



ENVIRONMENTAL STATEMENT

VOLUME 2

CHAPTER 12 – WATER ENVIRONMENT



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APPENDIX 12.1 – FLOOD RISK ASSESSMENT

ADVISORY

Trustees of J.P. Milne (DEC'D) Will Trust
Stakehill Industrial Estate
Middleton
Flood Risk Assessment

ADVISORY

Trustees of J.P. Milne (DEC'D) Will Trust
Stakehill Industrial Estate
Middleton
Flood Risk Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds
LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London, SE1 9SE
T: 0207 407 3879

Manchester
11 Portland Street, Manchester, M1 3HU
0161 233 4260

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

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Author:	Alex Eaton BSc (Hons)
Checked:	Sian Renwick MSci (Hons)
Approved:	Claire Gardner BSc (Hons) MSc MCIWEM C.WEM ACMI fCMgr

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG). It has been produced on behalf of Trustees of J.P. Milne (DEC'D) Will Trust in respect of a planning application for a proposed mixed-use development on land to the north of Stakehill Industrial Estate (approximate grid reference: SD893084).

This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented.

The Environment Agency (EA) Flood Map for Planning shows the site is shown to be entirely located within Flood Zone 1 (low probability of river/tidal flooding). The nearest Flood Zones are located approximately 760m southwest of the site attributed to the Trub Brook, a designated EA Main River. A review of EA Light Detection and Ranging (LiDAR) data shows the site is raised above the nearest Flood Zones by a minimum of approximately 19m.

Several ordinary watercourses have been identified within the site. The EA Risk of Flooding from Surface Water (RoFSW) mapping has been used as a proxy to determine the risk associated with surrounding watercourses. The mapping indicates that the ordinary watercourses pose a low risk of flooding to the site. In the event of exceedance of any culverted watercourses, flows are expected to be directed away from the site in a south westerly direction following the general topography.

The Rochdale Canal is located approximately 140m west of the site. EA LIDAR data shows the site is elevated above the canal by a minimum of approximately 1.5m. In the unlikely event of overtopping or breach, flows are expected to be conveyed away from the site in a south westerly direction following the general topography.

The site is considered to be at an overall low risk of groundwater flooding; however, surrounding borehole logs suggest shallow groundwater may be present. Should shallow groundwater be encountered during construction, a groundwater specialist should be consulted, and appropriate dewatering should be employed as necessary.

The site has been assessed against other sources of flood risk including surface water, reservoirs and large waterbodies, and sewers. The overall risk posed by these sources is considered low.

Finished floor levels should be raised a minimum of 150mm above surrounding ground levels to help mitigate residual flood risk. Ground levels should be profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.

It is proposed that a culverted watercourse is diverted around the proposed development. The diversion should be appropriately designed to ensure sufficient capacity is available and there are no adverse effects on flood risk within and downstream of the site. This diversion provides the opportunity for the culvert to be daylighted, in line with the aspirations of the Rochdale Adopted Core Strategy.

The proposed development will increase the area of impermeable surfaces, increasing the rate of runoff from the site prior to mitigation. Therefore, it is proposed to incorporate surface water attenuation as part of the development proposals. Foul water from the development is expected to be drained separately to surface water.

In compliance with the requirements of the NPPF, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff discharging from the site.

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1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG). The FRA has been produced on behalf of Trustees of J.P. Milne (DEC'D) Will Trust in respect of a planning application for a proposed mixed-use development on land to the north of Stakehill Industrial Estate.
- 1.2 This FRA is intended to support an outline planning application and as such, the level of detail included is commensurate and subject to the nature of the proposals at the planning stage. Summary information is included as **Table 1.1**.

Table 1.1: Site Summary

Site Name	Stakehill Industrial Estate
Location	Middleton
NGR (approx.)	SD893084
Application Site Area (ha)	24.9 (approx.)
Development Type	Residential and Industrial/Commercial
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	Residential – More Vulnerable Industrial - Less Vulnerable
Anticipated Development Lifetime	100+ years
Environment Agency Office	Greater Manchester, Merseyside and Cheshire
Lead Local Flood Authority	Rochdale Borough Council
Local Planning Authority	Rochdale Borough Council

Sources of Data

- i. Topographical Survey by Peak Surveying Services in April 2018 (reference: PSS-052-001)
- ii. Environment Agency (EA) 1m spatial resolution 2022 Light Detection and Ranging (LiDAR) Data
- iii. Level 1 Strategic Flood Risk Assessment for Greater Manchester – Update
- iv. Greater Manchester Level 2 Hybrid Strategic Flood Risk Assessment
- v. Greater Manchester Strategic Flood Risk Management Framework

- vi. Rochdale Metropolitan Borough Council Preliminary Flood Risk Assessment and Addendum
- vii. Rochdale Borough's Strategy for Flood Risk Management 2014 - 2024
- viii. Rochdale Adopted Core Strategy
- ix. Greater Manchester Combined Authority Places for Everyone Plan 2022 to 2039
- x. Site visit undertaken by BWB Consulting Ltd in March 2024
- xi. United Utilities Sewer Records
- xii. Drainage Investigation by Terrain Surveys in July 2024 (reference: TS24-386-1-Rev A)
- xiii. British Geological Survey (BGS) Drift & Geology Maps

Existing Site

- 1.3 The site is located approximately 3.1km north east of Middleton, Rochdale and is bound to the north and east by the A627(M), and to the south and west by Stakehill Lane and Bentley Avenue, beyond which lies Stakehill Industrial Estate. The location of the site is illustrated within **Figure 1.1**.

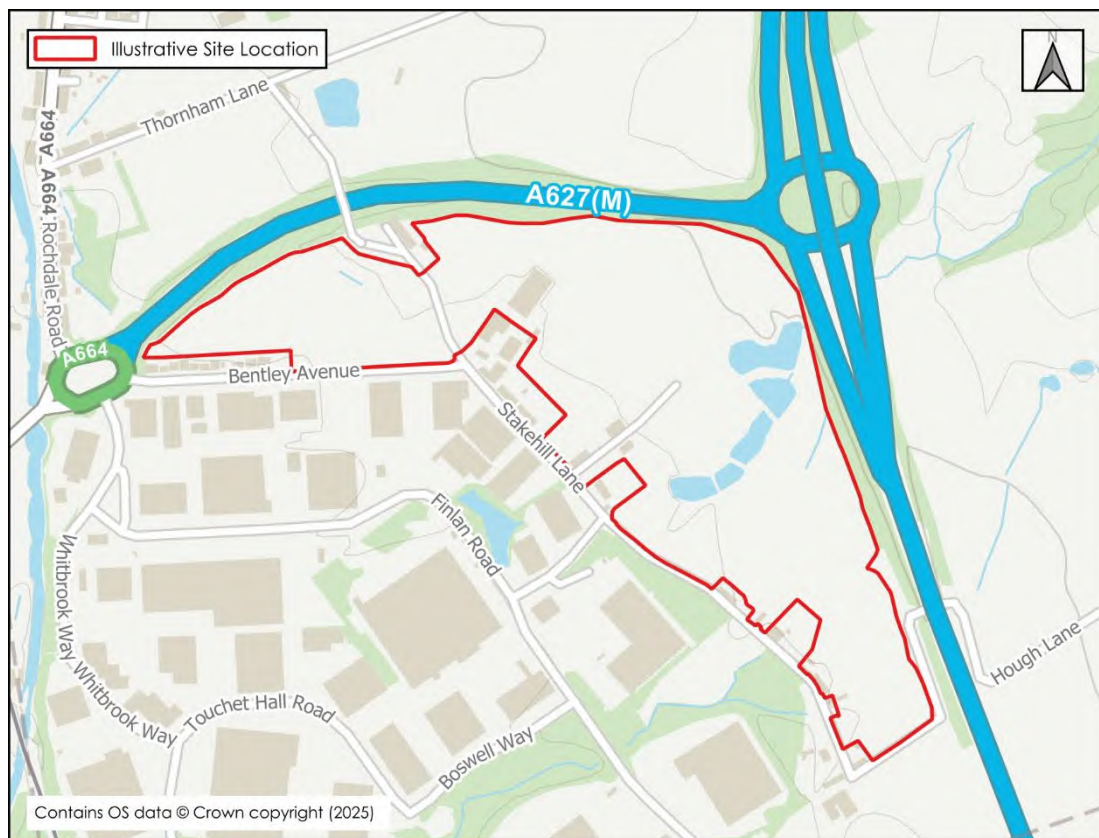


Figure 1.1: Site Location

- 1.4 The site is largely greenfield, comprising agricultural land. A series of ponds are located within the centre of the site, which are understood to be fishing ponds and to be managed by an angling club. Several minor agricultural/industrial buildings are also located within the site.

- 1.5 A topographical survey has been undertaken and included as **Appendix 1**. The site is shown to generally fall in a south westerly and southerly direction with levels ranging between approximately 155.5 metres Above Ordnance Datum (m AOD) in the north to approximately 129.2m AOD in the west.
- 1.6 A site visit was undertaken in March 2024 to observe the general condition of the site and any hydrological features. Several ordinary watercourses were observed within, and in the vicinity of, the site; the approximate locations of these watercourses are shown in **Figure 1.2**. It should be noted that the alignment of the watercourses is approximate and is based on site visit observations, surface water mapping and Ordnance Survey (OS) mapping. The alignment of the watercourses is subject to confirmation following further investigation.

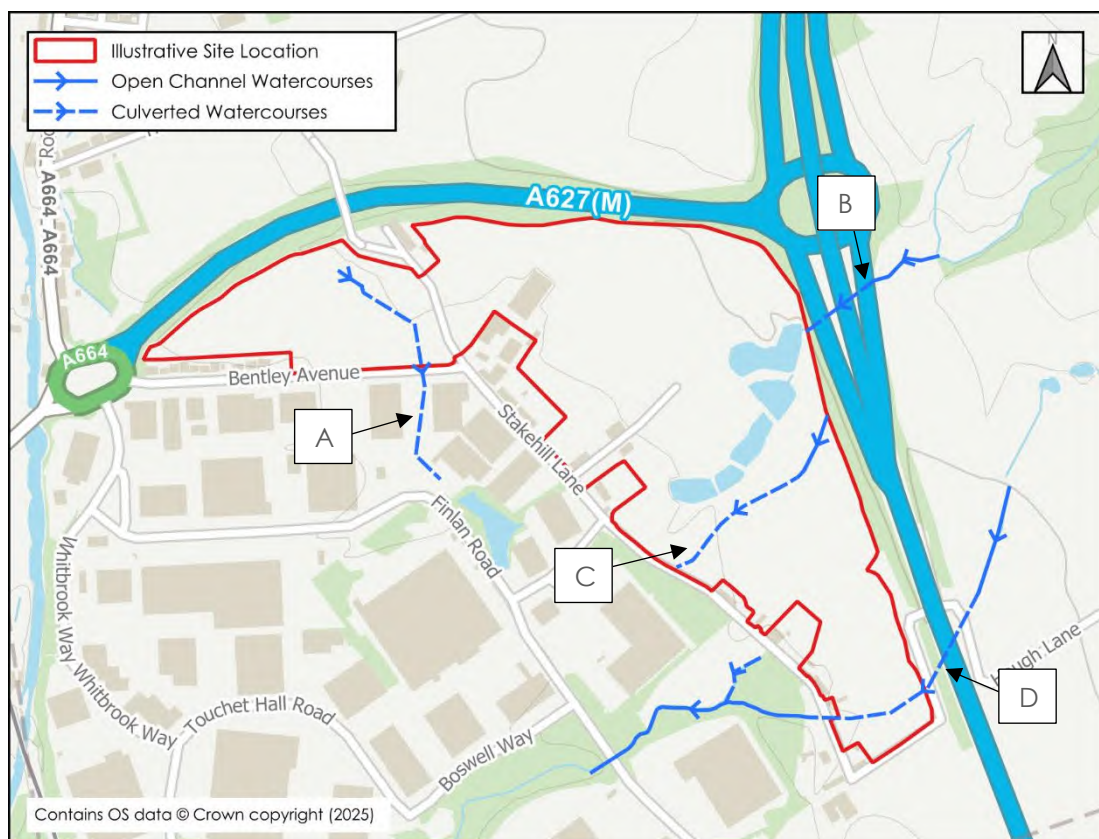


Figure 1.2: Approximate Alignment of Local Watercourses

- 1.7 The watercourses are described below:
- Watercourse A is understood to be a culverted watercourse. No visible manholes were observed during the site visit. The watercourse flows south through the site, towards Stakehill Industrial Estate.
 - Watercourse B is understood to be the Gerrard Wood Stream, which flows in a south westerly direction towards the site and is culverted under the A627(M). It is understood that the watercourse outfalls to the existing fishing ponds; however, onward connectivity is unconfirmed.
 - Watercourse C was observed to issue from culvert in the east of the site from beneath the A627(M). The watercourse flows as open channel before being

culverted within the site. The approximate alignment shown in **Figure 1.2** is based on the site topography and EA surface water mapping.

