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TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

WIGTON HEATH FARM, ALWOODLEY

DRAINAGE STRATEGY

JANUARY 2024

REPORT NO: 21304-DS-002

WIGTON HEATH FARM, ALWOODLEY

DRAINAGE STRATEGY

Park Lane Homes

Drainage Strategy

Project no: 21304-DS-002

Date: January 2024

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Planning	FRM Comments	Updated Site Plan	
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Prepared by	AY	AY	JE	
Checked by	GS	AY	AY	
Authorised by	GS	TM	GS	

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1 INTRODUCTION

1.1.1 This Drainage Strategy has been provided at the request of Park Lane Homes, hereafter referred to as "the client", to assess the flood risks associated with the proposed development of Wigton Heath Farm, Alwoodley, hereafter referred to as "the site".

1.1.2 The purpose of this DS is to:

- Investigate and define any potential drainage impacts associated with the site;
- Conceptually determine and define necessary surface water management controls to ensure no exacerbation of flood risk on the site or to external receptors due to any increase in surface water runoff; and
- Recommend appropriate and necessary mitigation measures and additional assessments that may be required to progress the sustainable development of the site.

1.1.3 The DS will comprises the following:

- A desktop review of publicly available information, including information from the Environment Agency (EA) and Leeds City Council (LCC) who are the Lead Local Flood Authority (LLFA) for the proposed development area; and
- An assessment and outline design of hydraulic controls and drainage requirements and drainage elements required to support the development of the site.

1.1.4 This report further details the methodologies employed within this study and provides recommendations as to any further work or investigations required to support the development of the site through the planning application process.

1.2 REGULATORY POLICY AND LEGISLATION

1.2.1 This assessment has been carried out in line with the current Government legislation, the National Planning Policy Framework (NPPF) 2023.

1.2.2 It has been assessed with reference to the following documents and legislative guidelines:

- CIRIA 753 The SUDS Manual V6 (2016);
- DEFRA "Flood Risk Assessment Guidance for New Developments" (2006);
- DEFRA "Surface Water Management Plan Technical Guidance" (2010);
- BS 8533 2011 Assessing & Managing Flood Risk in Development Code of Practice (2011);
- BS 8582:2013 Code of practice for surface water management for development Sites (2013);
- National Planning Practice Guidance (2012 – updated 2016);
- C624 Development and Flood Risk – Guidance for the Construction Industry' (2004);
- Design and Construction Guidance for Sewage Sector (DCGSS) (2020);
- Planning Policy Guidance – Flood Risk and Climate Change (2014 and as amended).

1.2.3 In addition to the above, this report has also been informed by the following documents:

- LCC Level 1 Strategic Flood Risk Assessment (SFRA)

- LCC Surface Water Management Plan (SWMP), Part 1 Report (May 2012)
- Core Strategy (as amended by the Core Strategy Selective Review, 2019)
- Leeds Natural Resources and Waste Local Plan (2013)

1.3 SCOPE OF OUTLINE DRAINAGE STRATEGY

1.3.1 Surface water runoff must be effectively managed to ensure that there is no exacerbation of potential surface water flooding issues on the site, or at any external receptors, due to any potential increases in surface water runoff rates and volumes.

1.3.2 The drainage hierarchy will be applied in determining the most suitable type and point of discharge of surface waters runoff from impermeable areas on the site. This will ensure that surface water is sustainably managed on the site, and that there is no exacerbation of flood risk elsewhere as a result of undertaking the development. This will be undertaken in accordance with industry best practice principles and guidance, such as the C753 SUDS Manual (2016), Design and Construction Guidance for Sewage Sector (DCGSS) (2020) and applicable sections of the Planning Policy Guidance (PPG).

1.3.3 Any increase in surface water runoff rate associated with the development of the site must also be managed in accordance with the guidelines set by LPA, the LLFA for the area.

1.3.4 As indicated in the Leeds City Council Minimum development control standards surface water runoff from the site must adhere to the following:

1.3.5 Demonstrate compliance with Note 1 – Give preference to on site retention and infiltration techniques, except where there is a history of groundwater flooding, high water table or where flows could re-emerge to flood lower-level property/basements.

1.3.6 Surface Water Drainage Design: As per current Yorkshire Water Adoption Criteria

- 50% AEP event = pipe full / No surcharge (with exceptions)
- 3.33% AEP event = No site flooding
- 1% AEP event + Climate Change (CC) = No property flooding

1.3.7 Surface Water Flooding from events in excess of 3.33% AEP can be within the site (e.g. in car parks, Public Open Space, etc.), provided that the associated risks are managed and there is no property flooding.

1.3.8 Surface Water Drainage: No increase in flood risk, offsite, up to and during the critical 1% AEP event (+CC)

1.3.9 To watercourse or to sewer:

- Greenfield rates up to the 1% AEP event (+CC)
- Volume control - Peak flow capped at QBAR to conform to no increase of 100-year 6-hour event volume. Additional downstream improvement works may be required

1.3.10 New connection to watercourse or sewer = As per Greenfield

1.3.11 Existing connection to watercourse or sewer Minor Developments: A min. 30% reduction to peak flow rates up to the 1% AEP event (+CC)

1.3.12 Major Developments: Where it can be proved by drainage survey that the existing site drains to a sewer or watercourse, then a 50% reduction can be applied. Where no proof is available, then Greenfield discharge rates will apply.

1.3.13 The DS will identify potential opportunities and locations for attenuation infrastructure, as well as potential connection points and provide calculations of permissible discharge rates for runoff generated on site.

1.3.14 The DS therefore aims to provide surety that any drainage provided as part of the project development can safely and appropriately convey all flows from the site to appropriate discharge locations. This is to ensure sustainable and safe operation within the site, as well as ensuring sustainable operation of any receiving infrastructure. These assessments have been undertaken in accordance with prescribed best practice and building codes, including prioritising the incorporation of SuDS, where appropriate and practicable for the management of surface water.

1.3.15 Following the completion of a final site masterplan the drainage scheme proposed within this report should be reassessed to ensure surface water runoff and foul water drainage can be appropriately managed in accordance with best practise and local and national standard requirements.

2 METHODOLOGY

2.1 INTRODUCTION

2.1.1 This report aims to demonstrate that the proposed development is sustainable and will not be impacted by or exacerbate flood risk elsewhere through the development of the site. This assessment will account for the effects of climate change, as well as identifying further opportunities to reduce the probability and consequences of flooding within the site locality.

2.1.2 This report aims to identify constraints and opportunities for the site based on the development proposals provided by the client (Appendix A) and provide recommendations for the sustainable provision of drainage and mitigation of any potential flood risk for the site.

2.1.3 The assessment methodology is as follows:

- Desktop review of the geology, hydrology and other pertinent environmental characteristics of the site, and how these affect flood risk of the proposed development and site drainage.
- Obtain and review existing baseline flood risk and drainage guidance information from relevant environmental authorities (EA, LLFA, etc.) as to site specific flood risk from all applicable sources
- Produce indicative design calculations for the DS to determine the requirements for developing the site's surface water drainage and providing adequate storage in line with local planning policy and guidance. This will include the presentation of drawings with an indicative layout for any additional drainage and attenuation infrastructure located on the site.
- Review the findings from the above and advise on the suitability of developing the site for the proposed development in consideration of the applicable flood risk and drainage and comment on limitations and opportunities for the site, with recommendations of further mitigation where applicable and appropriate

3 PROJECT BACKGROUND

3.1 DEVELOPMENT DESCRIPTION AND LOCATION

3.1.1 Andrew Moseley Associates (AMA) was appointed by Park Lane Homes to provide a Drainage Strategy in support of a residential development at Wigton Heath Farm, Alwoodley, Leeds, LS17 9NT, NGR: SE 32425 41085

3.1.2 The proposed development is located in the area of Alwoodley which is approximately 4 miles north of Leeds City Centre. Proposals for the site are for residential use, consisting of 3 dwellings and associated infrastructure and landscaping. A site layout plan can be found in Appendix A.

3.1.3 The Local Planning Authority for this development is LCC who are also the Lead Local Flood Authority for the area.

3.1.4 This report has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying technical guidance to assess all forms of flooding including the management of surface water on-site.

3.1.5 The site is referenced in Table 3-1 and Figure 1 below.

Table 3-1. Site context

Site Name	Wigton heath Farm
Location	Alwoodley
NGR (approx.)	SE 32425 41085
Application Site Area (ha)	0.58
General Locality	The site is a mix of greenfield farmland and redundant agricultural buildings. The site is bordered by further greenfield land on all sides. Pedestrian and vehicular access to the site is provided via the private road to the west of the site.
Development Type	Residential
EA Flood Zone	Flood Zone 1
EA Office	Yorkshire
Local Planning Authority	LCC

