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JOHN LEWIS PARTNERSHIP PENSIONS TRUST

VANGUARD WAY, BATTLFIELD ENTERPRISE PARK

FLOOD RISK AND DRAINAGE CONSTRAINTS

FEBRUARY 2015

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Wardell Armstrong
Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom
Telephone: +44 (0)845 111 7777 Facsimile: +44 (0)845 111 8888 www.wardell-armstrong.com

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JOHN LEWIS PARTNERSHIP PENSIONS TRUST

VANGUARD WAY, BATTLFIELD ENTERPRISE PARKS

FLOOD RISK AND DRAINAGE CONSTRAINTS

FEBRUARY 2015

PREPARED BY:

B Griffiths Environmental Scientist

APPROVED BY:

T J Perrins Technical Director

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APPENDICES

1 INTRODUCTION

1.1 Wardell Armstrong LLP has been appointed by John Lewis Partnership Pensions Trust (JLPPT) to undertake an appraisal of the potential constraints at a proposed development site, known as Greenhills, in Shrewsbury. This report provides a desk-based assessment of any constraints associated with flood risk and drainage which could prevent future development and indicative mitigation measures that may be required.

1.2 In preparing this report, reference has been made to the following reports:

- Flood Insight Report – ref: GS-1795042 (Groundsure – December 2014);
- Flood Risk Assessment – Plateau 2, Battlefield Way Shrewsbury (White Young Green – January 2008);
- Flood Risk Assessment – Mercedes Benz Dealership, Shrewsbury (Glanville – July 2012); and
- Reclamation Assessment for Proposed Industrial Development Site at Shropshire Food Enterprise Park, Shrewsbury (White Young Green – July 2008).

1.3 Reference has also been made to the following planning applications which contain comments regarding flood risk and approved mitigation measures:

- Shropshire County Council Planning Permission document for application MS2003/0985/SY for the Integrated Waste Management Facility, Vanguard Way (2003); and
- Shropshire Council Drainage Consultee Comments for application 11/03191/FUL for the Food Enterprise Centre, Battlefield Enterprise Park (2011).

2 SITE LOCATION

Location and Setting

2.1 The Greenhills development site is located in Shrewsbury, Shropshire. The site can be accessed via Vanguard Way, just removed from the A49 road to the north-east of Shrewsbury. The site measures approximately 9.7 hectares and is surrounded by industrial and commercial land uses to the east, south and west, and agricultural land to the north of the site. A site location plan is shown on Figure 1.

Figure 1: Site Location

2.2 The site is situated between the A5124 Battlefield Link Road to the north, Battlefield Way to the west and Vanguard Way to the south. A railway line runs north – south to the east of the site. The Battlefield Brook, classified as a Main River, flows west to east through the site area.

2.3 The site consists largely of unmaintained grassland with a tarmac access road from the southern boundary to the centre of the site and a small structure adjacent to the access road.

2.4 Adjacent land to the south-east is occupied by an Integrated Waste Management Facility and the Shropshire Food Enterprise Centre. A small area of land between these two developments is included within the site area. To the north of the site, beyond the Battlefield Link Road is agricultural land.

3 FLOOD RISK

Fluvial Flooding

3.1 The nearest surface water feature is the Battlefield Brook which flows west to east through the centre of the site, forming the southern boundary in the eastern half of the site. Battlefield Brook is culverted in three places within the site area.

3.2 The figure on page 6 of the Groundsure report (Appendix 1), based on the Environment Agency's Flood Map for Planning, shows the majority of the site to be located in fluvial Flood Zone 1. The area immediately surrounding Battlefield Brook as it flows through the site is shown to be located within Flood Zones 2 and Flood Zone 3. The flood map from the Groundsure report is shown in Figure 2.

3.3 The National Planning Policy Framework and National Planning Practice Guidance define the flood zones as follows:

- Flood Zone 1 (Low Probability) – Land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%).
- Flood Zone 2 (Medium Probability) – Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) in any year.
- Flood Zone 3a (High Probability) – Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year.
- Flood Zone 3b (Functional Floodplain) – Land where water has to flow or be stored in times of flood.