- Watercourse D is understood to be the Whit Brook which flows in a southerly direction towards the site beneath the A627(M). The watercourse is thought to be culverted within the site; however, the onward connectivity, alignment and condition of the culvert is not known and should be confirmed through further investigation. A flooded manhole was observed to be present along Hough Lane, which was assumed to be associated with the watercourse.

Proposed Development

- 1.8 The proposed development comprises a mixed-use development for residential and industrial/commercial uses. Residential development is proposed in the north of the site, whilst industrial/commercial development is proposed to the south of the existing fishery ponds. It is proposed to access the site via Stakehill Lane and Bentley Avenue.
- 1.9 As part of the development, it is proposed to divert the culverted section of Watercourse C around the area of built development, however, this is subject to further investigation and detailed design.
- 1.10 The Illustrative Masterplan is included as **Appendix 2**.

2. FLOOD RISK PLANNING POLICY & GUIDANCE

National Planning Policy Framework

- 2.1 The NPPF¹ sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The PPG is also available online².
- 2.2 The PPG sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.
- 2.3 The PPG also states that alternative sources of flooding, other than fluvial (river flooding), should be considered when preparing a FRA.
- 2.4 The PPG includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3). Table 2 and Table 3 are recreated within **Appendix 3** of this report for reference.
- 2.5 This FRA is written in accordance with the NPPF and the PPG.

Flood Map for Planning

- 2.6 With particular reference to planning and development, the Flood Map for Planning identifies Flood Zones in accordance with Table 1 of the PPG. Further details on the Flood Zone classifications are outlined in **Table 2.1**.

Table 2.1: Flood Zone Classifications

Flood Zone	Description
Flood Zone 1 (Low Probability)	Land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability (AEP)). All land outside of Flood Zone 2 and 3.
Flood Zone 2 (Medium Probability)	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
Flood Zone 3a (High Probability)	Land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.
Flood Zone 3b (The Functional Floodplain)	Flood Zone 3b (The Functional Floodplain) is defined as land where water must flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

¹ Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended December 2024

² Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>, amended February 2024

2.7 The site is shown to be located entirely within Flood Zone 1, as shown in **Figure 2.1**.

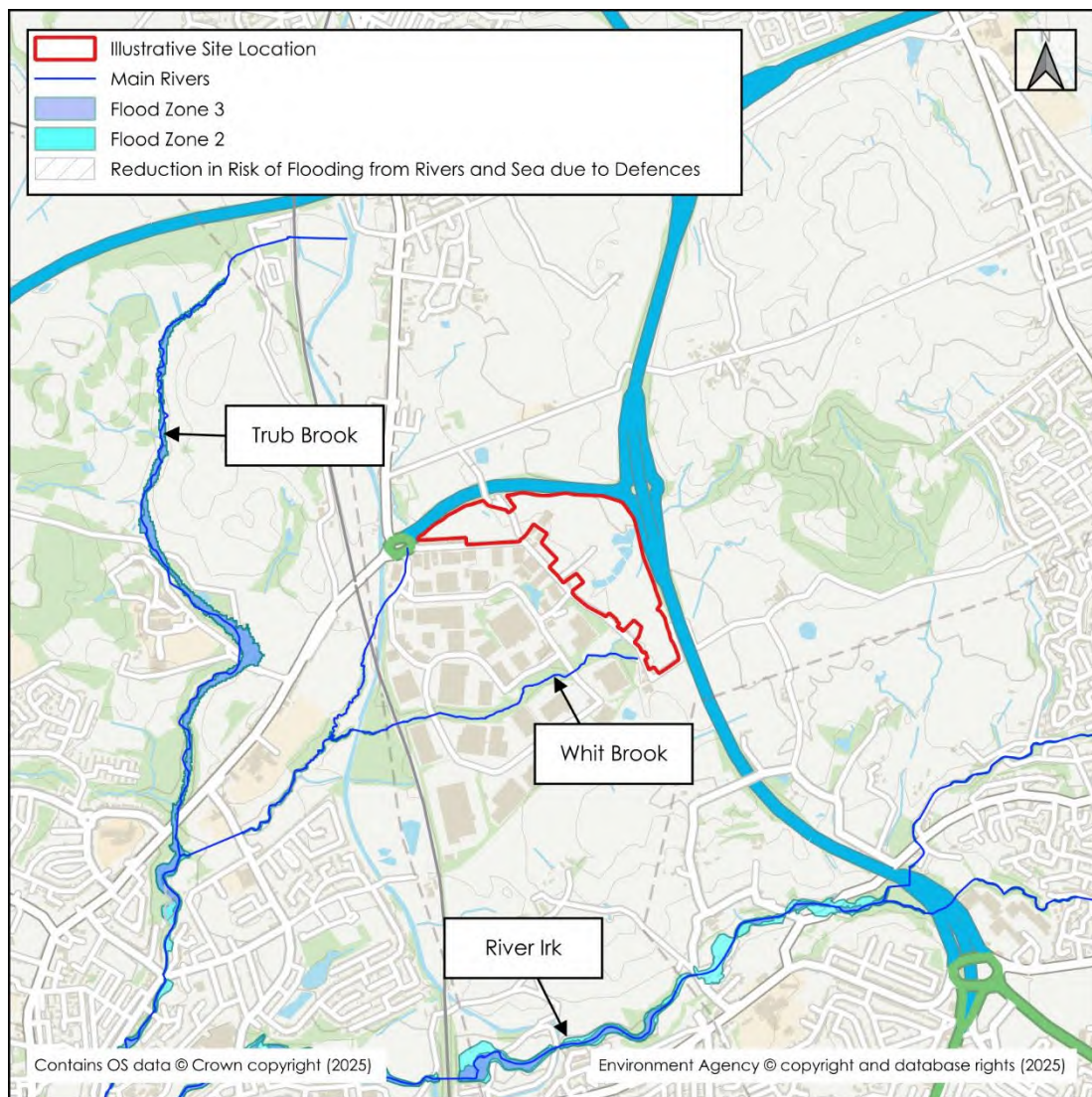


Figure 2.1: Flood Map for Planning

The Design Flood

- 2.8 The PPG identifies that new developments should be designed to provide adequate flood risk management, mitigation, and resilience against the 'design flood' for their lifetime.
- 2.9 This is a flood event of a given annual flood probability, which is generally taken as fluvial (river) and surface water (pluvial) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Climate Change

- 2.10 Predicted future changes in peak river flows caused by climate change are provided by the EA³, with a range of projections applied to regionalised 'River Basin Districts', which are further subdivided into Management Catchments.
- 2.11 The site falls within the Irwell Management Catchment of the North West River Basin District. **Table 2.2** identifies the relevant peak river flow climate change allowances from this Management Catchment.

Table 2.2: Peak River Flow Climate Change Allowances for the Irwell Management Catchment within the North West River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2125)
Upper End	24%	43%	75%
Higher Central	15%	26%	46%
Central	12%	19%	35%

- 2.12 When determining the appropriate allowance for use in a FRA, the Flood Zone classification, flood risk vulnerability and anticipated lifespan of the development should be considered. **Table 2.3** provides a matrix summarising the EA's guidance on determining the appropriate allowance(s).

Table 2.3: Application of Appropriate Peak River Flow Climate Change Allowances

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance where a location may fall within Flood Zone 2 or 3 in the future.				
2	Use the higher central allowance	Use the central allowance			
3a	Use the higher central allowance	Development should not be permitted	Use the central allowance		
3b	Use the higher central allowance	Development should not be permitted			Use the central allowance
If development is considered appropriate by the local authority when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the higher central allowance.					

³ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>. Last Accessed March 2025.

- 2.13 The site is located entirely within Flood Zone 1; the proposed development comprises 'Less Vulnerable' and 'More Vulnerable' use classes and has an anticipated lifespan of at least 100 years.
- 2.14 The EA have been working with local authorities to develop a new National Flood Risk Assessment (NaFRA2). From January 2025, new data, which shows the probability of flooding from rivers and the sea and from surface water has been made available. The Risk of Flooding from Rivers and Sea (RoFRS) mapping shows the probability based on the Central climate change allowances for the '2050s' epoch, which is the most precautionary data projection currently published by the EA. An extract of mapping is included as **Figure 2.2**.

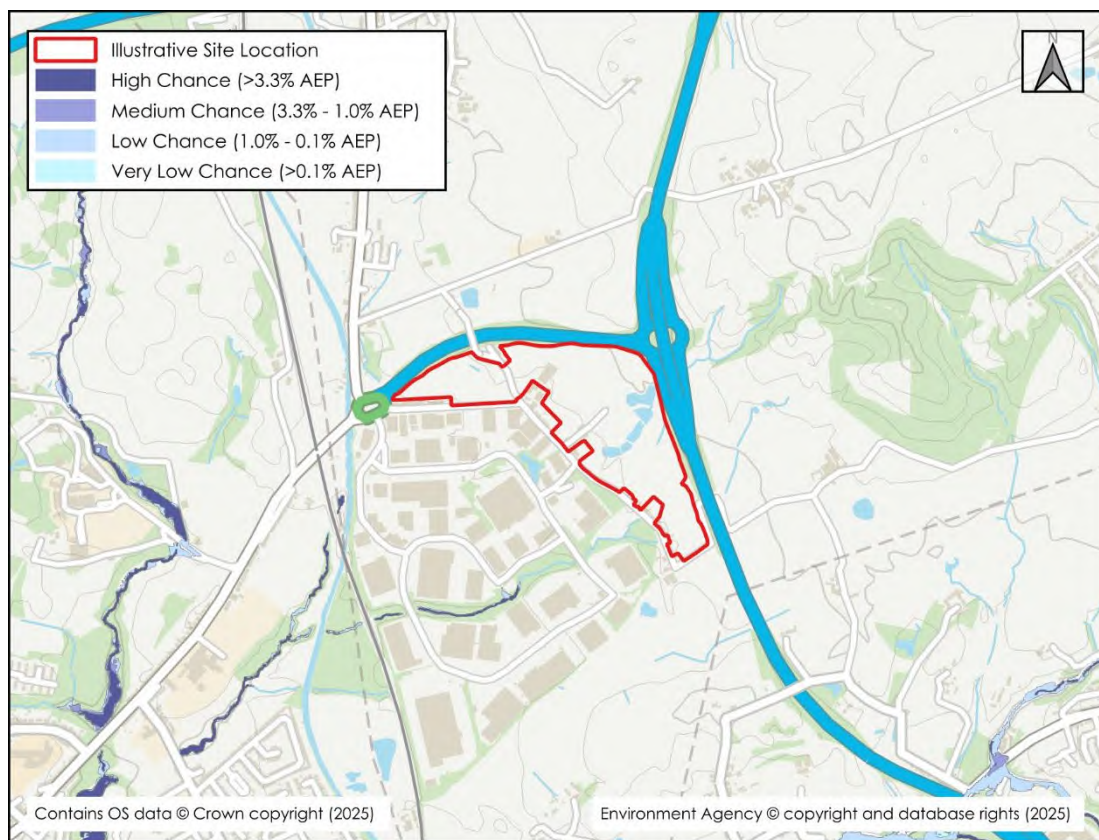


Figure 2.2: Risk of Flooding from Rivers and Sea (Yearly chance of flooding between 2036 and 2069)

- 2.15 The site is shown to be removed from the fluvial flood extents for all probabilities. Therefore, as the site is well removed from the 1 in 1000-year (0.1% AEP) floodplain up to the year 2069, there is confidence that the site will not be located within an area of Flood Zone 2 or 3 in the future. As such, fluvial climate change allowances have not been considered further within this report.