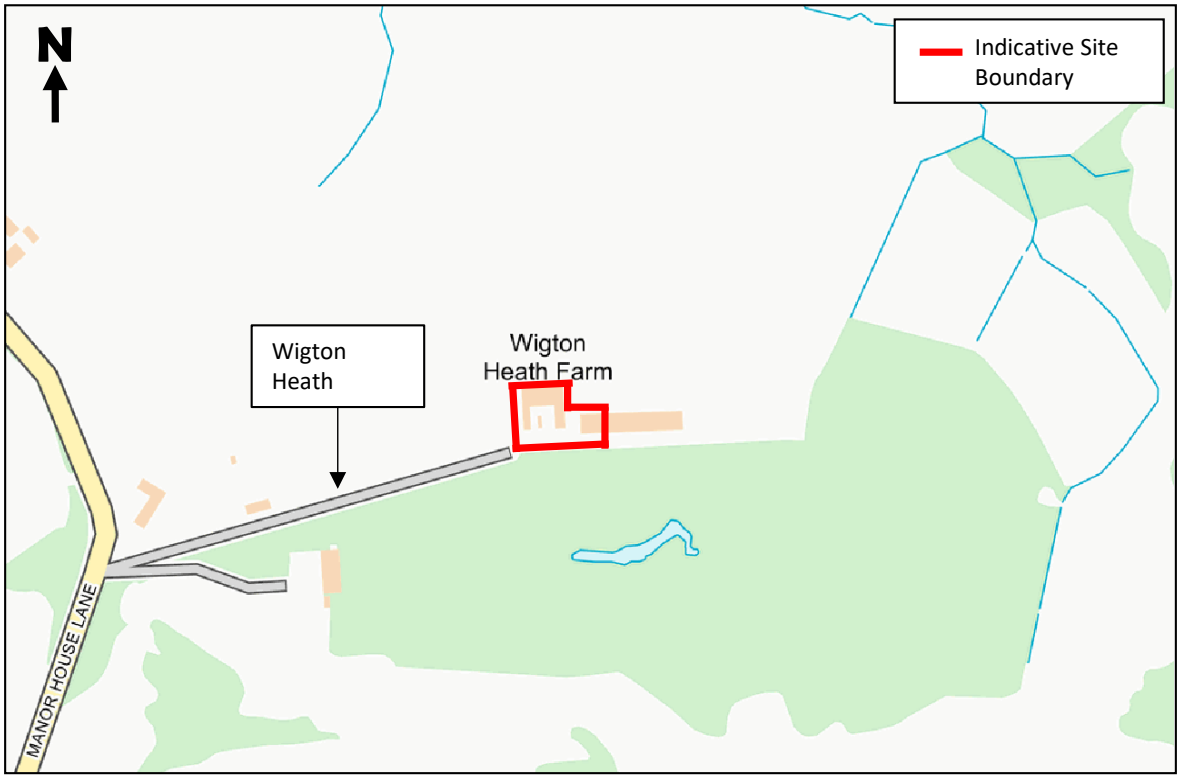

Figure 1. Site location

3.2 CURRENT SITE CONDITIONS

Ground cover and topography

3.2.1 A topographic survey provided by Park Lane Homes and undertaken by CSL Surveys (Ref: 10729-01E) is presented in Appendix B. The topographic survey shows ground levels at the site are shown to be in the region of 146.34 to 149.57 m Above Ordnance Datum (m AOD).

3.2.2 Further review of topographical data shows site levels to be lowest towards the north east of the site with the greatest elevations found towards the south west corner of the site. There is a general fall in gradient from south west to north east observed across the site.

3.2.3 Figure 2 below shows the wider topography of the ground surrounding the site, indicating once again that there is a fall in gradient from the site to towards the north.

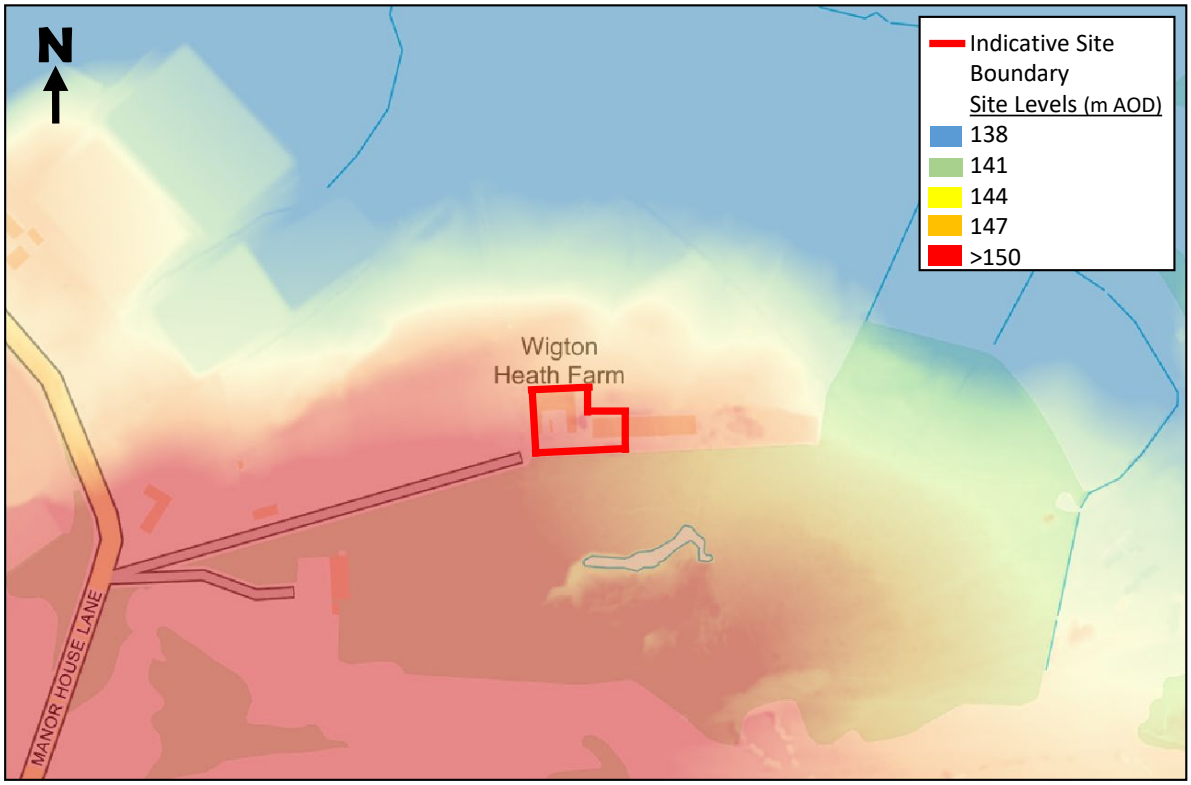

Figure 2. Site Digital Elevation Model

3.3 GEOLOGY

3.3.1 British Geological Survey (BGS) Open Geoscience website[1] indicates that the entire site is underlain by Midgley Grit - Sandstone with no overlying superficial deposits.

3.3.2 The BGS website information indicates that there is a borehole in close proximity to the site (borehole records Ref: SE34SW8); which is provided in Appendix C. The borehole is located approximately 300m south east of the site. The borehole record show ground conditions to consist of yellow clay leading to yellow sandstone, which is underlain by hard shale. Resting ground water levels were found to be in the order of 18m below ground level (bgl).

3.4 HYDROGEOLOGY

3.4.1 According to the Department for Environment, Food and Rural Affairs (DEFRA) MAGIC map[2], the site is indicated as not being located in a Groundwater Source Protection Zone (SPZ), as defined by the Environment Agency (EA) for the protection of a potable groundwater supply.

3.4.2 The site is located as being in an area of high ground water vulnerability and located above a Secondary A bedrock aquifer.

[1] Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html accessed on 13/05/2022
[2] Available at: https://magic.defra.gov.uk/MagicMap.aspx?startTopic, accessed on 13/05/2022

3.4.3 Information obtained from the Cranfield University's Soilscape website[3] indicates that the site is located in an area classified as being Soilscape 6, which is defined as having freely draining slightly acid loamy soils.

3.5 HYDROLOGY

3.5.1 As depicted in Figure 3 there are a series of watercourses located in close proximity to the site with the nearest being located 220m north east of the site. This watercourse is not classified as a main river and is not located within an IDB; therefore, it falls under the jurisdiction of LCC.

3.5.2 The EA's Catchment Data Explorer website[4] indicates that the site resides within the Wharfe Middle and Washburn Operational Catchment.

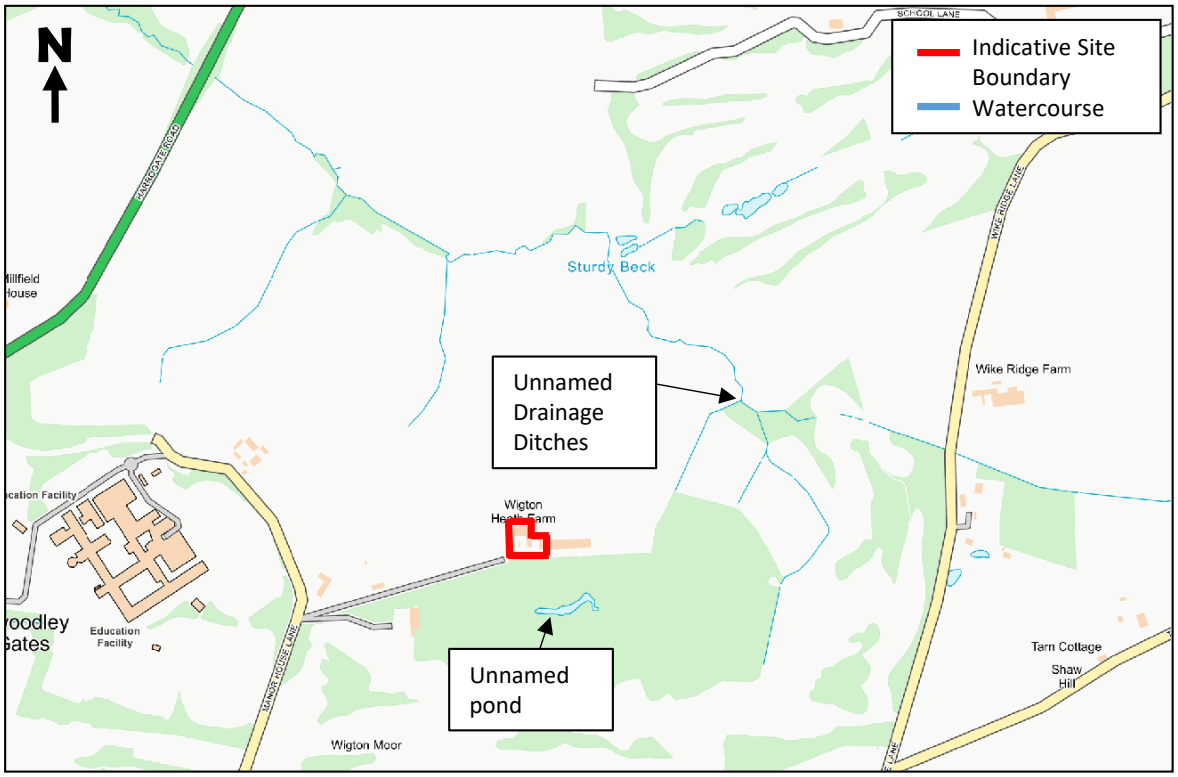

Figure 3. Watercourse location

[3] Available at: http://www.landis.org.uk/soilscapes/, accessed on 15/05/2022
[4] Available at: https://environment.data.gov.uk/catchment-planning/ , accessed on 15/05/2022

4 FOUL WATER DRAINAGE

4.1 INTRODUCTION

4.1.1 It is proposed to install a new foul drainage system to serve the proposed residential development.

4.1.2 The foul water system will be designed and constructed in accordance with the current Building Regulations, BS EN:752 'Drainage and Sewer Systems Outside Buildings', the Local Authority Building Control specifications and requirements, Sewers for Adoption 7th Edition and the Civil Engineering Specification for the Water Industry.

