth of STW sewers and downstream connectivity of proposed ditch outfalls.
6. No assessment of earthworks has been undertaken. This will be required to delineate the footprint of the proposed attenuation features.
7. Ground raising and earthworks may be required to ensure a gravity led surface water drainage system can be implemented across the Site. The exact nature of these earthworks is to be confirmed at a later design stage.
8. Drainage Strategy is indicative and subject to LLFA and Severn Trent Water review and approval.
9. No hydraulic modeling has been undertaken at this stage to understand the impacts of watercourse within the Site and may impact on basin location.
10. No assessment of surcharged outfall has been undertaken at this stage.
11. Indicative surface water drainage strategy based on:
    - 11.1. Causeway Flow Source Control Calculations.
    - 11.2. Attenuation provided up to the 1 in 100 year plus 40% climate change event.
    - 11.3. Impermeable Areas assumed to be 60%.
    - 11.4. Basins assumed 1.0m deep with 1:3 side slopes or Basins assumed 1.5m deep with 1:4 side slopes. Depths indicated do not include for permanently wetted areas below inlet / outlet pipes.
    - 11.5. FEH Rainfall Data.
    - 11.6. Permanently wetted areas shown 0.5m below identified basin invert level.

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REV	DATE	REVISION NOTE	BY
P2	14/08/2023	REVISED MASTERPLAN	AB
P1	08/11/2022	DRAFT FOR COMMENT	PR

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Indicative Surface Water Exceedance Strategy

DRAWING ISSUE STATUS
INFORMATION

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BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
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Appendix G Greenfield Run Off Calculations