Strategic Flood Risk Assessment

- 2.16 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.

- 2.17 The Level 1 SFRA for Greater Manchester - Update⁴ has been reviewed in the production of this FRA. The SFRA provides strategic flood risk information in the form of fluvial, surface water and groundwater flood risk mapping, as well as records of historical flooding. It also includes flood risk policy and guidance for the area. Information from the Level 1 SFRA will be referenced within **Section 3**, where applicable.
- 2.18 The Greater Manchester Level 2 Hybrid SFRA⁵ was produced to support the Greater Manchester Spatial Framework (GMSF). Upon review, the site is not referenced within the Level 2 Hybrid SFRA and no applicable information in relation to flood risk at the site was identified.

Preliminary Flood Risk Assessment

- 2.19 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authorities (LLFAs).
- 2.20 The Rochdale Metropolitan Borough Council PFRA⁶ considers flooding from surface water runoff, groundwater, ordinary watercourses and canals. It also references the historical river flooding which impacted Rochdale and Littleborough in 2008. However, no historical instances of flooding at the site are referenced. Information from the PFRA will be referenced within **Section 3**, where applicable.
- 2.21 The Rochdale Metropolitan Borough Council PFRA Addendum⁷ has also been reviewed in the production of this FRA. The Addendum provides an update to the 2011 PFRA; however, upon review, there is no additional information provided regarding past or future flood risk to the site.

Local Flood Risk Management Strategy

- 2.22 A Local Flood Risk Management Strategy (LFRMS) is prepared by an LLFA to help understand and manage flood risk at a local level.
- 2.23 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.
- 2.24 The Rochdale Borough's Strategy for Flood Risk Management 2014-2024⁸ has been reviewed and will be referenced within **Section 3**, where applicable.
- 2.25 The Greater Manchester Strategic Flood Risk Management Framework⁹ outlines the strategic flood risks posed to the Greater Manchester region. However, upon review, no applicable information in relation to flood risk at the site was identified.

⁴ Level 1 Strategic Flood Risk Assessment for Greater Manchester – Update (JBA Consulting, March 2019)

⁵ Greater Manchester Level 2 Hybrid Strategic Flood Risk Assessment (JBA Consulting, October 2020)

⁶ Rochdale Metropolitan Borough Council Preliminary Flood Risk Assessment (JBA Consulting, May 2011)

⁷ Rochdale Metropolitan Borough Council Preliminary Flood Risk Assessment Addendum (Rochdale Metropolitan Borough Council, December 2017)

⁸ Rochdale Borough's Strategy for Flood Risk Management 2014 - 2024 (Rochdale Borough Council, March 2014)

⁹ Greater Manchester Strategic Flood Risk Management Framework (JBA Consulting, September 2018)

River Basin Flood Risk Management Plan

- 2.26 Flood Risk Management Plans (FRMPs) explain the risk of flooding from rivers, the sea, surface water, groundwater and reservoirs. FRMPs set out how risk management authorities will work with communities to manage flood and coastal risk. Risk management authorities include the EA, Natural Resources Wales, local councils, Internal Drainage Boards, National Highways and LLFAs.
- 2.27 The first FRMPs were published in March 2016 and were subsequently updated in December 2022. These describe actions to manage flood risk across England between 2021 to 2027.
- 2.28 The site is located within the North West River Basin District and the North West River Basin District FRMP¹⁰ has been reviewed. However, no applicable information in relation to the site was identified.

Surface Water Management Plan

- 2.29 Surface Water Management Plan (SWMPs) are non-statutory plans which preceded the introduction of the Flood and Water Management Act 2010. They can provide an important evidence base of local flood risk issues which can include surface water drains, groundwater and small watercourses.
- 2.30 The Greater Manchester SWMP¹¹ has been reviewed and will be referenced within **Section 3**, where applicable.

Section 19 Flood Investigation Reports

- 2.31 Under their duties of the Flood and Water Management Act 2010, LLFAs have a responsibility to publish reports of investigations of flood incidents. A Section 19 Flood Investigation report is a public statement of the circumstances of a historical flood event and what parties have a role in managing the risks. The investigation does not always give an in-depth analysis of the flood risk or mechanisms, but it can provide a valuable record of past events.
- 2.32 Upon review of the Rochdale Borough Council website, the LLFA have not published any Section 19 Flood Investigation reports at the time of writing.

Local Plan

- 2.33 The Rochdale Adopted Core Strategy¹² has been reviewed in the production of this FRA. The Core Strategy sets out the long-term spatial strategy for future development of Rochdale Borough up to 2028.

¹⁰ North West River Basin District Flood Risk Management Plan 2021 to 2027 (Environment Agency, December 2022)

¹¹ Greater Manchester Surface Water Management Plan (JBA Consulting, January 2012)

¹² Rochdale Adopted Core Strategy (Rochdale Borough Council, October 2016)

2.34 The Places for Everyone Plan 2022 to 2039¹³ has also been reviewed in the production of this FRA. This document outlines the strategic spatial plan to deliver sustainable development across Greater Manchester.

2.35 Key policies from both documents are outlined below.

Rochdale Adopted Core Strategy

G8 - Managing water resources and flood risk

2.36 The LLFA will expect new development to not increase flood risk elsewhere and to contribute to alleviating existing flood risk where possible. Appropriate management of surface water will be required through the use of Sustainable Drainage Systems (SuDS).

2.37 The LLFA also support the opening up of existing culverts wherever possible.

Places for Everyone Plan 2022 to 2039

Policy JP-S4: Flood Risk and the Water Environment

2.38 To protect the quality of existing watercourses and waterbodies within Greater Manchester, development must be located and designed to minimise the impacts of current and future flood risk. Developments are expected to manage surface water through the use of SuDS.

Policy JP Allocation 2: Stakehill

2.39 The site is included within the wider Stakehill allocation area. The allocation notes that development will be required to deliver high quality landscaping and green and blue infrastructure within the site.

¹³ Places for Everyone Joint Development Plan Document for Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan 2022 to 2039 (Greater Manchester Combined Authority, March 2024)

3. POTENTIAL SOURCES OF FLOOD RISK

- 3.1 Flooding can occur from a variety of sources, or combination of sources, which may be natural or artificial. **Table 3.1** below identifies the potential sources of flood risk to the site in its current condition, and the impacts which the development could have in the wider catchment, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 4**.

Table 3.1: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial			X		The site is located entirely within Flood Zone 1. The site is considered to be at a low risk from surrounding ordinary watercourses. In the event of exceedance flows are expected to be directed away from the site following the general topography
Pluvial runoff			X		The site is shown to be at an overall low probability of surface water flooding. Areas of low to high surface water ponding are shown to align with topographical low points.
Canals			X		The site is raised above the Rochdale Canal by a minimum of approximately 1.5m. In the unlikely event of overtopping or breach, flows are expected to be conveyed away from the site in a south westerly direction following the general topography.
Groundwater			X		The site is shown to fall within an area predicted to be at a low to medium susceptibility to groundwater flooding. In the event of groundwater emergence, flows are expected to be conveyed away from the site in a south westerly direction following the general topography.

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Reservoirs and waterbodies			X		The site is shown to fall outside of the area at risk of inundation in the event of reservoir failure for both the 'dry-day' and 'wet-day' scenarios. The existing fishery ponds are considered to pose a low risk to the site.
Sewers			X		Public sewers are located within, and in the vicinity of, the site. In the event of exceedance of the nearby assets, flows are expected to be conveyed away from the site following the general topography.
Effect of Development on Wider Catchment		X			The development could result in the impedance of fluvial or pluvial flow routes, unless properly mitigated.
		X			The development will increase the area of impermeable surfaces leading to a potential increase in runoff.

Fluvial Flood Risk

- 3.2 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

Historical Flooding

- 3.3 The EA Historical Flood Map shows there are no previously recorded flood outlines which have impacted the site or surrounding area. The nearest recorded flood outline to the site is approximately 2km southwest of the site, attributed to the Whit Brook exceeding its channel capacity in 2015.
- 3.4 The 'Local Historic Flood Map' appended to the Rochdale Metropolitan Borough Council PFRA shows there are no previously recorded flood events which have impacted the site.
- 3.5 The 'GM LLFA historic flood incidents' included within the Level 1 SFRA for Greater Manchester shows there are no previously recorded flood events which have impacted the site or the surrounding area.

Main Rivers

- 3.6 As shown in **Figure 2.1**, the site is located entirely within Flood Zone 1. The nearest EA Flood Zone extents are located approximately 760m west of the site, associated within the Trub Brook. The nearest Flood Zones associated with the Whit Brook are located approximately 780m south west of the site. Both watercourses are dedicated Main Rivers.
- 3.7 A review of EA LiDAR data shows the site is raised a minimum of approximately 19m above the Flood Zones in the vicinity of the site. Ground levels fall away from the site in a westerly direction; therefore, in the event of exceedance, the preferential flow route is expected to be away from the site.

Risk of Flooding from Rivers and Seas

- 3.8 As outlined within **Section 2**, the EA released the new NaFRA2 dataset in January 2025 which uses the best available data from the EA and local authorities to inform current and future probability of flooding.
- 3.9 The RoFRS mapping shows the probability of flooding from rivers and the sea to areas of land, taking into account the presence and condition of flood defences. The mapping considers the Central climate change allowances for the '2050s' epoch, which is the most precautionary data projections currently published by the EA. An extract of mapping is included as **Figure 2.2**.
- 3.10 The RoFRS mapping shows broadly similar outputs to the Flood Map for Planning, albeit with probable fluvial flooding associated with the Whit Brook in closer vicinity to the site. However, the site is shown to be removed from the probable fluvial flood extents for all probabilities up to 2069.