4.2 FOUL WATER DISCHARGE RATES

4.2.1 The estimate design Dry Weather Flow (DWF) generated by the proposed development, based on a gravity system, has been calculated as 0.138 litres per second.

4.2.2 This figure is based on 3 dwellings at 4,000 litres per dwelling as prescribed in Sewers for Adoption.

4.3 FOUL WATER CAPACITY AND POINT OF CONNECTION

4.3.1 AMA attained a Yorkshire Water pre development enquiry which can be seen in Appendix D of this report. They state that foul water can discharge to either the 150 or 225 mm diameter public combined sewer recorded in Manor House Lane, which is located approximately 800 metres to the southwest of the site.

4.3.2 Due to the distance between the foul water sewer and the site and also the possible requirement to pump the foul water, foul water will instead discharge to the watercourse located to the north east of the site via a suitably sized package treatment plant such as the Klargester BioDisc® (series BC) with an overall diameter: 2450mm

4.4 EXISTING SEWERS

4.4.1 No other public sewers have been recorded within the site.

5 SURFACE WATER DRAINAGE STRATEGY

5.1 INTRODUCTION

5.1.1 The National Planning Policy Framework (NPPF) and accompanying Technical Guidance indicate that surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management.

5.1.2 Consideration should therefore firstly be given to using sustainable drainage (SuDS) techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. Approved document Part H of the Building Regulations (2015) sets out a hierarchy for the disposal of surface water which encourages a SuDS approach.

5.2 PRE-DEVLOPMENT SURFACE WATER RUN-OFF

5.2.1 The site is approximately 0.58ha in area and currently comprises of green field agriculture land and redundant agricultural buildings.

5.2.2 For the purposes of determining the existing rate of surface water run-off the site is considered to greenfield therefore the run-off will be estimated using the IH124 method.

5.2.3 The table below summarises the existing greenfield runoff rates generated by the development for a range of storm return periods. A calculation summary sheet from the UK SuDS website can be found in Appendix E.

Table 5-1. Existing run-off rates

Area (Ha)	Q_{BAR} (L/S)	Q_1 (I/S)	Q_{30} (L/S)	Q_{100} (L/S)	Q_{200} (L/S)
0.58	1.17	1.01	2.06	2.44	2.78

5.3 GROUNDWATER PROTECTION

5.3.1 The proposed development site is not identified as being within a groundwater source protection zone (SPZ), as such no special measures are required to prevent risk to drinking water supplies.

5.4 METHODS OF SURFACE WATER MANAGEMENT

5.4.1 There are three methods that have been reviewed for the management and discharge of surface water which are detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority as listed:

- Discharge via Infiltration
- Discharge to a watercourse
- Discharge to Surface Water Sewer or Highway Drain
- Discharge to public sewer

5.5 INFILTRATION

5.5.1 Any impermeable areas that can drain to a soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.

5.5.2 The British Geological Society (BGS) Geology of Britain Viewer indicates that the entire site is underlain by Midgley Grit - Sandstone with no overlying superficial deposits.

5.5.3 Information obtained from the Cranfield University's Soilscape website indicates that the site is in an area classified as being Soilscape 6, which is defined as freely draining slightly acid loamy soils.

5.5.4 From a desktop review of the geology and soil at the site. It is believed that infiltration could be possible at the site.

5.5.5 To confirm the desktop review of the geology and soil at the site AMA undertook an infiltration test at the site. The AMA infiltration test report can be found in Appendix F of this report.

5.5.6 Four infiltration tests were undertaken at locations across the site. It was confirmed through a BRE 365 standard infiltration test that soakaways would not be a viable option to discharge surface water from the site.

5.6 WATERCOURSE

5.6.1 As discussed previously in Section 3.5 there is a watercourse which is located approximately 220m north east of the site.

5.6.2 The watercourse in question would provide a suitable way of discharging surface water from the site. Firstly, as shown in Appendix B, the watercourse is at a much lower elevation then that of the site meaning a gravity connection could be utilised. Furthermore, even though the watercourse is located in third party land, permission has been granted to access the land and create a connection between the site and the watercourse.

5.6.3 Therefore, it can be concluded that surface water from the site can be discharged into the watercourse located to the north east of the site subject to the relevant permissions.

5.7 PUBLIC SEWERS

5.7.1 As a last resort and following the hierarchy of surface water, disposal discharge to the public sewer system may need to be considered.

5.7.2 In the Yorkshire Water Predevelopment enquiry (Appendix D) they state that even though the site is previously developed, however there is no surface water sewer infrastructure within close proximity of the site. Therefore, the local public sewer network does not have capacity to accept any surface water from the proposed site.

5.7.3 Furthermore, the SuDS hierarchy should be followed when discharging surface water from the site.

5.8 PROPOSED DISCHARGE RATES

5.8.1 Discharge via infiltration is required to be explored further before it can be ruled out. If infiltration has proved to be ineffective and evidenced to the satisfaction of the LLFA an agreement to connect into or the public sewers will be required, and it would be necessary to restrict discharge to greenfield runoff rates in accordance with Local Authority and YW requirements.

5.8.2 From the topographical survey information an estimation of the development area has been calculated to be 4,733m² or 0.47ha.

5.8.3 As the site is currently greenfield, the rate of discharge to the watercourse has been calculated using the greenfield run off rate calculation (IH124 Method) in Appendix E and provides a QBAR discharge rate of 2.04 l/s.

5.8.4 Typically, any discharge rate less than 5 l/s is prone to blockage and will create maintenance issues because of the small size of the orifice required. Where the greenfield discharge suggests a discharge rate of less than 3 l/s the figure of 3 l/s shall be used to reduce the risk of blockages. This would need to be confirmed by the approving authority

5.9 ATTENUATION REQUIREMENTS

5.9.1 As discussed earlier the site does not benefit from a freely draining ground conditions, therefore it is not possible to use soakaways as a source of discharging surface water.

5.9.2 However, it is possible to have a gravity connection into the watercourse to the north east of the site. As discussed previously the surface water discharge rate will be restricted to 3 l/s, therefore attenuation will be provided on site based on the proposed hardstanding areas. An impermeable area plan can be found in Appendix G.

5.9.3 Causeway Flow drainage design software has been used to estimate the maximum storage volume required on-site for the 100-year storm event plus 45% allowance for climate change.

5.9.4 The results below are based on a single attenuation tank for the total impermeable area. The causeway calculations can be found in Appendix H

5.9.5 The proposed drainage layout can be seen in Appendix I.

Total Area

5.9.6 This volume is based on using an attenuation tank with a discharge rate of 3 l/s. The details on the attenuation can be found in Table 5-2 below.

Table 5-2. Attenuation Volume

Attenuation Volume

Gross area (ha)	Max Discharge (l/s)	Imp. Area (ha)	Q100+45%(CC) Volume (m^3)
0.58	3 l/s	0.09	36

6 SUSTAINABLE DRAINAGE SYSTEMS

6.1.1 Where possible, Sustainable drainage (SuDS) systems/techniques should be used to drain the site of surface water runoff. These could be in the form of permeable paving, rainwater harvesting, ponds, and other above ground green systems. Swales could also be incorporated into the layout to convey surface runoff rather than below ground pipes (which tend to have a higher velocity).

6.2 SUSTAINABLE DRAINAGE (OVERVIEW)

6.2.1 Drainage systems can contribute to sustainable development and improve urban design, by balancing the different issues that influence the development of communities. Approaches to manage surface water that take account of water quantity (flooding), water quality (pollution) and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS).

6.2.2 SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to slow water down (attenuate) before it enters streams, rivers, and other watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration).

6.2.3 SUDS are technically regarded a sequence of management practices, control structures and strategies designed to efficiently and sustainably drain surface water, while minimising pollution and managing the impact on water quality of local water bodies.

6.2.4 SuDS are more sustainable than traditional drainage methods because they:

- Manage runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding
- Protect or enhance water quality (reducing pollution from runoff)
- Protect natural flow regimes in watercourses
- Are sympathetic to the environment and the needs of the local community
- Provide an attractive habitat for wildlife in urban watercourses
- Provide opportunities for evapotranspiration from vegetation and surface water
- Encourage natural groundwater/aquifer recharge (where appropriate)
- Create better places to live, work and play.

6.3 SUDS PRINCIPALS

6.3.1 Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:

- storing runoff and releasing it slowly (attenuation)
- allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- filtering out pollutants
- allowing sediments to settle out by controlling the flow of the water
- The above was replicated from www.susdrain.org

6.4 SUDS TECHNIQUES

6.4.1 The following table is a list of SuDS features that may/may not be feasible for the proposed site.

Table 6-1. SuDS feasibility table

SUDS Technique	Can they be feasibly incorporated into the site?	Comments
Green Roofs	×	The sloping roofs of the proposed development would not permit a green-roof design
Basins and Ponds	×	The proposed development could not be designed to incorporate these elements due to site constraints such as the topography.
Filter Strips, Swales and Bio-Retention	×	The proposed development could not be designed to incorporate these elements due to site constraints.
Infiltration techniques	×	BRE 365 infiltration test indicates that infiltration would not be feasible at the site.
Permeable surfaces and tree pits	✓	Surfacing of the external areas could be in a permeable material, such as permeable paved access roads and driveways.
Rainwater Harvesting	✓	New roofs could be directed to rainwater harvesting tanks for reuse.
Tanked Systems	✓	Attenuation storage could be provided if a restricted discharge is required by the LLFA.

7 SUDS MAINTENANCE PLAN

7.1 SURFACE WATER DRAINAGE MAINTENANCE AND MANAGEMENT SCHEDULE

Attenuation Tank

Table 7-1. Attenuation Tank

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action	Monthly for the first 3 months of operation then annually
	Recover debris from catchment surface area where it may cause risk to performance	Monthly
	Remove sediment and debris from pre-tank system	Annually
Remedial Actions	Repair inlets/outlets/vents/overflows	As necessary
Monitoring	Inspect all inlets/outlets and upstream drainage system to ensure they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment and build up and remove if necessary	Every 5 years

Hydrobrake Manhole

Table 7-2. Hydrobrake Manhole

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from flow control chambers and upstream manholes	Monthly for first 12 months than 6 monthly
Remedial Actions	Replace or clean hydrobrake if performance deteriorates or failure occurs	As necessary
Monitoring	Check flow control to ensure emptying is occurring	Quarterly and post high intensity storm event

8 SUMMARY & CONCLUSION

8.1.1 The site is in an area identified as having a low probability of flooding on the EA Flood Map and is located in Flood Zone 1.