3.4 The 2008 White Young Green FRA (Appendix 2) makes reference to more detailed modelling of the Battlefield Brook, conducted by Enviros Consulting Limited in 2003 as part of an earlier FRA for the site. The flood risk map produced from the modelling results confirmed that a small area in the eastern part of the site adjacent to the brook is located within Flood Zone 3. Flood levels for the 1 in 100 year flood were calculated to be between 69.84 mAOD at the western site boundary and 69.33 mAOD at the eastern boundary. Flood levels were compared to a topographical survey of the site in the White Young Green FRA. It was determined that there is a minimum of 2.9m between ground levels and modelled flood levels.

3.5 The 2014 Groundsure report states that the Environment Agency has no record of past flooding at the site.

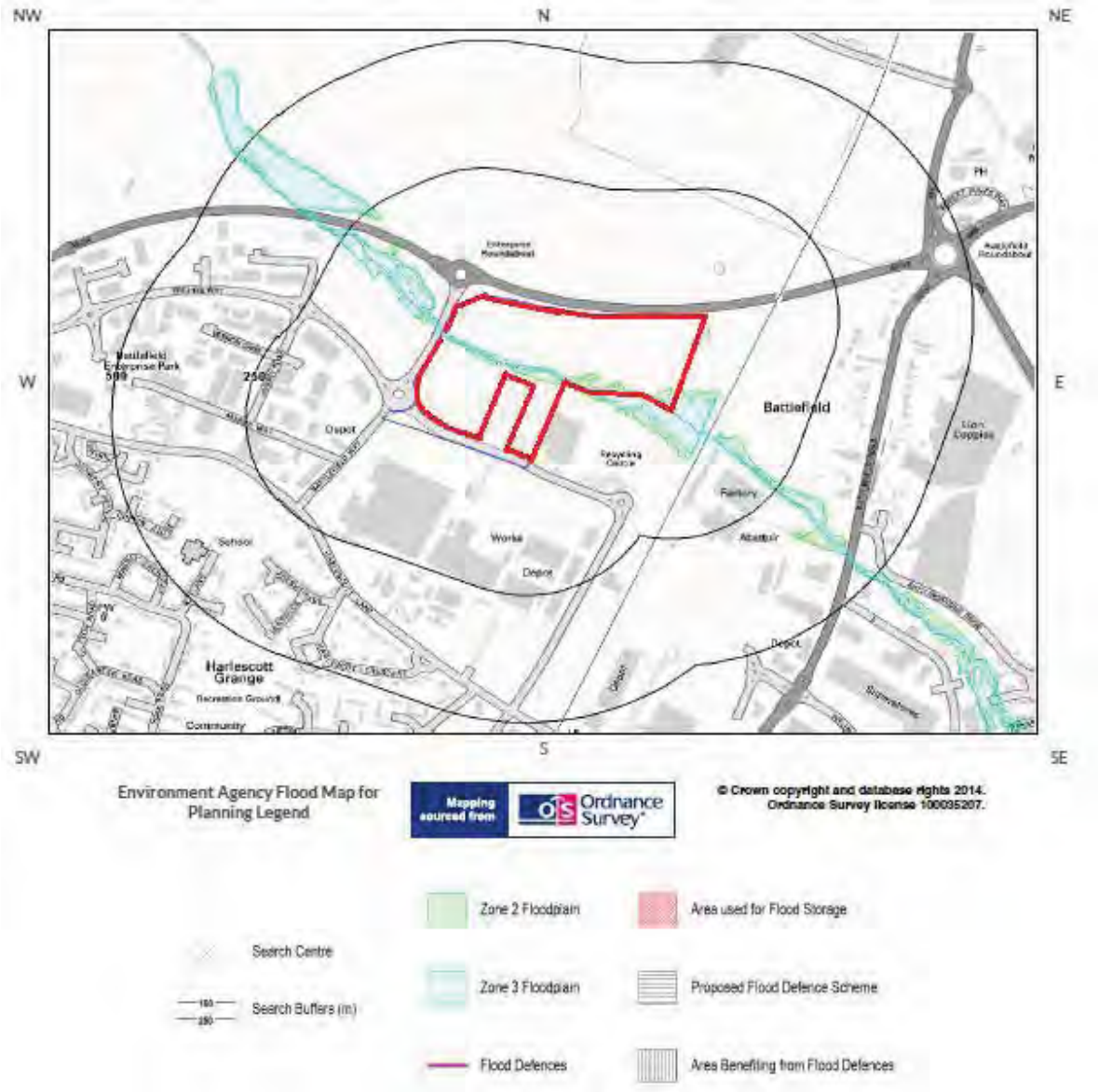

Figure 2: Groundsure Flood Map (modified to show current site boundary)

3.6 Planning applications submitted to Shropshire County Council for proposed developments in the vicinity of the site contained the following conditions relating to flood risk.