Ordinary Watercourses

- 3.11 Several ordinary watercourses were identified within the site during a site visit undertaken in March 2024. The approximate locations of these watercourses are shown in **Figure 1.2**.
- 3.12 The EA Risk of Surface Water Flooding (RoFSW) mapping dataset can be used as a proxy to provide an indication of the potential floodplain associated with watercourses omitted from the Flood Map for Planning and RoFRS datasets. The mapping shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The mapping considers the Central climate change allowances for the '2050s' epoch, which is the most precautionary data projections currently published by the EA. An extract of mapping is included as **Figure 3.1**.

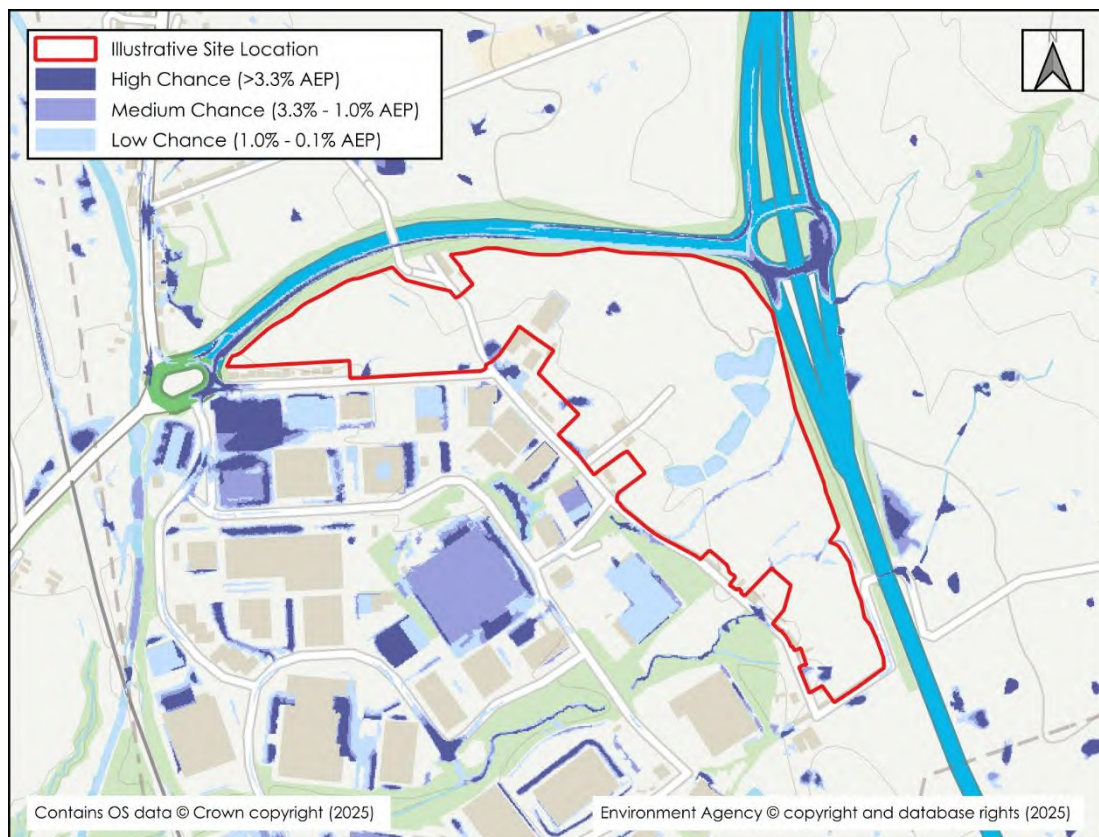


Figure 3.1: Risk of Flooding from Surface Water Mapping (Yearly chance of flooding between 2040 and 2060)

- 3.13 The mapping shows low to high probability flows associated with the approximate alignment of Watercourse C. The flows are shown to be constrained to the open section of watercourse channel, therefore, the risk associated with the watercourse is considered to be low. All other culverted watercourses are shown to pose a low risk to the site.
- 3.14 In the event of exceedance of the culverted watercourses, flows are expected follow the overland flow routing demonstrated within the RoFSW mapping, before being directed away from the site in a south westerly direction following the general topography.
- 3.15 Overall, the site is considered to be at a low risk of fluvial flooding.

Pluvial Flood Risk

- 3.16 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.
- 3.17 The RoFSW mapping (**Figure 2.2**) shows the majority of the site to be at a very low probability of surface water flooding, with minor areas at low to high probability ponding associated with existing topographical low points and hedge lines. The areas of ponding are shown to originate within the site.

- 3.18 The pluvial flow route shown to the south of the fishing ponds aligns with the assumed route of Watercourse C. This is considered to be fluvial in nature and is discussed within the above **Fluvial Flood Risk** section.
- 3.19 The site access and egress via Stakehill Lane and Bentley Avenue are shown to be at a very low probability of surface water flooding.
- 3.20 There are no previously recorded surface water flood events which have impacted the site reported within the Level 1 SFRA for Greater Manchester, the Rochdale Borough Council PFRA, or the Rochdale Borough's Strategy for Flood Risk Management.
- 3.21 Hotspots were identified within the Greater Manchester SWMP as areas that are susceptible to surface water flooding during the 1 in 200-year rainfall event. The 'Greater Manchester Strategic Hotspots' map shows that the site is not located within a surface water flood hotspot.
- 3.22 Overall, the site is considered to be at low probability of surface water flooding. Mitigation measures to address residual risks are discussed within **Section 4**.

Flood Risk from Canals

- 3.23 The Canal and River Trust (CRT) generally maintains canal levels using reservoirs, feeders and boreholes and manages water levels by transferring it within the canal system.
- 3.24 Water in a canal is typically maintained at predetermined levels by control weirs. When rainfall or other water enters the canal, the water level rises and flows out over the weir. If the level continues rising, it will reach the level of the storm weirs. The control weirs and storm weirs are normally designed to take the water that legally enters the canal under normal conditions. However, it is possible for unexpected water to enter the canal or for the weirs to become obstructed. In such instances, the increased water levels could result in water overtopping the towpath and flowing onto the surrounding land.
- 3.25 Flooding can also occur where a canal is impounded above surrounding ground levels and the retaining structure fails.
- 3.26 The Rochdale Canal is located approximately 140m west of the site. A review of EA LIDAR data shows the site is elevated above the canal by a minimum of approximately 1.5m.
- 3.27 In the unlikely event of overtopping or breach, flows are expected to be conveyed away from the site in a south westerly direction following the general topography.
- 3.28 The Level 1 SFRA for Greater Manchester reports one historical overtopping event of the Rochdale Canal which impacted Holland Street, located approximately 9km southwest of the site within Manchester City Centre.
- 3.29 The Rochdale Borough Council PFRA reports one incident of localised flooding attributed to the Rochdale Canal in 1927; however, the magnitude and exact location of flooding are not provided.

3.30 Due to the management and maintenance responsibilities of the CRT, the actual probability of a significant failure or overtopping event is considered to be low.

3.31 Overall, the site is considered to be at a low risk of flooding from canals.

Groundwater Flood Risk

3.32 Groundwater flooding occurs when the water table rises above ground elevations, or it rises to depths containing basement level development. It is most likely to happen in low lying areas underlain by permeable geology. This is most common on regional scale chalk aquifers, but there may also be a risk on sandstone and limestone aquifers or on thick deposits of sands and gravels underlain by less permeable strata such as that in a river valley.

3.33 BGS mapping shows the site to be predominantly underlain by Pennine Lower Coal Measures Formation (Mudstone, Siltstone and Sandstone) with bands of Royley Sandstone (Sandstone) mapped through the north east of the site. Superficial deposits of Till, Devensian (Diamicton) and Glaciofluvial Deposits, Devensian (Sand and Gravel) are expected to be present throughout the site.

3.34 The EA designates these bedrock geologies and superficial deposits as Secondary A Aquifers, which comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers.

3.35 There are no previously recorded groundwater flood events which have impacted the site reported within the Level 1 SFRA for Greater Manchester, Rochdale Borough Council PFRA, or Rochdale Borough's Strategy for Flood Risk Management.

3.36 'Areas Susceptible to Groundwater Flooding' mapping, included within the PFRA and LFRMS, shows the site to be situated across three 1km² cells which are considered to be at a low (< 25%) and medium (>= 25% <50%) susceptibility to groundwater flooding. The site is predominantly situated within cells where <25% of the cell area is considered to be susceptible to groundwater flooding.

3.37 It should be noted that the mapping is based on strategic scale mapping which identifies areas susceptible to flooding from groundwater at a broad scale on the basis of geological and hydrogeological conditions. Therefore, the classification could potentially be based on another area within the particular cell. Areas of medium groundwater susceptibility are likely to be in continuity with the Trub and Whit Brook and their fluvial floodplains.

3.38 The BGS holds historical records of borehole samples across the UK and can provide an indication of possible groundwater levels in metres below ground level (m bgl) that could be experienced. There are no BGS borehole logs located within the site; however, a number of borehole logs are located approximately 300m west of the site and are underlain by similar geology, so can be used to indicate conditions at the site. The interrogated records are summarised in **Table 3.2**.

Table 3.2: Summary of Interrogated BGS Borehole Records

Borehole Reference	Date Sampled	Depth of Borehole (m)	Groundwater Strike (m bgl)
SD80NE293	1998	4.10	2.00
SD80NE294	1998	4.00	0.75
SD80NE295	1998	4.00	2.10
SD80NE4	1913	64.01	Groundwater not Recorded
SD80NE5	1913	58.83	Groundwater not Recorded

- 3.39 The borehole logs indicate shallow groundwater to be present within the vicinity of the site. It is expected that the shallow groundwater levels are in continuity with the surrounding watercourses.
- 3.40 In the event of groundwater emergence, flows are expected to be conveyed away from the site in a south westerly direction towards the Whit Brook, following the general topography.
- 3.41 Based on the available data, the site is considered to be at a low risk of groundwater flooding. However, due to shallow groundwater encountered in the vicinity of the site, mitigation measures to address residual risks are discussed within **Section 4**.

Flood Risk from Reservoirs & Large Waterbodies

- 3.42 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.
- 3.43 To help identify this risk, reservoir failure flood risk mapping has been prepared and published by the EA; this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst-case scenario and is only intended as a guide. An extract of mapping is included as **Figure 3.2**.