8.1.2 As with any drainage system, blockages within the surface water sewer systems constructed to serve the development has the potential to cause flooding or disruption. Any drainage systems which are not to be offered for adoption to either the Water Company or the Local Authority will have a suitable maintenance regime scheduled and an appropriate management company appointed to carry out the works.

8.1.3 The primary option for surface water disposal is to discharge into a watercourse located 220m north east of the site.

8.1.4 Surface water disposal through infiltration has been proven to be unsuitable at the site via a BRE 365 infiltration test on site.

8.1.5 There is not a suitable public sewer in the vicinity of the site which could be utilised to dispose of the surface water as YW has stated that the sewers do not have capacity.

8.1.6 Attenuation will be required as there is a restricted surface water discharge rate of 3 l/s.

8.1.7 There is no formal point of connection into a YW public foul water sewer in close proximity to the site. Therefore, Foul Water will discharge into the same watercourse via a packaged treatment plant.

9 LIMITATIONS

9.1 LIMITATIONS

9.1.1 This report has been prepared for exclusive use by Park Lane Homes for the purpose of assisting them in evaluating the potential constraints imposed by flood risk and drainage in making a Planning Application.

9.1.2 AMA accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of AMA. Any advice, opinions or recommendations within this document should be read and relied upon only in the context of the document as a whole.

9.1.3 AMA has endeavoured to assess all information provided to them during this appraisal. The report summarises from several external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

9.1.4 This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

9.1.5 A topographic survey has been completed for the site and was supplied to AMA by the client. AMA accepts no liability for the accuracy of this survey, and it is recommended that it is verified on-site prior to the commencement of any construction work.

APPENDICES

APPENDIX A – PROPOSED SITE LAYOUT

APPENDIX B – TOPOGRAPHIC SURVEY

APPENDIX C – BGS BOREHOLE RECORDS

APPENDIX D – YORKSHIRE WATER PRE DEVELOPMENT

APPENDIX E – UK SUDS GREENFIELD RUN OFF RATES

APPENDIX F – INFILTRATION TEST REPORTS

APPENDIX G – IMPERMEABLE AREA PLAN

APPENDIX H – CAUSEWAY CALCULATIONS

APPENDIX I – DRIANAGE LAYOUT DRAWING

Appendix A

PROPOSED SITE LAYOUT

Ground Floor 1 : 100

Northpoint:

Rev	Date	Amendments	By	Chkd
A	15/12/23	Drawing updated to Client comments.	HSS	ADP
B	15/12/23	Accom Schedule updated to include parking spaces	HSS	ADP
C	18/12/23	Drawing updated.	HSS	ADP

KEY

- Existing Wall
- Proposed Wall
- Demolished
- Post and Rail Fence
- Proposed Paving
- Proposed Hedge/Planting

Gross Internal Area (GIA)

Name	Area	Ft2
Plot 1	263.3 m²	2835 ft²
Plot 2	151.0 m²	1626 ft²
	414.4 m²	4460 ft²

Gross External Area (GEA)

Name	Area	Ft2
Plot 1	294.9 m²	3174 ft²
Plot 2	169.5 m²	1825 ft²
	464.4 m²	4999 ft²

0 1 5 10 M

8 Wharf Street,
Leeds, LS2 7EQ

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Project:
Proposed Residential Development, Wigton Heath, Alwoodley, Leeds

Client:
Park Lane Homes

Dwg Title:
Proposed Plan

DRAFT FOR DISCUSSION

Date:	Scale:	Drawn:	Checked:
December 2023	1 : 100	HSS	ADP

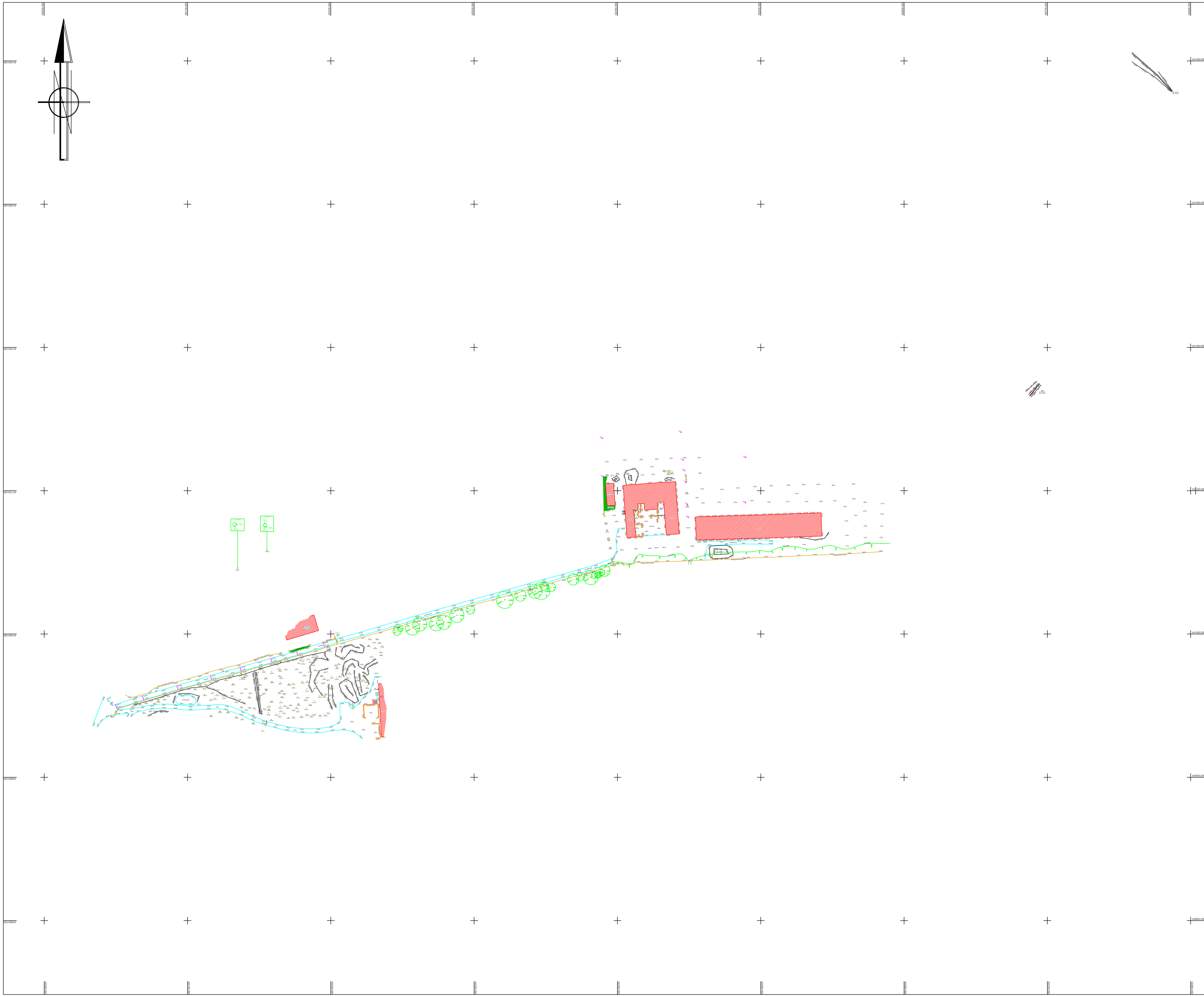
Project No:	Size:	Status:
3183	A1	Preliminary

Drawing Number: 3183-DEN-ZZ-00-DR-A-2000

Revision: C

Appendix B

TOPOGRAPHIC SURVEY



CSL SURVEYS

CONSULTING SURVEYORS
LAND-ENGINEERING-BUILDING

751 Scott Hall Road ▪ Moortown ▪ Leeds
Tel 01132 893924 ▪ Tel 07739 753 651
Email info@cslsurveys.co.uk ▪ www.cslsurveys.co.uk

TITLE
Topographical Survey
Alwoodley Golf Club Farm
Leeds

CLIENT
Park Lane Homes

DATE	DRAWN BY	CHKD. BY
Jan 2021	ACA	SA

DRG NO	PLOT SCALE
10729 - 01F	1:1000 @ A1

REV	AMENDMENT	DATE	BY	CHKD.
A	Pegs as per setting-out & access added.	04/10/21	SA	ACA
B	Pegs 02-07 moved. Additional areas added.	11/11/21	SA	ACA
C	Dimensions added to access road.	04/02/22	SA	ACA
D	Peg positions amended.	14/03/22	SA	ACA
E	Various drainage features added.	03/06/22	SA	ACA
F	Area of Manor House Lane removed.	14/06/22	SA	ACA

NOTES

This survey is fitted to National Grid and Datum using GPS, and has been drawn at a scale factor of 1.0000.

Although this survey is tied to National Grid, due to the scale factor, any setting out or design works should strictly use the control co-ordinates contained within the table.

Boundaries shown are physical features on site and do not necessarily represent the legal extents of ownership.

Points shown in magenta depict timber pegs as set-out on 01/10/21.