- The 2003 planning permission document for MS2003/0985/SY, adjacent to the site states that development should not take place below the 69.7m AOD (the 1 in 100 year flood level in this location) in order to prevent increased flooding risk and the loss of floodplain storage, and that the loss of any floodplain storage would require the provision of compensatory flood storage within the site area.
- The 2011 consultee response for 11/03191/FUL states that floor levels in the development should be 150mm above the existing ground level to protect the development from overland flooding.

3.7 The current Environment Agency flood risk advice also recommends that finished floor levels are set at 600mm above the 1 in 100 year flood level. Based on the maximum modelled flood elevation in the White Young Green FRA of 69.84 mAOD, the minimum finished floor levels would be 70.44 mAOD.

3.8 Based on the elevated situation of the site in relation to modelled flood extents, and assuming that similar mitigation measures are taken to the conditions given in the planning applications above, the risk of fluvial flooding should be considered to be low. Flood risk would be further reduced by Environment Agency guidelines requiring an 8m 'no-build' easement from the top of the bank on both sides of a watercourse.

Surface Water Flooding

3.9 The figure on page 16 of the 2014 Groundsure report, shown in Figure 3 below, shows the risk of flooding from surface water (overland flow) to be Negligible for the majority of the site. Negligible risk is defined as flooding to a depth of less than 0.1m in a 1 in 1000 year rainfall event.

3.10 An elongated area of the site coinciding with the Battlefield Brook channel alignment is shown to be at Low to Significant risk of surface water flooding. Low risk is defined as vulnerability to flooding to a depth of greater than 0.1m in a 1 in 1000 year rainfall event, while Significant risk is defined as vulnerability to flooding to a depth between 0.3m and 1m in a 1 in 1000 year rainfall event. Areas of Significant risk in this area correspond with sections of the Battlefield Brook upstream of culverted sections of the brook. Due to the Environment Agency's 8m 'no build' easement, there will be little or no development in these areas.

3.11 Small areas in the northern and southern parts of the site are shown to be at a High risk of flooding from surface water flooding. High risk is defined as a vulnerability to flooding to a depth of 0.1m and 0.3m in a 1 in 75 year rainfall event. The area in the north of the site was noted to be waterlogged during a site visit in February 2014.

3.12 Both areas at High risk of flooding are considered to be associated with topographic depressions within the site rather than overland flows from off-site sources. It is possible that the risk in these parts of the site could be removed through re-engineering of the site topography. As both areas are in Flood Zone 1, this would not result in the loss of any floodplain storage.