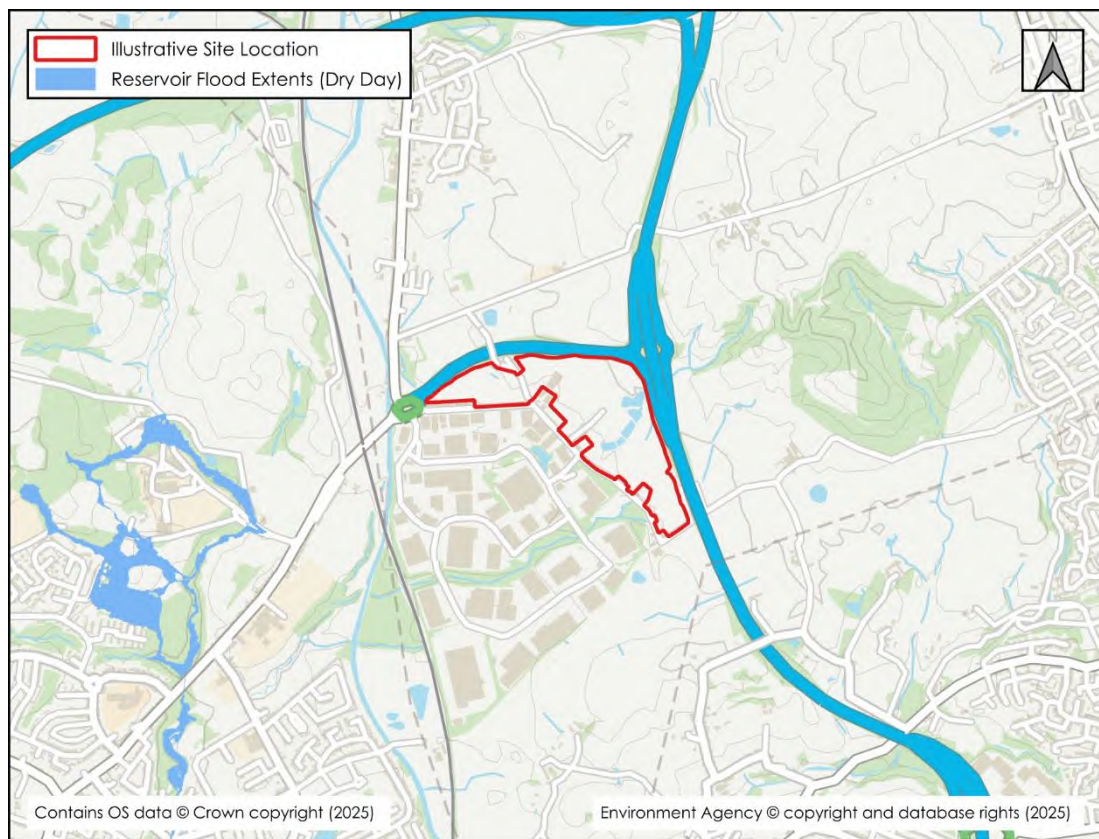


Figure 3.2: Reservoir Failure Flood Risk Map

- 3.44 There are two flooding scenarios shown on the reservoir flood maps: a 'dry-day' and a 'wet-day'. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet-day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme flood.
- 3.45 The mapping shows the site is located outside of the flood extents in the event of a reservoir failure. The nearest extents are located approximately 800m west of the site attributed to Hatters Reservoir during a 'dry-day' scenario.
- 3.46 A series of fishing ponds, ranging from approximately 0.05 to 0.4ha in area, are located within the site. The topographical survey (**Appendix 1**) shows the existing water levels of the ponds are approximately 0.5m below surrounding ground levels.
- 3.47 A Drainage Investigation was undertaken by Terrain Surveys in July 2024 (reference: TS24-386-1-Rev A) and is included as **Appendix 4**. This confirmed that the ponds are fed by a watercourse which is culverted under the A627(M) and are linked via existing pipework. However, the onward connectivity from the ponds could not be confirmed.
- 3.48 It is understood that the fishing ponds are managed by an angling club, and as such, the ponds will be subject to safety inspections and maintenance. However, in the unlikely event of the ponds overtopping, flows would be directed away from the site in a south westerly direction towards Stakehill Industrial Estate, in line with the site topography.

- 3.49 Overall, the risk of flooding from reservoirs and large waterbodies is considered to be low.

Flood Risk from Sewers

- 3.50 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.
- 3.51 The local sewerage undertaker is United Utilities; a copy of their asset plans is included as **Appendix 5**.
- 3.52 The records show two 300mm diameter combined sewers to flow in a southerly and north westerly direction along Stakehill Lane, in the vicinity of the north and south of the site respectively. The combined sewers converge within the west of the site before travelling in a south westerly direction through the site as a 225mm diameter combined sewer.
- 3.53 A 225mm diameter surface water sewer is shown to be present within Bentley Avenue and flows in a westerly direction towards Stakehill Industrial Estate. A 150mm-300mm diameter surface water sewer is also shown to be located within Stakehill Lane which flows in a south easterly direction towards Stakehill Industrial Estate.
- 3.54 The records also show the culverted watercourse located within the west of the site where the head of the system is understood to originate. This watercourse, shown on **Figure 1.2** as Watercourse A, flows south through the site, towards Stakehill Industrial Estate. It is understood that the culverted watercourse is not a United Utilities asset.
- 3.55 The Drainage Investigation undertaken by Terrain Surveys (**Appendix 4**) confirmed the presence of the surface water sewers in Bentley Avenue and Stakehill Lane and the combined sewers within the site and Stakehill Lane.
- 3.56 In the event of exceedance of the surrounding sewerage assets, flows are expected to be conveyed away from the site in a southerly and westerly direction following the general topography.
- 3.57 United Utilities provided their DG5 register and Wastewater Incident Register System as part of the Rochdale Borough Council PFRA. The records indicate that two previous sewer flood events have impacted Stakehill Industrial Estate to the south of the site. However, the date and magnitude of flooding are not provided.
- 3.58 The 'UU historic sewer flooding incidents and GM SWMP Hotspots' mapping included within the Level 1 SFRA for Greater Manchester shows there to be no previous recorded sewer flood incidents which have impacted the site or surrounding area.
- 3.59 Overall, the site is considered to be at a low risk of flooding from sewers.

Effect of Development on Wider Catchment

Displacement of Floodplain and Impedance of Flood Flows

- 3.60 Unless properly mitigated the development has the potential to impede or redirect existing fluvial and surface water flow routes. Appropriate mitigation to prevent this is discussed in **Section 4**.

Development Land Use/Drainage Considerations

- 3.61 The proposed development will result in an increase in impermeable surfaces. This has the potential to increase pluvial runoff volumes if appropriate mitigation measures are not put in place. These mitigation measures will be discussed in **Section 4**.

4. FLOOD RISK MITIGATION

- 4.1 **Section 3** has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Sequential Arrangement

- 4.2 The site is located in Flood Zone 1 and is considered to be at a low risk of surface water flooding, as such, the site does not need to be sequentially arranged. Areas of existing surface water risk originate within the site and will be managed by the proposed surface water drainage strategy.
- 4.3 It is proposed that Watercourse C, located immediately south of the fishery ponds, is diverted around the proposed development. This diversion should be appropriately designed to ensure sufficient capacity is available and to avoid cross-catchment transfer of flows. This will ensure that there are no adverse effects on flood risk within and downstream of the site. This diversion provides the opportunity for the culvert to be daylighted, in line with Policy 'G8 - Managing water resources and flood risk', in the Rochdale Adopted Core Strategy.

Groundwater Considerations

- 4.4 Based on the available data, the site is considered to be at a low risk of groundwater flooding. However, should shallow groundwater be encountered during construction, a groundwater specialist should be consulted, and appropriate dewatering should be employed as necessary.

Development Levels

- 4.5 It is recommended that finished floor levels are raised a minimum of 150mm above surrounding ground levels to help mitigate against any residual flood risk.
- 4.6 It is also recommended that ground levels are profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.

Safe Access and Egress

- 4.7 The access routes via Stakehill Lane and Bentley Avenue are shown to be at a low risk of flooding from fluvial and surface water sources. Therefore, safe access and egress can be achieved via these routes.

Easements

- 4.8 It is recommended that development be set back a minimum of 8m from the top of banks of the ordinary watercourses within the site. It is anticipated that an 8m easement

would also be required either side of any culverted watercourse within the site. The required easements should be confirmed with the LLFA.

- 4.9 United Utilities have confirmed via pre-development enquiry, included within **Appendix 5**, that a 6m easement would be required for the public sewerage assets within the site.

Surface Water and Foul Water Drainage

- 4.10 To mitigate the impact of the development on the current runoff regime, it is proposed to incorporate surface water attenuation and storage as part of the development proposals.
- 4.11 In brief, the proposed development will continue to discharge surface water to the local watercourse at the equivalent greenfield QBAR rate. Attenuated surface water storage will be provided in the form of SuDS detention basins with capacity for the 1 in 100-year storm with an allowance for climate change.
- 4.12 The development should be designed with exceedance in mind and the road network should be used to convey excess overland flows towards the attenuation points.
- 4.13 It is proposed to drain foul water from the development separately to surface water.
- 4.14 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement (reference: 233493-BWB-ZZ-XX-T-W-0005_SDS).

5. CONCLUSIONS AND RECOMMENDATIONS

- 5.1 This FRA has been prepared in accordance with requirements set out in the NPPF and the associated PPG. The FRA has been produced on behalf of Trustees of J.P. Milne (DEC'D) Will Trust in respect of a planning application for a proposed mixed-use development on land to the north of Stakehill Industrial Estate.
- 5.2 This FRA is intended to support an outline planning application and as such, the level of detail included is commensurate and subject to the nature of the proposals at the planning stage.
- 5.3 This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. The identified risks and mitigation measures are summarised within **Table 5.1**:

Table 5.1: Summary of Flood Risk Assessment

Flood Source	Risk & Proposed Mitigation Measures
Fluvial	The site is located within Flood Zone 1. The nearest Flood Zones are located approximately 760m west of the site attributed to the Trub Brook, a designated EA Main River. A review of EA LiDAR data shows the site is raised above the nearest Flood Zones by a minimum of approximately 19m. Several ordinary watercourses were identified within the site during a site visit undertaken in March 2024. EA RoFSW mapping indicates the ordinary watercourses pose a low risk of flooding to the site. In the event of exceedance of the culverted watercourses, flows are expected to be directed away from the site in a south westerly direction following the general topography.
Canals	The Rochdale Canal is located approximately 140m west of the site. EA LIDAR data shows the site is elevated a minimum of approximately 1.5m above the canal. In the unlikely event of overtopping or breach, flows are expected to be conveyed away from the site in a south westerly direction following the general topography.
Groundwater	The site is considered to be at an overall low risk of groundwater flooding; however, borehole logs in the vicinity of the site indicate shallow groundwater may be present. Should shallow groundwater be encountered during construction, a groundwater specialist should be consulted, and appropriate dewatering should be employed as necessary.
Other Sources	The site has been assessed against other sources of flood risk including surface water, reservoirs and large waterbodies, and sewers. The overall risk posed by these sources is considered low.
Impact of the Development	Finished floor levels should be raised a minimum of 150mm above surrounding ground levels to help mitigate residual flood risk. Ground levels should be profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point. It is proposed that Watercourse C is diverted around the proposed development. The diversion should be appropriately designed to ensure sufficient capacity is available and there are no adverse effects on flood risk within and downstream of the site. This diversion provides the opportunity for

	the culvert to be daylighted, in line with the aspirations of the Rochdale Adopted Core Strategy. The proposed development will increase the area of impermeable surfaces, increasing the rate of runoff from the site prior to mitigation. Therefore, it is proposed to incorporate surface water attenuation as part of the development proposals. Foul water from the development is expected to be drained separately to surface water.
This summary should be read in conjunction with BWB's full report. It reflects an assessment of the Site based on information received by BWB at the time of production.	

- 5.4 In compliance with the requirements of NPPF, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff discharging from the site.