Key:

BB	Bottom of Bank
Bol.	Bollard
BT	British Telecom
CB	Control Box
CONC.	Concrete
DC	Drainage Channel
DK	Drop Kerb
DP	Downpipe
EP	Electricity Pylon
FL	Floor Level
FH	Fire Hydrant
G	Gully
GP	Gate Post
GV	Gas Valve
H	Height
IC	Inspection Cover
IL	Invert Level
LP	Lamp Post
MH	Manhole
NB	Notice Board
RE	Rodding Eye
RS	Road Sign
RW	Retaining Wall
TB	Top of Bank
TL	Traffic Light
TP	Telegraph Pole
UTL	Unable to lift
WM	Water Meter
WO	Water Oriface
SV	Stop Valve
⚠	Survey Station
⊕	Borehole
⊕	Soil Sample
∅	Diameter
⊠	Trial Pit

Appendix C

BGS BOREHOLE RECORDS

British Geological Survey

Version 2.0.6.6

BGS ID: 101295 : BGS Reference: SE34SW8
British National Grid (27700) : 431980,440651

Report an issue with this borehole

(For Survey use only) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (If measurements start below ground surface, state how far ....)		THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches	70/316 SE 34 SW 8
	Soil	0.15	-	6	-	6	0.15
	Yellow Clay.	1.68	5	6	6	-	1.83
	Yellow Sandstone	6.71	22	-	28	-	8.53
	Soft Shale.	4.57	15	-	43	-	13.11
	Hard Shale.	8.23	27	-	70	-	21.34
	Grey Sandstone with Shale Beds.	10.97	36	-	106	-	32.31
	Shale.	18.90	62	-	168	-	51.21
	Grey Sandstone.	11.28	37	-	205	-	62.48

Appendix D

YORKSHIRE WATER PRE DEVELOPMENT ENQUIRY

432172 : 440608

Map Name : SE3140SE

Title

Notes

Yorkshire Water,
PO Box 500,
Halifax Road,
Bradford BD6 2LZ
Contact Name :
YorMap Advisor C ROBERTS
Contact Tel : 87 2582

Partial Key
Foul Sewer = F
Combined Sewer = C
Surface Water Sewer = SW
Trade Sewer = TD
Partially Separate = PS

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

Date Req : 09/05/2022, 11:55:22

Date Gen : 09/05/2022, 11:56:07

Source : Sewer Network Enquiry

UPN: Undefined   Originator: C ROBERTS, YorMap, 87 2582

YorkshireWater

Mr A Yesudian
Andrew Moseley Associates
51a St Pauls Street
Leeds
LS1 2TE
aaron@amatp.co.uk

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Your Ref:
Our Ref: Y006477

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

9th May 2022

Dear Mr Yesudian,

Wigton Heath Farm, Land Off Manor House Lane, Alwoodley, Leeds, LS17 9NT - Pre-Planning Sewerage Enquiry U635587 (RESIDENTIAL)

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul Water

Foul water domestic waste can discharge to the 150/225 mm diameter public combined sewer recorded in Manor House Lane, at a point approximately 760 metres to the southwest of the site.

From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network. If sewage pumping is required foul water discharge must not exceed 4.7 (four point seven) litres per second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

It is understood that watercourses are located close to the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

The public sewer network does not have any capacity available to accept any discharge of surface water from the proposal. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority with a view to establishing a suitable watercourse for discharge.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for Code for Adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

YorkshireWater

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts
Development Services Technician

Appendix E

UK SUDS GREENFIELD RUN OFF RATES

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Aaron Yesudian
Site name:	Wigton Heath Farm
Site location:	Leeds

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.86524° N
Longitude:	1.50752° W
Reference:	698436706
Date:	Jun 09 2022 09:05

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.58

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	766	766
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	1.17	1.17
1 in 1 year (l/s):	1.01	1.01
1 in 30 years (l/s):	2.06	2.06
1 in 100 year (l/s):	2.44	2.44
1 in 200 years (l/s):	2.78	2.78

Appendix F

INFILTRATION TEST REPORT

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

PERCOLATION TEST

WIGTON HEATH FARM
ALWOODLEY

MAY 2022

Percolation Test Report

WIGTON HEATH FARM
ALWOODLEY

PARK LANE HOMES LTD

Confidential

Project no: 21304

Date: 23.05.22

Andrew Moseley Associates

51A St Paul's Street
Leeds, LS1 2TE

www.amatp.co.uk

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks		Follow up perc. Tests 18th May		
Date	11.05.22	23.05.22		
Prepared by	A Allenby	A Allenby		
Checked by	G Shepherd	G Shepherd		
Authorised by	G Shepherd	G Shepherd		

1 TESTING REPORT

Percolation tests were carried out on the 29th April 2022 and 18th May 2022 to establish if infiltration methods were going to be a suitable solution for draining the site.

29th April 2022

1 Test Pit was formed with the following dimensions; 2100mm x 400mm x 1800mm deep.

The water level drop was monitored and recorded (**Appendix A**)

As shown in **Appendix B** the ground at approximately 500mm below surface is a light brown clayey soil.

In the first test the test pit was filled with water to a depth of 830mm and drained down to 750mm in 120 minutes.

Based on the minimal drop in water height after 2 hours, the test pit was abandoned and repeated tests were not carried out.

Appendix A shows that the rate calculated is close to the minimum range for suitable infiltration rates, therefore infiltration is unlikely to be viable for the proposed development.

It should be noted that during a site walkover, there were two sizable pools of stagnant water exceeding 500mm deep shown in **Appendix B**. The percolation test and the stagnant pools suggest that water does not freely drain to ground.

18th May 2022

Test pit 1 was formed with the following dimensions; 1600mm x 300mm x 1300mm deep.

The water level drop was monitored and recorded (**Appendix C**)

The test pit was filled with water to a depth of 840mm and drained down to 770mm in 60 minutes.

Based on the minimal drop in water height after 2 hours, the test pit was abandoned and repeated tests were not carried out.

Test pit 2 was formed with the following dimensions; 1400mm x 300mm x 1200mm deep.

The water level drop was monitored and recorded (**Appendix C**)

The test pit was filled with water to a depth of 600mm and the water level did not reduce over 3 hour period.

Test pit 3 was formed with the following dimensions; 1200mm x 300mm x 1300mm deep.

The water level drop was monitored and recorded (**Appendix C**)

The test pit was filled with water to a depth of 500mm and drained down to 490mm in 60 minutes.

Based on the minimal drop in water height after 2 hours, the test pit was abandoned and repeated tests were not carried out.

The ground conditions were found to be similar light brown clayey soils in the test pits outlined above to the test pit excavated on the 29th April 2022, as shown in **Appendix D**.

Conclusion

The results from the percolation tests carried out the 29th April and 18th May show that soakaways are not a viable drainage strategy.

2 TESTING METHOD

The test pits were excavated following the below instruction as outlined in BRE 365 Digest.

- Excavate a soakage trail pit to the required depth (typically 1.0m - 2.0m deep) using minimum width (0.3m) and length (1.0m). Carefully trim sides and bottom.
- Carefully measure size of pit and note sizes below.
- Place straight edge over top of soakage pit and measure (dip) to the top of the water.
- Record time versus dips in table below. Dip every 5 minutes for the first hour and every hour until pit is one quarter full. Repeat test 3 times in total on the same or consecutive days.

Site Location	**Wigton Heath Farm, Alwoodley**
Date of Test	**29/04/2022**
Weather Conditions	**Dry – Spring**
Engineer Name	**Adam Allenby**

APPENDICES

Appendix A –

Percolation Test Sheets 29th April 2022

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	1
Prepared by	Date
AJA	29/04/2022
Checked By	Date
GS	29/04/2022

Site Name: Wigton Heath Farm, Alwoodley

Soakaway Test Data

Pit no: **01** Test no: **01**

Light brown clayey soil was found approximately 0.5m below ground level, and remained the same at the full depth of the test pit (1.8m).
The water depth did not lower substantially to continue monitoring.
Therefore the test was abondoned and the soils deemed to not infiltrate.

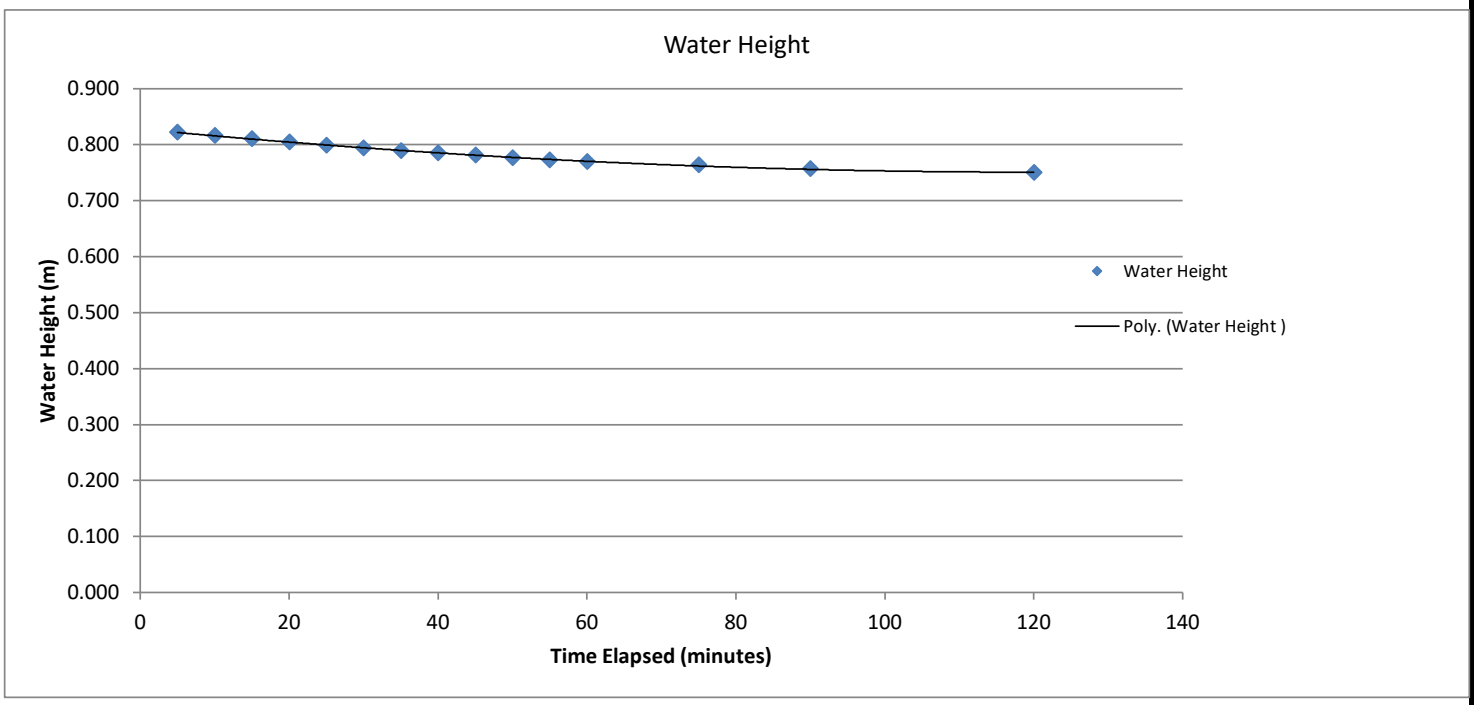
Real Time	Time elapsed (days hh:mm)	Time elapsed (minutes)	Depth to Water (m)	Water Height	Comment
				0.830	
		5		0.822	
		10		0.816	
		15		0.811	
		20		0.805	
		25		0.799	
		30		0.794	
		35		0.789	
		40		0.785	
		45		0.781	
		50		0.777	
		55		0.773	
		60		0.770	
		75		0.764	
		90		0.757	
		120		0.750	

Total depth	1.35
H (m)	1.05
$H_{75\%}$ (m)	0.79
$H_{50\%}$ (m)	0.53
$H_{25\%}$ (m)	0.26

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	2
Prepared by	Date
AJA	29/04/2022
Checked By	Date
GS	29/04/2022

Site Name:



A_{P50}	
Side (Square)	4.150
Base	0.84
A_P50	**1.722**

Square Section	
Length	2.100
Width	0.400
Height	1.800
water height	0.830

V_{p75-25}	**0.000**

t_{p75}	0
t_{p25}	0
t_{p75-25}	**0**

Soil infiltration rate, f (m/s)	#DIV/0!