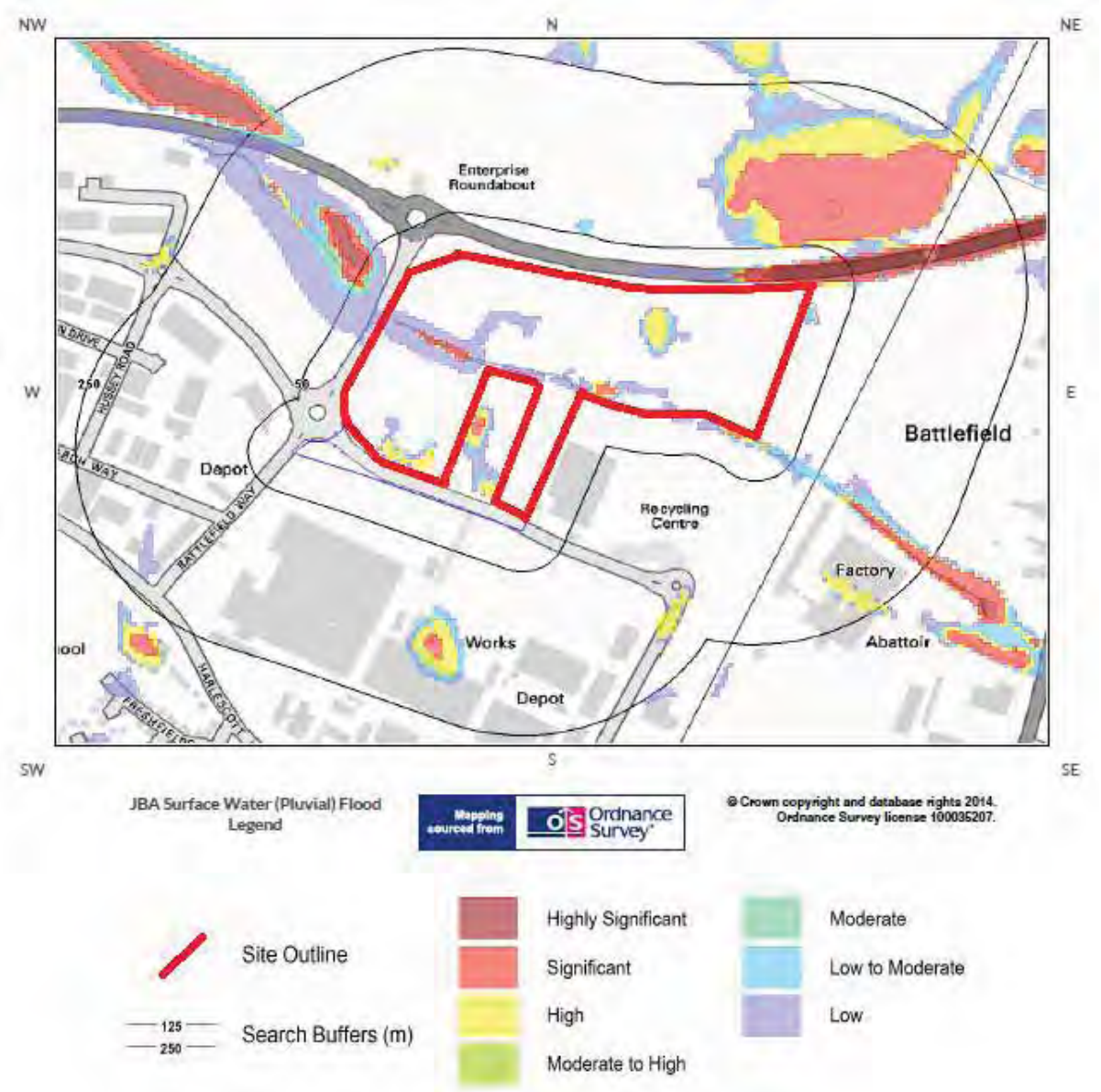

Figure 3: Groundsure Surface Water Flooding Map (modified to show current site boundary)

3.13 Two areas of Highly Significant and Significant surface water flooding risk are present to the north of the site boundary. Highly Significant flood risk is defined as vulnerability to flooding to a depth of greater than 1m in a 1 in 75 year flooding event. It is assumed that the Battlefield Link Road would act as a barrier to any overland flow routes onto the site from the north, with all surface water runoff generated in these areas being intercepted and contained by kerbs and drainage in the roads.

3.14 An area of Highly Significant surface water flooding risk is also present to the west of Battlefield Road and corresponds with the location of a pond. It was noted from aerial photography that a connection exists between the pond and the Battlefield Brook. It was concluded in the White Young Green FRA that the low ground surrounding the pond would be sufficient to contain elevated water levels without flooding.

3.15 The Shropshire Council drainage and flooding interactive map used in the Glanville FRA (Appendix 3) to indentify surface water flooding risk, shows the site area is not at risk of surface water flooding, therefore surface water flooding was not assessed further.

3.16 Development in the areas of site shown to be at high risk of surface water flooding will be minimised by adherence to the Environment Agency requirement for 8m easement in the vicinity of the brook, and any re-engineering of site topography. It is considered that there are no off-site sources of surface water flooding that could pose a risk to the site. Mitigation measures in addition to those recommended for fluvial flooding are, therefore, unlikely to be required. Based on this, the risk of surface water flooding at the site should be considered to be low.