APPENDICES

Appendix 1: Topographical Survey



408500N

408400N

408300N

408200N

300080E

300080E

300080E

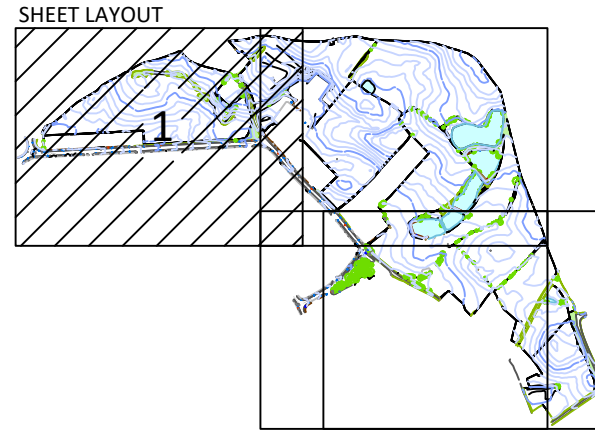
300080E

300080E

LEGEND

- Bottom of Bank
 - Canopy
 - Change Of Surface
 - Dropped Kerb
 - Fence
 - Gate
 - Hedge
 - Kerb Channel
 - Kerb Top
 - Overhead Cable
 - Road Edge
 - Sign
 - Step
 - Top Of Bank
 - Topographic Contour (1m Interval)
 - Topographic Contour (5m Interval)
 - Track
 - Vegetation
 - Verge
 - Wall Bottom
 - Wall Top
 - Water
- BOL BOLLARD
BT BT COVER
CATV CATV
FH FIRE HYDRANT
GST GAS STOP TAP
GY GULLY
IC INVERT COVER
LP LAMP POST
MH MANHOLE COVER
Post POST
SV SAFETY VALVE
Shrub SHRUB
Sign SIGN
TP TELEGRAPH POLE
Tree TREE
WT WALL TOP
Water Level WATER LEVEL
WM WATER METER
WST WATER STOP TAP
Building BUILDING
Vegetation VEGETATION
Water WATER

Station	Easting	Northing	Level	Description
PS4	389716.544	408174.451	136.072	Survey nail
WST	389707.751	408079.088	130.742	Survey nail



NOTES:
Site surveyed to Ordnance Survey OSNet™ GB OS2836(15) through Leica SmartNet.
LBS REF: OS COMPOSITE SURVEY ES-GB-2016
Survey updated 10th July 2018 following instruction to survey the woodland area adjacent to Trian Road.

DRAWN BY: MS CHECKED BY: RB

CLIENT:

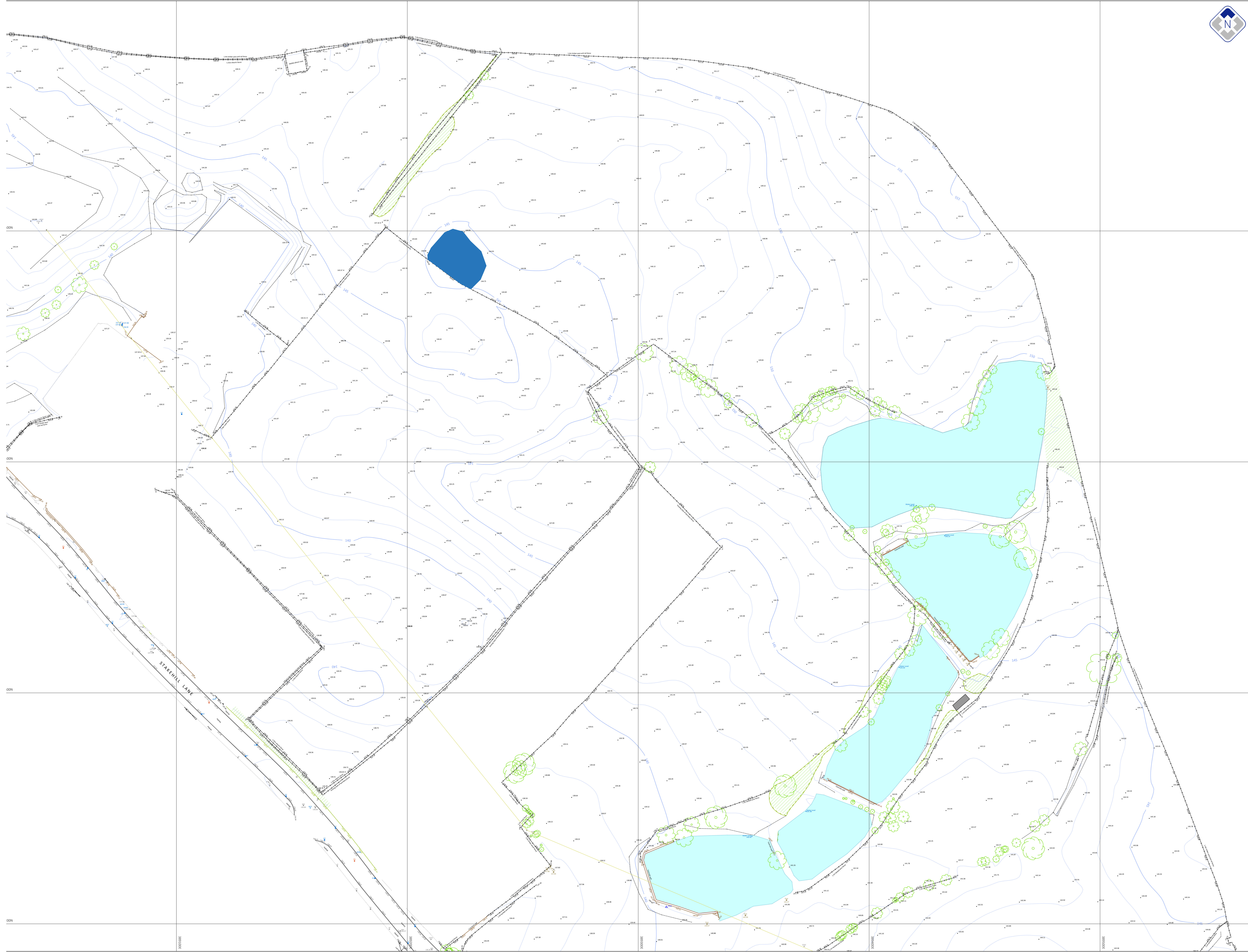
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PLAN: TOPOGRAPHIC SURVEY - March 2018 - (Plan 1 of 4)

Scale: 1:500 @ A0 4th April 2018

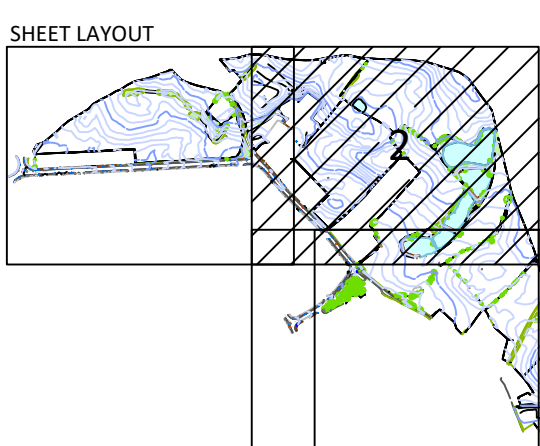
PSS - 052 - 001 - 001.1a

Stakehill House, 3 Satterton Road, Matlock, Derbyshire, DE4 3JZ
Telephone: 01629 381389
Email: mail@peaksurveyservices.com
Website: www.peaksurveyservices.com



- LEGEND**
- Bottom of Bank
 - Canopy
 - Change Of Surface
 - Dropped Kerb
 - Fence
 - Gate
 - Hedge
 - Kerb Channel
 - Kerb Top
 - Overhead Cable
 - Road Edge
 - Sign
 - Step
 - Top Of Bank
 - Topographic Contour (1m Intervi
 - Topographic Contour (5m Intervi
 - Track
 - Vegetation
 - Verge
 - Wall Bottom
 - Wall Top
 - Water
- BOL ○ Bollard
BT □ BT Cover
CATV □ CATV
Fire Hydrant
Gas Stop Tap
GY □ Gully
IC □ Inspection Cover
IL □ Invert Level
LP ○ Lamp Post
MH □ Manhole Cover
Post □ Post
Safety Valve
Shrub
Sign ○ Sign
TP □ Telegraph Pole
Tree ○ Tree
Wall Top
Water level
Water Meter
Water Stop Tap
Building
Vegetation
Water

Station	Easting	Northing	Level	Descr
P54	189716.344	408174.451	116.072	Survey
P55	189710.751	408079.098	116.794	Survey



NOTES:
Site surveyed by Ordnance Survey OSNet™ GB OS0236(1/5) through Leica SmartNet.
LSS ref: OS COMPOSITE SURVEY 25-05-2018
Survey updated 10th July 2018 following instruc
to survey the wooded area adjacent to Trian R.

DRAWN BY: MS CHECKED BY: RB

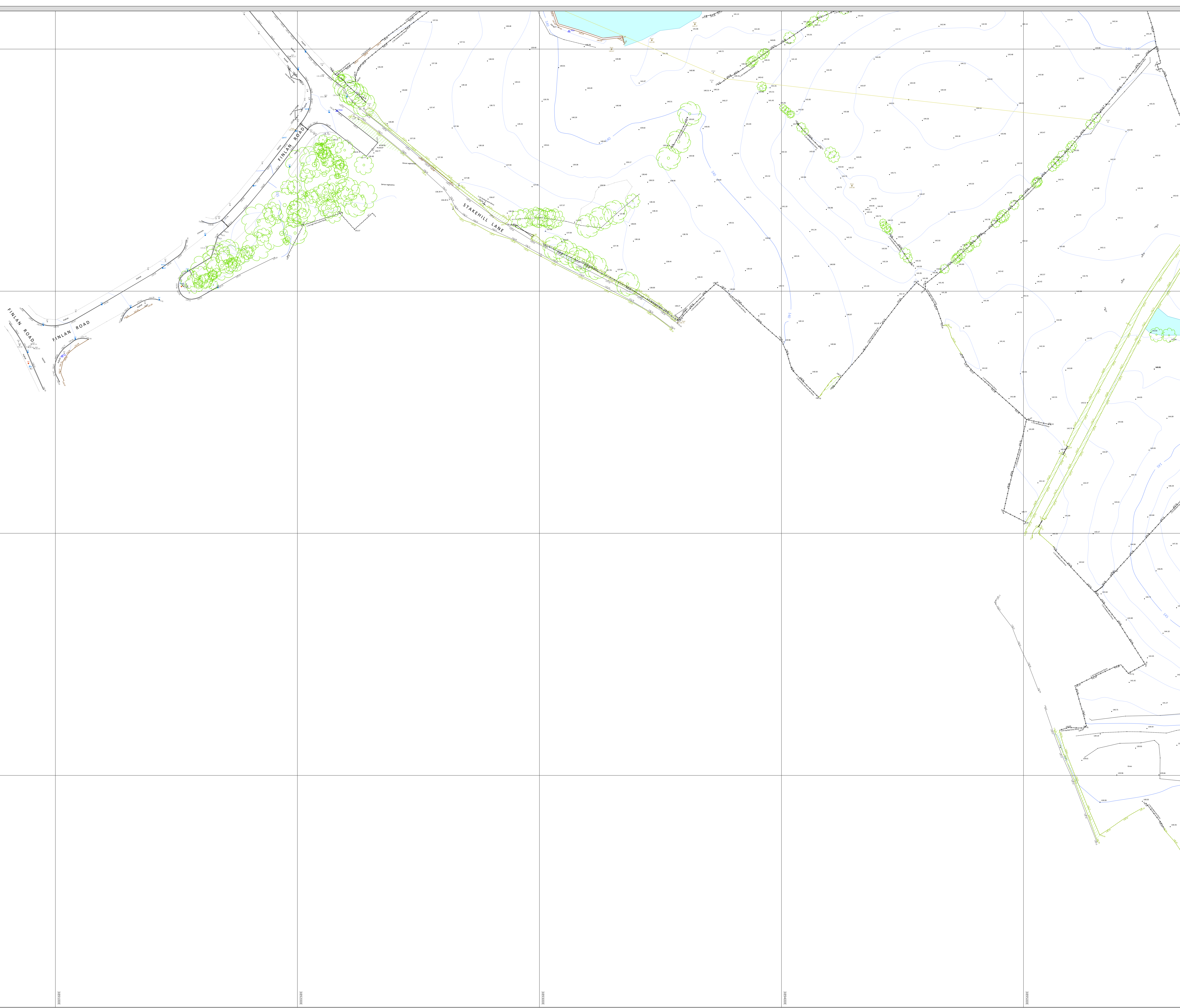
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SITE: **STAKEHILL LANE, MIDDLETON**

PLAN: **TOPOGRAPHIC SURVEY - March 2018 - (Plan 2 of 4)**

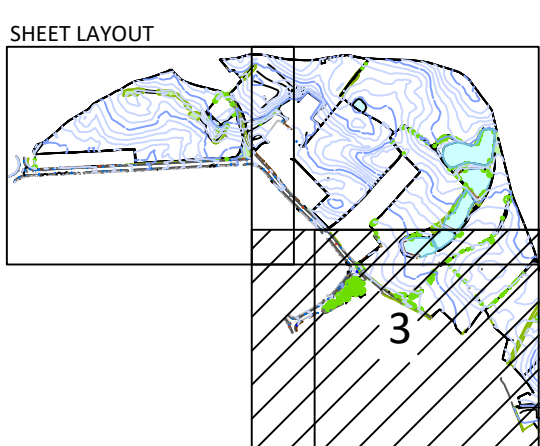
Scale: 1:500 @ A0 4th April 21

PSS - 052 - 001 - 001..