Appendix B

Percolation Photography 29th April 2022

Test Pit

Appendix C

Percolation Test Sheets 18th May 2022

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	1
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name: Wigton Heath Farm, Alwoodley

Soakaway Test Data

The water depth did not lower substantially to continue monitoring.
Therefore the test was abandoned and the soils deemed to not infiltrate.

Pit no: **01** Test no: **01**

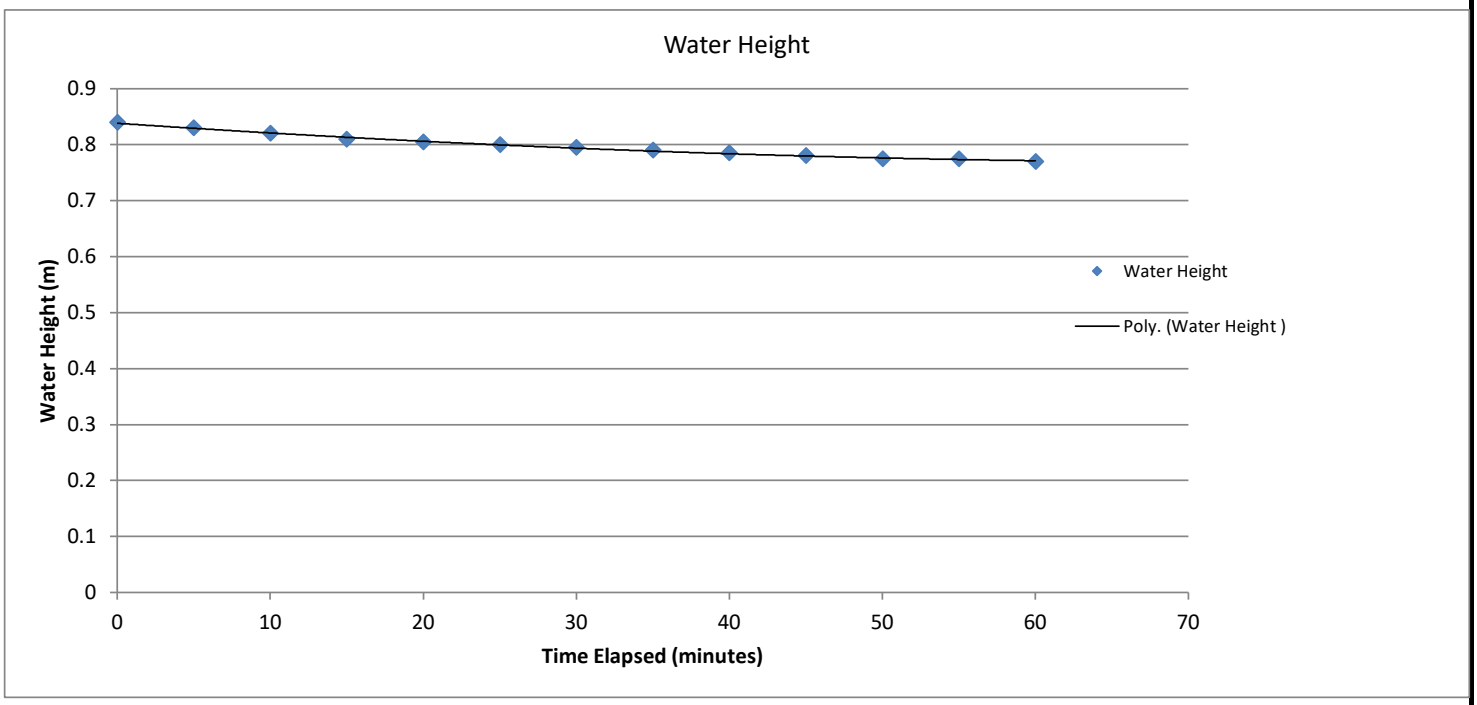
Real Time	Time elapsed (days hh:mm)	Time elapsed (minutes)	Depth to Water (m)	Water Height	Comment
		0		0.840	
		5		0.830	
		10		0.820	
		15		0.810	
		20		0.805	
		25		0.800	
		30		0.795	
		35		0.790	
		40		0.785	
		45		0.780	
		50		0.775	
		55		0.775	
		60		0.770	

Total depth	1.30
H (m)	1.30
$H_{75\%}$ (m)	0.98
$H_{50\%}$ (m)	0.65
$H_{25\%}$ (m)	0.33

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	2
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name:



A_{P50}	
Side (Square)	3.116
Base	0.48
A_P50	**1.278**

Square Section	
Length	1.600
Width	0.300
Height	1.300
water height	0.820

V_{p75-25}	**0.000**

t_{p75}	0
t_{p25}	0
t_{p75-25}	**0**

Soil infiltration rate, f (m/s)	#DIV/0!

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	1
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name: Wigton Heath Farm, Alwoodley

Soakaway Test Data

The water depth did not lower within an hour of monitoring. Therefore the test was abandoned and the soils deemed to not infiltrate.

Pit no: **02** Test no: **01**

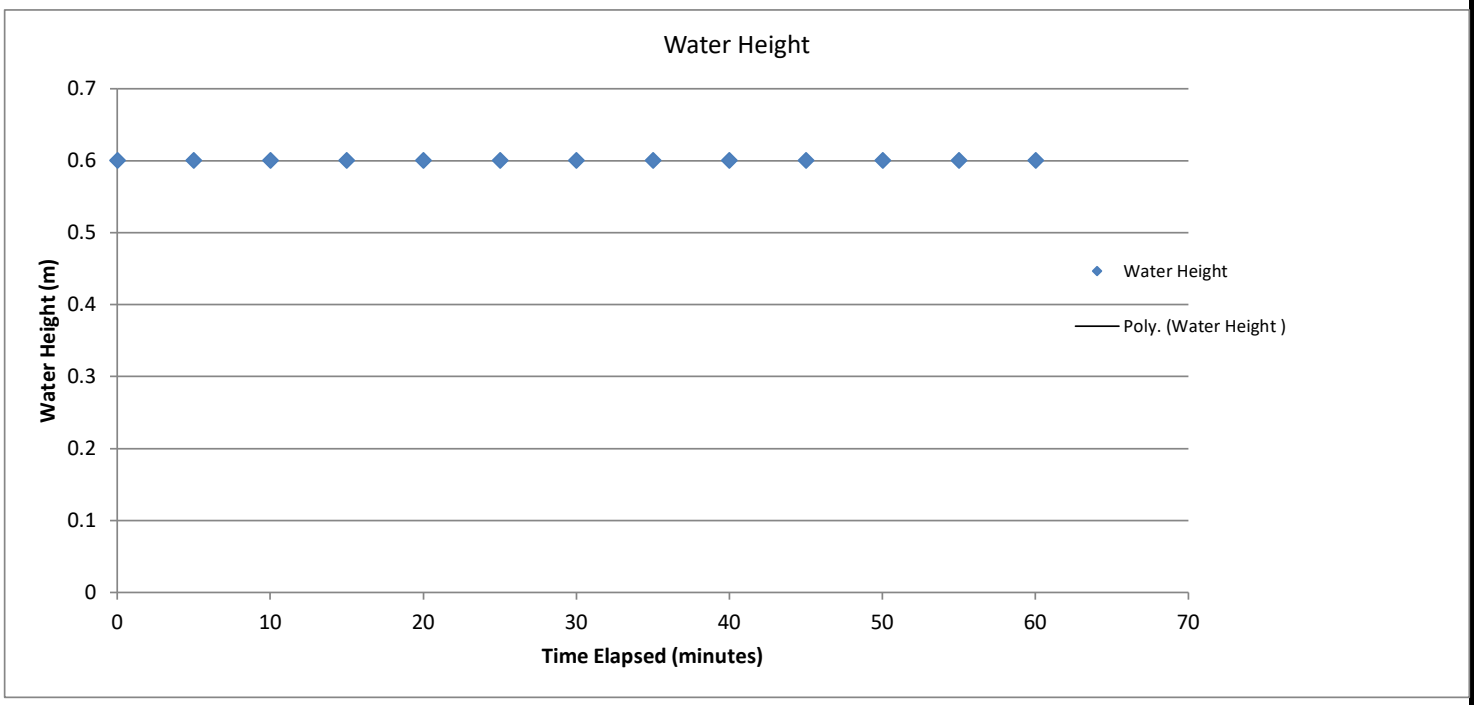
Real Time	Time elapsed (days hh:mm)	Time elapsed (minutes)	Depth to Water (m)	Water Height	Comment
		0		0.600	
		5		0.600	
		10		0.600	
		15		0.600	
		20		0.600	
		25		0.600	
		30		0.600	
		35		0.600	
		40		0.600	
		45		0.600	
		50		0.600	
		55		0.600	
		60		0.600	

Total depth	1.35
H (m)	1.05
$H_{75\%}$ (m)	0.79
$H_{50\%}$ (m)	0.53
$H_{25\%}$ (m)	0.26

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	2
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name:



A_{P50}	
Side (Square)	2.040
Base	0.42
A_P50	**0.612**

Square Section	
Length	1.400
Width	0.300
Height	0.200
water height	0.600

V_{p75-25}	**0.000**

t_{p75}	0
t_{p25}	0
t_{p75-25}	**0**

Soil infiltration rate, f (m/s)	#DIV/0!