Groundwater Flooding

3.17 The figure on page 25 of the Groundsure report, which is based on British Geological Survey (BGS) data, shows there to be "limited potential" for groundwater flooding at the site. The source of any flooding would be from an unconfined aquifer (Clearwater Flooding) as opposed to shallow sedimentary aquifers (Superficial Deposits Flooding). BGS confidence in the result is, however, rated as "Low".

3.18 The Shrewsbury Surface Water Management Plan (SWMP) used in the Glanville FRA to assess groundwater flooding risk shows the site to be outside any areas at risk of groundwater flooding.

3.19 A site investigation was conducted as part of the Glanville FRA. However reference to any groundwater level data is not contained in the report.

3.20 No site investigation was conducted as part of the White Young Green FRA, although it was considered likely that groundwater levels would be similar to the normal water level in the Battlefield Brook, which is approximately 4m below ground level at the site. It was concluded, therefore, that there would be no risk of groundwater flooding at the site provided deep basements were not constructed as part of the proposed development.

3.21 Based on the data in the Groundsure report and conclusions of the FRA reports, the risk of groundwater flooding at the site should be considered to be low, and could be further minimised by excluding deep basements from any future designs.

Sewer Flooding

3.22 The plan in the Glanville FRA showing the location of services, shows a 300mm public foul water sewer flowing north-west to south-east parallel to the southern bank of the Battlefield Brook and two surface water sewers (675mm and 225mm) beneath the access road in the south-west of the site.

3.23 The Geo-environmental Constraints Plan drawing in the 2008 White Young Green Reclamation Assessment report (Appendix 4) shows the 300mm foul public foul water sewer extends across the full length of the site area and crosses the eastern site boundary. The drawing also shows a network of S104 adpoted sewers in the central and eastern areas of the site.

3.24 Based on the Sewers for Adoption guide, Severn Trent Water requires a minimum distance of 5m between any building or structure and a 300mm-1000mm diameter public, or prospectively adoptable, gravity sewer.

3.25 Reference is made to the Shrewsbury SWMP in the Glanville FRA which states that there were 5 recorded incidents of sewer flooding in the SY13 postcode area, although specific locations were not given.

3.26 The capacity of sewers within the site area are unknown, and there is the potential for these to block and cause flooding. However, it is likely that the location of the sewers in close proximity to the Battlefield Brook would mean any flooding would be intercepted by the brook and would not affect any development. The risk of sewer flooding should, therefore, be considered low.

Artificial Sources

3.27 The Groundsure report shows the site is not situated in an area identified to be at risk of flooding in the event of a canal breach or reservoir failure. This was also stated in the Glanville FRA.

3.28 Culverted sections of watercourses are also considered to be a source of artificial flooding. Surface water flood mapping shows areas of elevated flood risk to coincide with the approximate location of culverts along the Battlefield Brook. Notwithstanding this, flooding occurring upstream of culverts was not evident on the flood outline for the brook modelled by Enviros Consulting Limited in 2003, which is considered to provide the most accurate representation of flooding at the site.

3.29 Based on the available information, the risk of artificial flooding at the site could be considered to be low.

4 CONCLUSIONS

4.1 This report gives an assessment of flood risk to the site from various sources in order to identify any potential risk or development constraints.

4.2 The assessment is based on the findings of four reports produced for land within, or adjacent to, the site boundary and also on mitigation measures proposed in planning applications for the Integrated Waste Management Facility and Food Enterprise Centre.

4.3 The majority of the site is located within Flood Zone 1, with small areas of land in the vicinity of the Battlefield Brook located within Flood Zone 2 and Flood Zone 3. The 2008 White Young Green Flood Risk Assessment determined that the site is elevated above the modelled extent of a 1 in 100 year flood event by a minimum of 2.9m.

4.4 In order to reduce the fluvial flood risk, it is recommended that finished floor levels should be set a minimum of 70.44 mAOD and no development should take place below the highest modelled flood elevation of 69.84 mAOD. There should also be an 8m easement from the top of the bank on both sides of the Battlefield Brook, as required by Environment Agency guidelines. With these recommendations implemented, the risk of fluvial flooding to any development should be considered to be low.

4.5 The risk of surface water flooding to the site is considered negligible for the majority of the site area. Areas of land at risk are present in the vicinity of the Battlefield Brook and in two topographical depressions.