LEGEND

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—	Canopy
---	Change Of Surface
---	Dropped Kerb
-X-X-X-X-	Fence
	Gate
---	Hedge
---	Kerb Channel
---	Kerb Top
---	Overhead Cable
---	Road Edge
---	Sign
---	Stop
---	Top Of Bank
---	Topographic Contour (1m Interval)
---	Topographic Contour (5m Interval)
---	Track
---	Vegetation
---	Verge
---	Wall Bottom
---	Wall Top
---	Water
BOL	Bollard
BT	BT Cover
CATV	CATV
	Fire Hydrant
	Gas Stop Tap
GY	Gutter
IC	Inlet
UP	Lamp Post
MH	Manhole Cover
	Post
	Safety Valve
	Shrub
	Sign
TP	Telegraph Pole
	Tree
WT	Water Level
WT	Water Meter
WT	Water Stop Tap
	Building
	Vegetation
	Water



NOTES:
Site surveyed to Ordnance Survey OSNet™ GB
OSGB36(15) through Leica SmartNet.
LSS ref: 005 COMPOSITE SURVEY 22-03-2018
Survey updated 10th July 2018 following instruction
to survey the woodland area adjacent to Finlan R.

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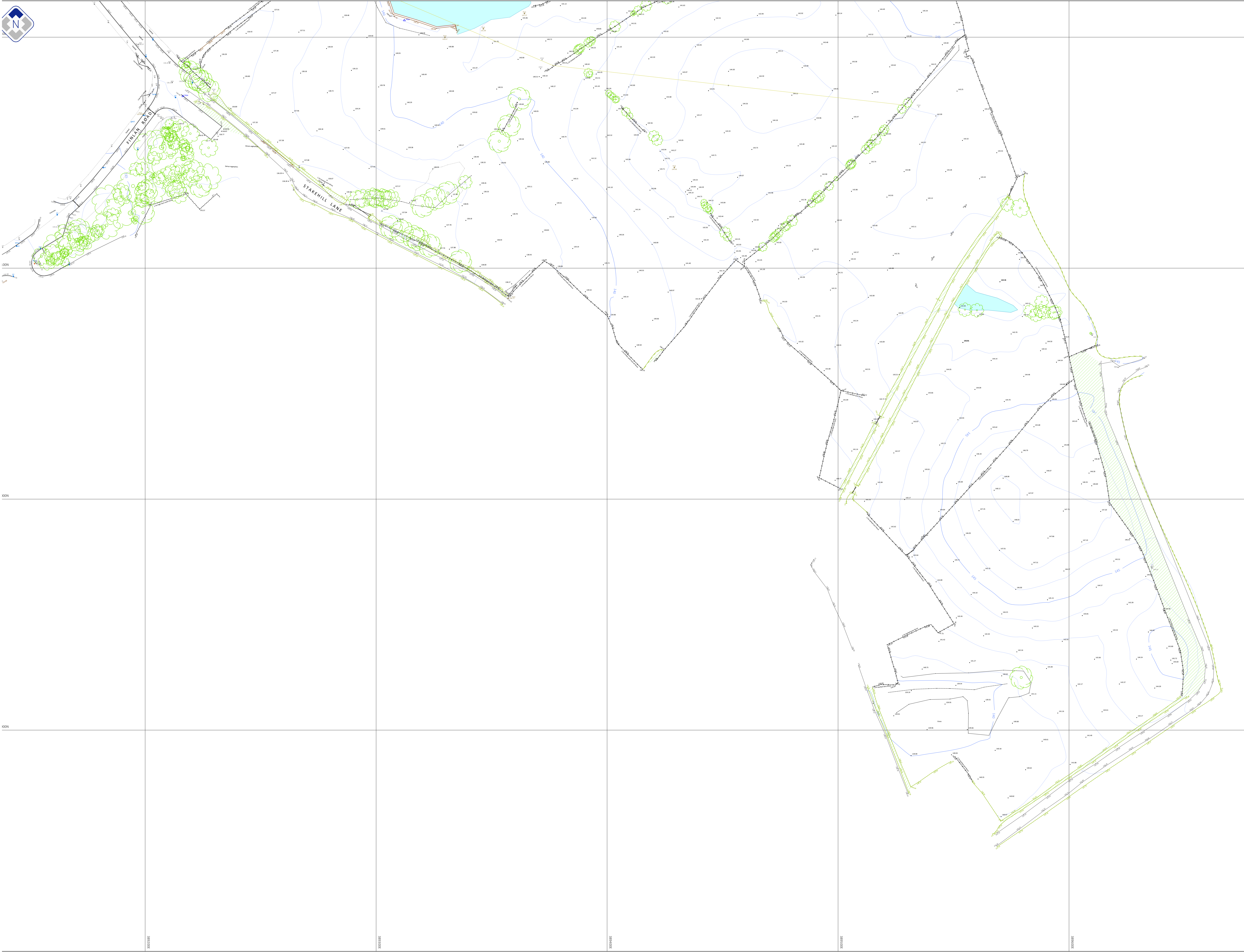
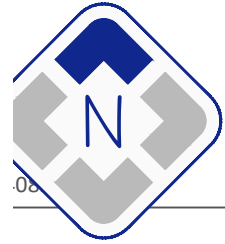
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MIDDLETON

PLAN: TOPOGRAPHIC SURVEY
- March 2018 -
(Plan 3 of 4)

Scale: 1:500 @ A0 4th April 2017

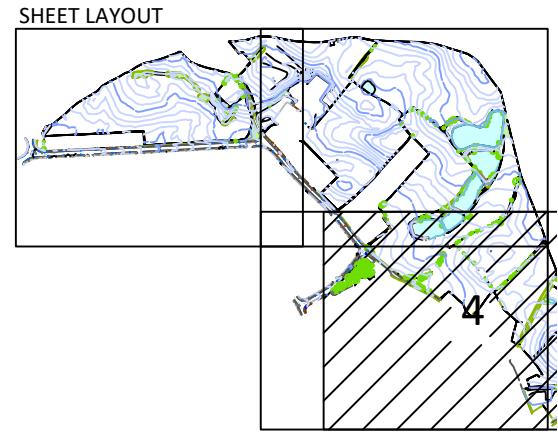
PSS - 052 - 001 - 001

Snitterton House, 3 Snitterton Road, Matlock,
Derbyshire, DE4 3LZ
Telephone: 01629 581389
Email: mail@peaksurveyingservices.com
Website: www.peaksurveyingservices.com



- LEGEND**
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 - Topographic Contour (1m Interval)
 - Topographic Contour (5m Interval)
 - Track
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 - Wall Bottom
 - Wall Top
 - Water
- SYMBOLS**
- BOL: Bollard
 - BT: BT Cover
 - CATV: CATV
 - CH: Fire Hydrant
 - OST: Gas Stop Tap
 - GY: Gully
 - IC: Inspection Cover
 - IL: Invert Level
 - LP: Lamp Post
 - MH: Manhole Cover
 - Post: Post
 - SV: Safety Valve
 - Shrub: Shrub
 - Sign: Sign
 - TP: Telegraph Pole
 - Tree: Tree
 - WT: Wall Top
 - WL: Water Level
 - WM: Water Meter
 - WST: Water Stop Tap
 - Building: Building
 - Vegetation: Vegetation
 - Water: Water

Station	Easting	Northing	Level	Descr
PS4	189716.344	408174.451	116.072	Survey
PS5	189710.751	408073.098	110.764	Survey



NOTES:
Site surveyed to Ordnance Survey OSNet™ GB OS0236(1/5) through Leica SmartNet.
LSS ref: OS COMPOSITE SURVEY 22-05-2018
Survey updated 10th July 2018 following instrux to survey the wooded area adjacent to Finlan Rd.

DRAWN BY: MS CHECKED BY: RB

CLIENT:

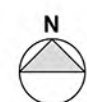
SITE: **STAKEHILL LANE, MIDDLETON**

PLAN: **TOPOGRAPHIC SURVEY - March 2018 - (Plan 4 of 4)**

Scale: 1:500 @ A0 4th April 2018

PSS - 052 - 001 - 001

Appendix 2: Illustrative Masterplan



Appendix 3: NPPF Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classifications (recreated from the NPPF Planning Practice Guidance)

Vulnerability Classification	Description
Essential infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood. • Wind turbines. • Solar farms.
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'.)
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.
Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks.
Water-Compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • 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.

Flood Zone Compatibility (recreated from the NPPF Planning Practice Guidance)

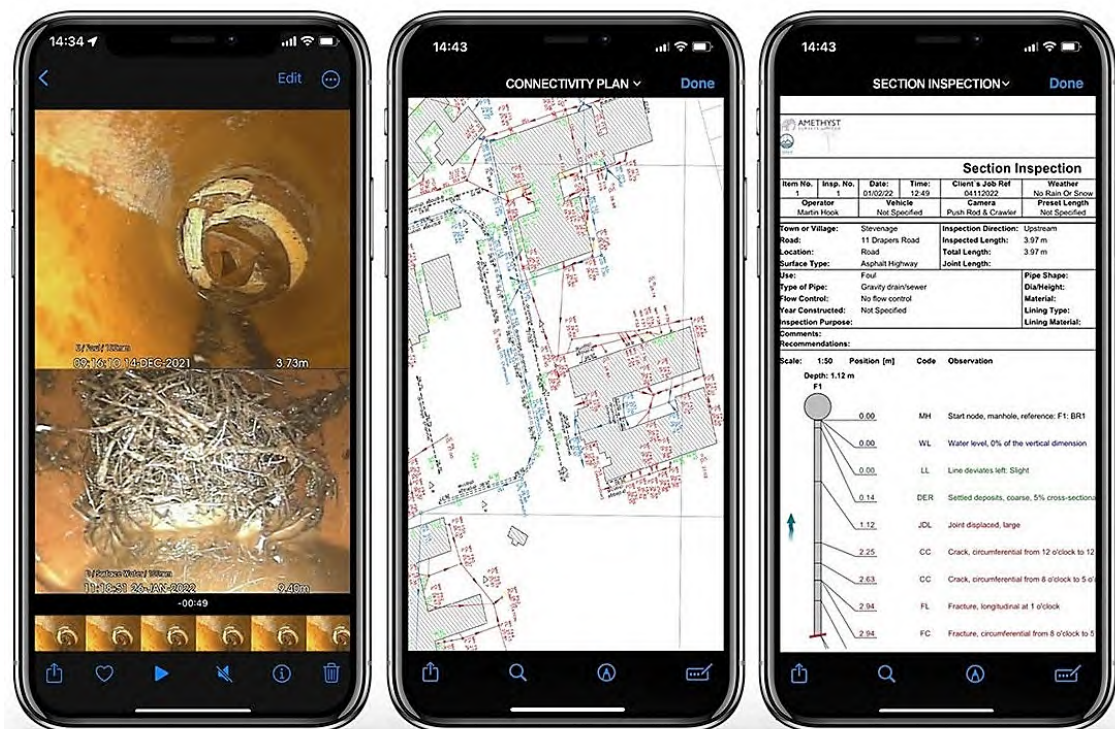
Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1 (Low Probability)	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 2 (Medium Probability)	Development is appropriate	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate	Development is appropriate
Flood Zone 3a (High Probability)	To be deemed appropriate an exception test is required to demonstrate: The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk the sustainability benefits of the development to the community outweigh the flood risk. Additionally, essential infrastructure should be designed and constructed to remain operational and safe in times of flood.	Development should not be permitted	To be deemed appropriate an exception test is required to demonstrate: - The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk - the sustainability benefits of the development to the community outweigh the flood risk.	Development is appropriate	Development is appropriate