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	1
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name: Wigton Heath Farm, Alwoodley

Soakaway Test Data

The water depth did not lower substantially to continue monitoring.
Therefore the test was abandoned and the soils deemed to not infiltrate.

Pit no: **03** Test no: **01**

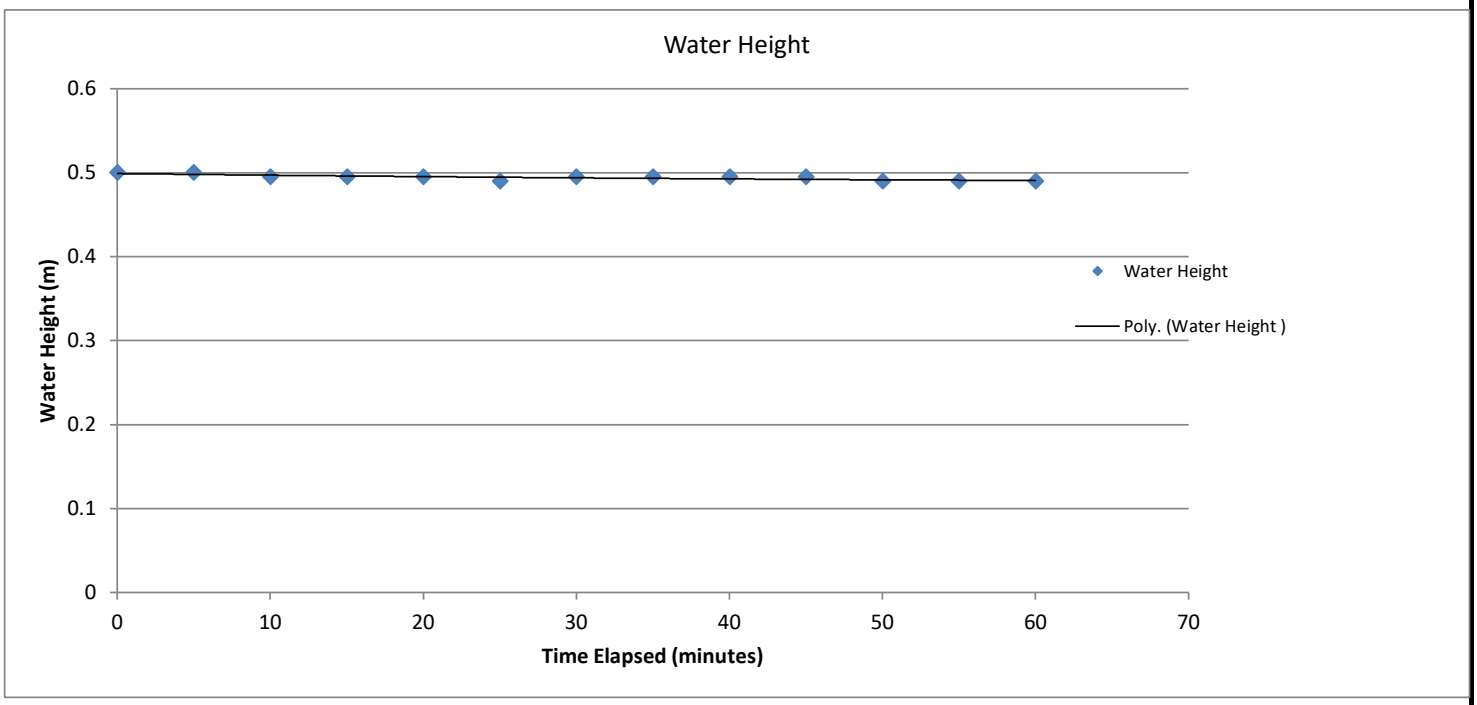
Real Time	Time elapsed (days hh:mm)	Time elapsed (minutes)	Depth to Water (m)	Water Height	Comment
		0		0.500	
		5		0.500	
		10		0.495	
		15		0.495	
		20		0.495	
		25		0.490	
		30		0.495	
		35		0.495	
		40		0.495	
		45		0.495	
		50		0.490	
		55		0.490	
		60		0.490	

Total depth	1.30
H (m)	1.30
$H_{75\%}$ (m)	0.98
$H_{50\%}$ (m)	0.65
$H_{25\%}$ (m)	0.33

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project No.	Sheet No.
21304	2
Prepared by	Date
AJA	18/05/2022
Checked By	Date
GS	18/05/2022

Site Name:



A_{P50}	
Side (Square)	1.500
Base	0.36
$A_{P}50$	**0.375**

Square Section	
Length	1.200
Width	0.300
Height	1.300
water height	0.500

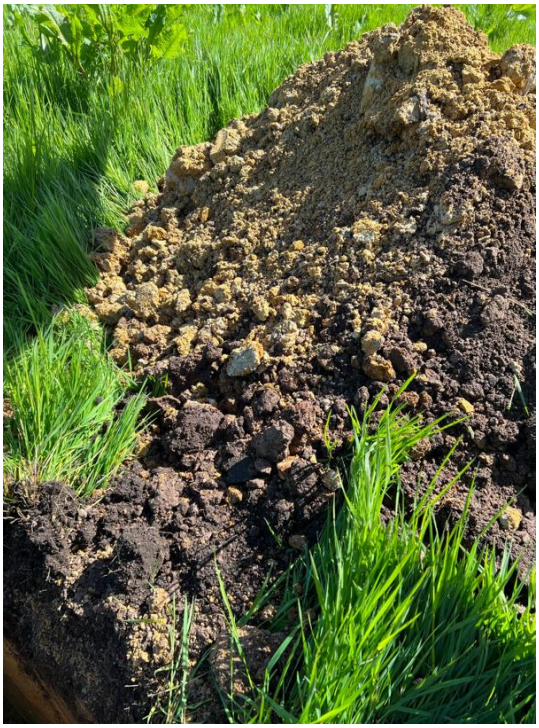
V_{p75-25}	**0.000**

t_{p75}	0
t_{p25}	0
t_{p75-25}	**0**

Soil infiltration rate, f (m/s)	#DIV/0!

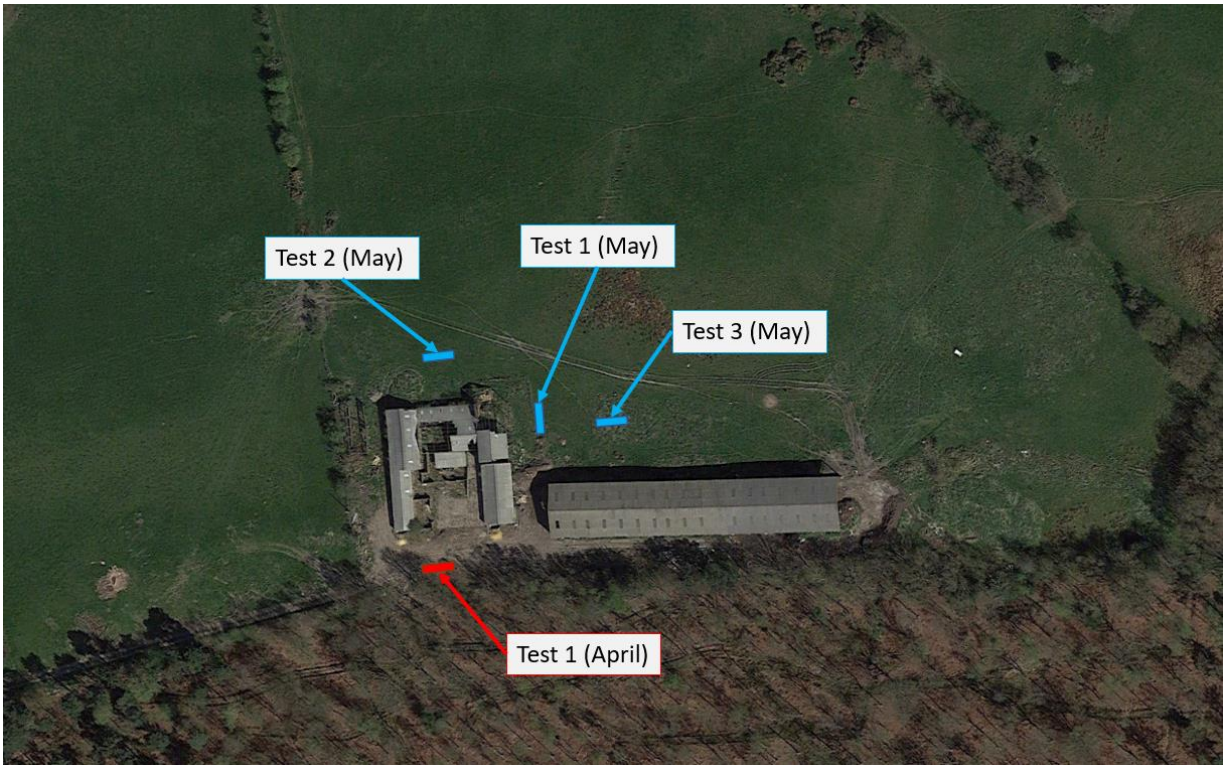
Appendix D

Percolation Photography 18th May 2022



Appendix E

Percolation Test Pit Locations



APPENDICES

Appendix A – Percolation Test Sheet 29th April 2022

Appendix B – Percolation Photography 29th April 2022

Appendix C – Percolation Test Sheet 18th May 2022

Appendix D – Percolation Photography 18th May 2022

Appendix E – Percolation Test Pit Locations

Andrew Moseley Associates, 51A St Paul's Street, Leeds, LS1 2TE

www.amatp.co.uk

info@amatp.co.uk

Appendix G

IMPERMEABLE AREA PLAN

NOTES

P1	Preliminary - Initial Issue	11/01/2024	JE

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project:
Wigton Heath Farm,
Alwoodley

Client:
Park Lane Homes

Drawing:
Impermeable Area Plan

Drawn By:	Date:	
JE	11/01/2024	
Checked:	Scale:	
GS	1:200	A3
Drawing No.		Rev.
AMA-21304-D-002		P1

Appendix H

CAUSEWAY CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.500	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW 1	0.037	5.00	147.300	450	1.330
SW 2	0.028	5.00	146.810	450	1.420
SW 3	0.000	5.00	146.230	1200	1.370
Tank	0.000	5.00	146.500	1200	1.600
COMB 1	0.000	5.00	146.500	450	1.680

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW 1	SW 2	6.700	0.600	145.970	145.390	0.580	11.6	150	5.07	50.0
1.001	SW 2	Tank	5.600	0.600	145.390	144.900	0.490	11.4	150	5.14	50.0
1.002	Tank	SW 3	3.600	0.600	144.900	144.860	0.040	90.0	150	5.17	50.0
1.003	SW 3	COMB 1	3.900	0.600	144.860	144.820	0.040	97.5	150	5.21	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.980	52.7	6.7	1.180	1.270	0.037	0.0	36	2.053
1.001	2.997	53.0	11.7	1.270	1.450	0.065	0.0	48	2.413
1.002	1.060	18.7	11.7	1.450	1.220	0.065	0.0	86	1.119
1.003	1.018	18.0	11.7	1.220	1.530	0.065	0.0	88	1.082

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	6.700	11.6	150	Circular	147.300	145.970	1.180	146.810	145.390	1.270
1.001	5.600	11.4	150	Circular	146.810	145.390	1.270	146.500	144.900	1.450
1.002	3.600	90.0	150	Circular	146.500	144.900	1.450	146.230	144.860	1.220
1.003	3.900	97.5	150	Circular	146.230	144.860	1.220	146.500	144.820	1.530

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW 1	450	Manhole	Adoptable	SW 2	450	Manhole	Adoptable
1.001	SW 2	450	Manhole	Adoptable	Tank	1200	Manhole	Adoptable
1.002	Tank	1200	Manhole	Adoptable	SW 3	1200	Manhole	Adoptable
1.003	SW 3	1200	Manhole	Adoptable	COMB 1	450	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW 1	147.300	1.330	450				
				0	1.000	145.970	150
SW 2	146.810	1.420	450	1	1.000	145.390	150
				0	1.001	145.390	150
SW 3	146.230	1.370	1200	1	1.002	144.860	150
				0	1.003	144.860	150
Tank	146.500	1.600	1200	1	1.001	144.900	150
				0	1.002	144.900	150
COMB 1	146.500	1.680	450	1	1.003	144.820	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.500	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	40	0	0
100	45	0	0

Node SW 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	144.860	Product Number	CTL-SHE-0085-3000-0829-3000
Design Depth (m)	0.829	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

Node Tank Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	144.900	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	93	Depth (m)	1.000
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	1.00	Length (m)	5.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW 1	10	146.007	0.037	7.1	0.0266	0.0000	OK
15 minute summer	SW 2	9	145.441	0.051	12.5	0.0281	0.0000	OK
30 minute summer	SW 3	24	145.039	0.179	3.2	0.2022	0.0000	SURCHARGED
30 minute summer	Tank	24	145.040	0.140	10.9	3.5443	0.0000	OK
15 minute summer	COMB 1	1	144.820	0.000	2.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW 1	1.000	SW 2	7.1	1.668	0.134	0.0286	
15 minute summer	SW 2	1.001	Tank	12.5	2.187	0.236	0.0537	
30 minute summer	SW 3	Hydro-Brake®	COMB 1	2.9				6.8
30 minute summer	Tank	1.002	SW 3	3.2	0.395	0.173	0.0625	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW 1	10	146.013	0.043	9.2	0.0305	0.0000	OK
15 minute summer	SW 2	9	145.448	0.058	16.2	0.0320	0.0000	OK
30 minute summer	SW 3	25	145.092	0.232	3.4	0.2622	0.0000	SURCHARGED
30 minute summer	Tank	25	145.094	0.194	13.9	4.9350	0.0000	SURCHARGED
15 minute summer	COMB 1	1	144.820	0.000	3.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW 1	1.000	SW 2	9.2	1.791	0.174	0.0344	
15 minute summer	SW 2	1.001	Tank	16.2	2.234	0.306	0.0639	
30 minute summer	SW 3	Hydro-Brake®	COMB 1	3.0				8.8
30 minute summer	Tank	1.002	SW 3	3.4	0.410	0.183	0.0634	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW 1	11	146.050	0.080	24.5	0.0575	0.0000	OK
15 minute summer	SW 2	11	145.709	0.319	42.7	0.1762	0.0000	SURCHARGED
60 minute winter	SW 3	59	145.595	0.735	3.6	0.8312	0.0000	SURCHARGED
60 minute winter	Tank	59	145.597	0.697	18.9	18.0773	0.0000	SURCHARGED
15 minute summer	COMB 1	1	144.820	0.000	3.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW 1	1.000	SW 2	24.2	1.978	0.459	0.0911	
15 minute summer	SW 2	1.001	Tank	40.0	2.299	0.756	0.0986	
60 minute winter	SW 3	Hydro-Brake®	COMB 1	3.0				28.0
60 minute winter	Tank	1.002	SW 3	3.6	0.425	0.192	0.0634	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW 1	11	146.415	0.445	32.9	0.3181	0.0000	SURCHARGED
15 minute summer	SW 2	12	146.137	0.747	54.4	0.4131	0.0000	SURCHARGED
60 minute winter	SW 3	59	146.007	1.147	3.8	1.2972	0.0000	FLOOD RISK
60 minute winter	Tank	59	146.010	1.109	25.0	26.1428	0.0000	SURCHARGED
15 minute summer	COMB 1	1	144.820	0.000	3.0	0.0000	0.0000	OK

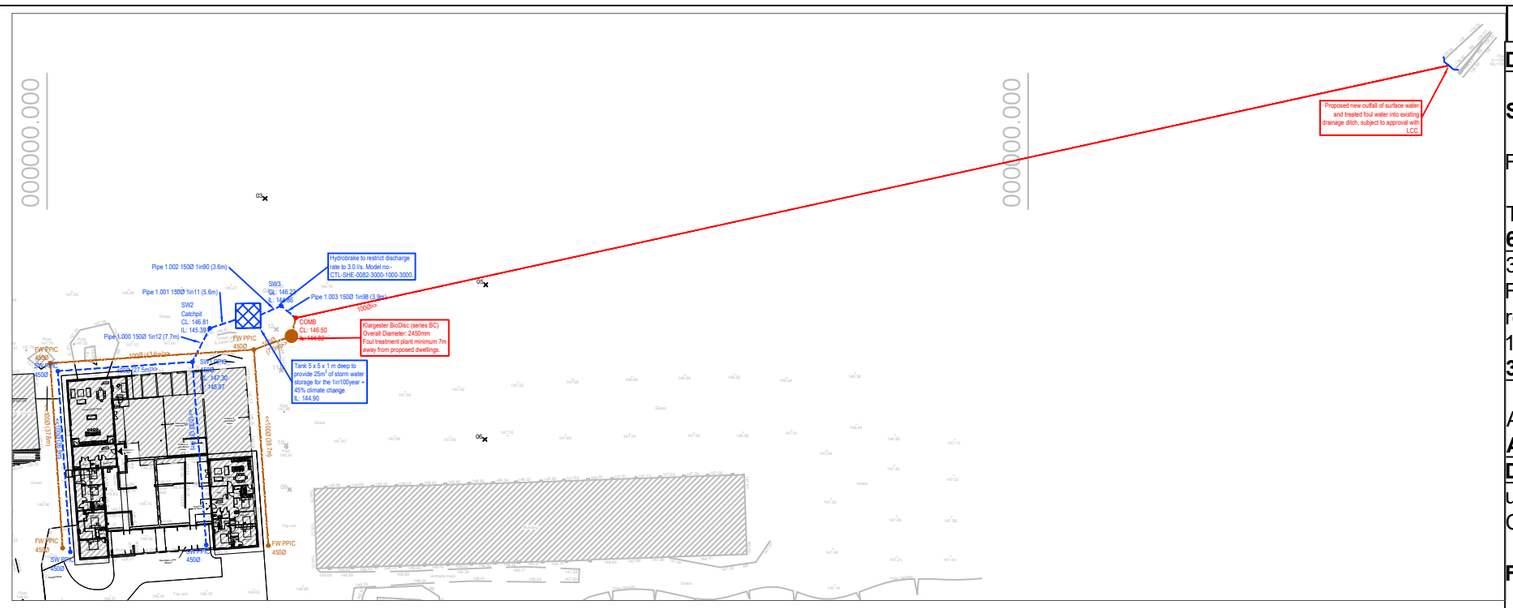
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW 1	1.000	SW 2	30.0	1.935	0.570	0.1180	
15 minute summer	SW 2	1.001	Tank	52.3	2.970	0.987	0.0986	
60 minute winter	SW 3	Hydro-Brake®	COMB 1	3.5				38.2
60 minute winter	Tank	1.002	SW 3	3.8	0.443	0.204	0.0634	

Appendix I

DRAINAGE LAYOUT DRAWING

Key

- Proposed Surface Water Drainage
- Proposed Foul Water Drainage
- Proposed Combined Drainage



Proposed Off Site Drainage (1:1250)

Proposed Drainage Strategy (1:500)

NOTES

Drainage Strategy

Surface Water

Flow restriction 3.0 l/s.

The proposed impermeable area is **650m²**. Based on a flow restriction of 3.0 l/s and modeling using Causeway Flow software, the attenuation requirement for a peak return period of 1in100years + 45% climate change is **36m³**.

Attenuation will be provided via **ATTENUATION TANK 6 x 6 x 1 m DEEP**. The flows will be attenuated using a Hydrobrake Model No:- CTL-SHE-0082-3000-1000-3000.

Foul Water

Foul water be treat via foul treatment plant and discharged to the drainage ditch to the west of the site.

P1	Preliminary - Initial Issue	11/01/2024	JE

ANDREW MOSELEY ASSOCIATES
TRANSPORT AND DEVELOPMENT PLANNING CONSULTANTS

Project:
Wigton Heath Farm, Alwoodley

Client:
Park Lane Homes

Drawing:
Drainage Layout Drawing

Drawn By:	Date:	
JE	11/01/2024	
Checked: GS	Scale: As shown @ A3	A3
Drawing No. AMA-21304-D-001		Rev. P1

Andrew Moseley Associates, 15 St Paul's Street, Leeds, LS1 2JG

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