Flood Zone	Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 3b (The Functional Floodplain)	To be deemed appropriate an exception test is required to demonstrate: • The development will be safe for its life time without increasing flood risk elsewhere, and where possible reduce overall flood risk • the sustainability benefits of the development to the community outweigh the flood risk. Additionally, development should be designed and constructed to: • remain operational and safe for users in times of flood; • result in no net loss of floodplain storage; • not impede water flows and not increase flood risk elsewhere.	Development should not be permitted	Development should not be permitted	Development should not be permitted	Development is appropriate if designed and constructed to: • remain operational and safe for users in times of flood; • result in no net loss of floodplain storage; • not impede water flows and not increase flood risk elsewhere.

Appendix 4: Drainage Investigation (Terrain Surveys, 2024)

Terrain Surveys Site Attendance Report

Client: BWB Consulting (Birmingham)
Contact: Lucy Reeves
Date: 8th July 2024
Site: Stakehill Industrial Estate
Job Ref: TS24-386



Services we provide

- Topographical surveys
- Measured building surveys
- 3D Revit survey models
- Laser scanning
- Pointcloud data & viewer files
- Arboriculturist reports
- PAS 128 underground utility surveys
- CCTV drainage surveys
- Drainage Repairs (trenches and excavated)
- Aerial/Drone surveys
- Hydrographic surveys
- Monitoring

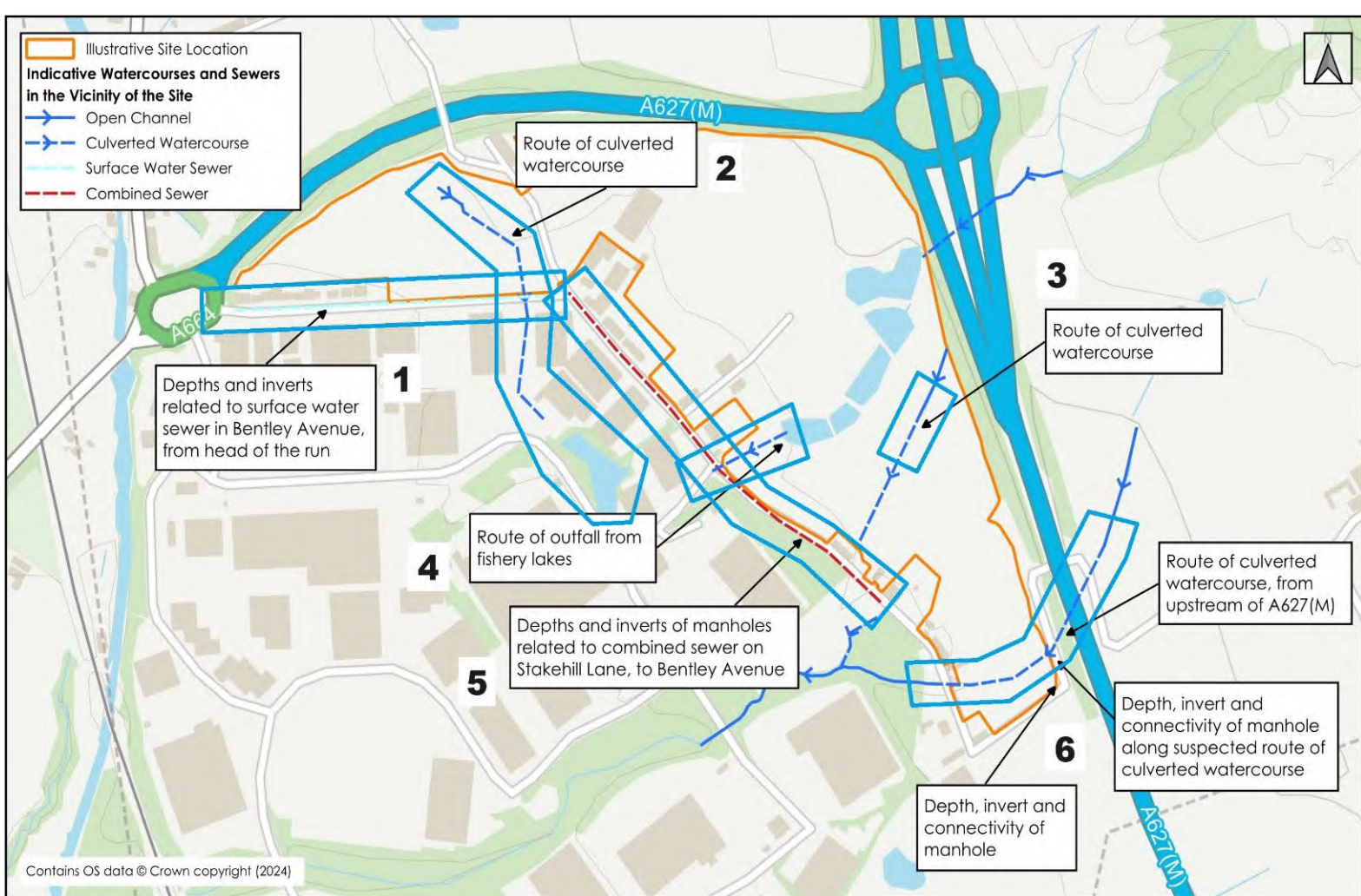
Accreditations

- The Survey Association (TSA)
- CICES
- CHAS
- CSCS
- Construction Line (Gold/Level 3)
- Acclaim
- ISO9001:2015

Works Overview

Attended site to undertake an investigation/connectivity survey of the surface water and foul water drainage systems within the land to the north and east of Stakehill Industrial Park, focusing on specific sections of drainage systems & watercourses.

For reference the 8 points of interest have been summarized below as 6 survey areas as detailed below:



Set up temporary traffic management to safely access & lift all accessible manholes within Bentley Ave and undertook a connectivity survey of the surface water system, including recording measurements to complete detailed manhole cards.

Manhole S5 was confirmed to be the head of the surface water run serving this section of carriageway before flowing downstream through to manhole S8.

Note: Manhole S8 could not be lifted safely due to its proximity to the busy A627(M)/A664 junction.

The main line was noted to be free flowing although during the survey several of the road gullies were observed to be blocked and causing localised flooding.

The hinged cover on manhole MH2 has become compressed into its frame and could not be lifted after repeated attempts to free it with hand tools and mechanical lifter.

Recommendations

- Combination Lorry Jetting Unit to attend site to empty and HPWJ all road gullys serving Bentley Ave
- Break out and replace seized manhole MH2 to complete survey of chamber and verify possible connectivity with MH3 (see Area 2)

Area 1 Reference Pictures

Road Gully Condition Example



Road Gully Condition Example



MH2 Cover Condition View



Manhole S8 Location View



Area 2 Works Overview

Undertook visual survey of the culverted watercourse route as detailed on the plan supplied. The open section of ditch/watercourse located within the farmers field to the north of Bentley Ave is enclosed within dense foliage and appears to have become silted as an outlet could not be located. The farmers field running along the downstream route of the culvert has been built up to create an enclosed storage bund at the field entrance off the north section of Stakehill Lane. This bund has become heavily vegetated and any possible existing culvert access points along this section could not be located. There is a large flag stone laying in the field possibly located on the route of the culvert which was lifted to investigate but no chamber was concealed beneath. Noted an open void in the field nearby, undertook investigation and cleared vegetation for access confirming the void to be a catchpit made up of a brick-built shaft with a 225mmØ piped outlet (referenced MH3 on the connectivity plan).

Note: MH3 has various inlet pipes from 150mmØ to 300mmØ connected with all pipework containing large amounts of silt/debris/soil due to it being unmaintained, no further tracing could be undertaken from this point. The flag stone may have been originally placed over MH3, due to its size & weight we were unable to lift it safely back on top of the chamber and would recommend a raised manhole cover to be fitted over this chamber to prevent potential injury and provide future safe access.

A visual survey of the pond located next to Filan Road confirmed there to be a 225mmØ outfall which corresponded with the assumed culvert route detailed on the plan supplied by the client. Undertook electronic trace from the headwall upstream into the neighboring industrial unit. Spoke to site contact regarding permission to access and continue line trace to a concealed chamber. Site made access with a forklift to remove various stored materials and we confirmed there to be a 3-stage petrol interceptor (PI1)

Lifted & accessed PI1 to facilitate electronic trace upstream with a sonde/locator to a point of scale build up within the line (see photo for reference in report) within the industrial unit's boundary.

The Located manholes/chambers were picked up with GPS to be overlaid onto site topo plan at a later date for reference.

Recommendations

- Combination Lorry Jetting Unit with remote hose reel to attend site to HPWJ MH3 located within the field to facilitate access to CCTV survey for condition and trace the line.
- Break out and replace seized manhole MH2 (See Area 1) to complete survey of chamber and verify any potential connectivity with culvert.
- Install a new raised 600 x 600 D400 manhole cover & frame on MH3.
- Cut/back clear vegetation to locate the ditch/watercourse end, excavate to investigate any potential outfall into the culverted section to further assess condition including any further recommendations for HPWJ/CCTV.
- Combination Lorry Jetting Unit to undertake HPWJ upstream of petrol interceptor to clear the obstruction and facilitate access to complete the trace line and CCTV condition survey.
(Access to be arranged/agreed with unit owners prior to attendance)

Area 2 Reference Pictures

MH3 Location View



MH3 Internal View Before Clearing



MH3 Internal View During Clearing



MH3 Internal View



Watercourse/Ditch Location View



Pond Inlet Headwall



Petrol Interceptor Location View



PI Upstream Pipe Condition View



Area 3 Works Overview

Undertook a visual survey to locate the open section of watercourse as detailed on the plan supplied and located the outfall which had become concealed with foliage and the collapsing bank.

Exposed the pipe with hand tools to undertake electronic tracing of downstream line through to a possible stone built chamber/culvert.

Metal detected the area of line trace but were unable to pick up any positive signals for a potential manhole cover over a chamber.

Recommendations

- Excavate stone built chamber/culvert to access and determine its condition to enable further recommendations/requirements to continue survey.