4.6 Development in the vicinity of the brook will be limited by the requirement for 8m of easement around the Battlefield Brook. In addition to recommendations for reducing fluvial flood risk, the surface water flood risk in low-lying areas of the site can be reduced by re-engineering of the topography. The risk of surface water flooding to any development should, therefore, be considered to be low.

4.7 The risk of flooding from groundwater is considered to be low and could be further minimised by limiting the use of deep basements in future developments.

4.8 The capacity of sewers on site is not known, however it is considered likely that any flooding would be intercepted by the Battlefield Brook. Flood risk would be further reduced by the requirement for an easement of 5m between any structure and sewers by Severn Trent Water. The risk of sewer flooding to any development is considered, therefore, to be low.

4.9 The risk of flooding from artificial sources, including culverted sections of the Battlefield Brook is considered to be low.

4.10 Following recommendations made in this report for reducing flood risk, the flood risk should be considered to be low and the site suitable for development.

APPENDICES

APPENDIX 1

Flood Insight Report
(Groundsure – December 2014)

Wardell Armstrong

WARDELL ARMSTRONG LLP,SIR HENRY DOULTON HOUSE, FORGE LANE, STOKE-ON-TRENT, ST1 5BD

GroundSure Reference:	GS-1795042
Client Reference:	ST14489-020
Report Date	1 Dec 2014
Report Delivery Method:	xml
Client Email:	bgriffiths@wardell-armstrong.com

GroundSure FloodInsight

Address: 350890, 316550,

Dear Sir/ Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure FloodInsight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above GroundSure reference number.

Yours faithfully,

Managing Director
Groundsure Limited

Enc.
GroundSure FloodInsight

GroundSure FloodInsight

Address:	**350890, 316550,**
Date:	**1 Dec 2014**
Reference:	**GS-1795042**
Client:	**Wardell Armstrong**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	27-Mar-2012
Grid Reference:	350974,316604
Site Size:	10.73ha

Contents Page

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed.

Section 1: Environment Agency Flood Zones	
1.1 Are there any Enviroment Agency Zone 2 floodplains within 250m of the study site?	Yes
1.2 Are there any Environment Agency Zone 3 floodplains within 250m of the study site	Yes
1.3 Are there any Flood Defences within 250m of the study site?	No
1.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
1.5 Are there any Proposed Flood Defences within 250m of the study site?	No
1.6 Are there any areas used for Flood Storage within 250m of the study site?	No

Section 2: National Flood Risk Assessment (NaFRA)	
2.1 What is the National Flood Risk Assessment (NaFRA) Flood Rating for the study site?	High

Section 3: Historic Flood Events	
3.1 Has the site been subject to past flooding as recorded by the Environment Agency?	No

Section 4: JBA Surface Water (Pluvial) Flood	
4.1 Is the site or any area within 50m at risk of Surface Water (Pluvial) Flooding?	Yes

Section 5: Surface Water Features	
5.1 Are there any surface water features within 250m of the study site?	Yes

Section 6: Groundwater Flooding	
6.1 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Limited potential
6.2 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Low

Section 7: BGS Geological Indicators of historic flooding	
7.1 **Are there any geological indicators of historic flooding within 250m of the study site?**	Yes

Section 8: JBA Reservoir and Canal Data	
8.1 Is the property located in an area identified as being at potential risk in the event of a reservoir failure?	No
8.2 Is the property located in an area identified as being at potential risk in the event of a canal break?	No

Additional Matters

Riparian ownership

If your land abuts a river, stream or ditch, you may have responsibility to maintain this watercourse, even if Title Deeds show the property boundary to be adjacent to the watercourse. This includes the responsibility for clearing debris and obstructions which may impede the free passage of water and fish, and also includes the responsibilities to accept flood flows through your land, even if these are caused by inadequate capacity downstream. There is no duty in common law for a landowner to improve the drainage capacity of a watercourse. Please contact GroundSure if you need further advice on riparian ownership issues relating to this property.

Sewerage Flooding

Extreme rainfall events may overwhelm sewerage systems and cause local flooding. The water and sewerage companies within the UK are required to maintain 'DG5 – At Risk Registers' which record properties that have flooded from sewers and/or are considered to be at risk of flooding from sewers in the future. If your property is on the 'At Risk' Register, this may be recorded within a standard CON29 Drainage and Water search.

Using this Report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client.

Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

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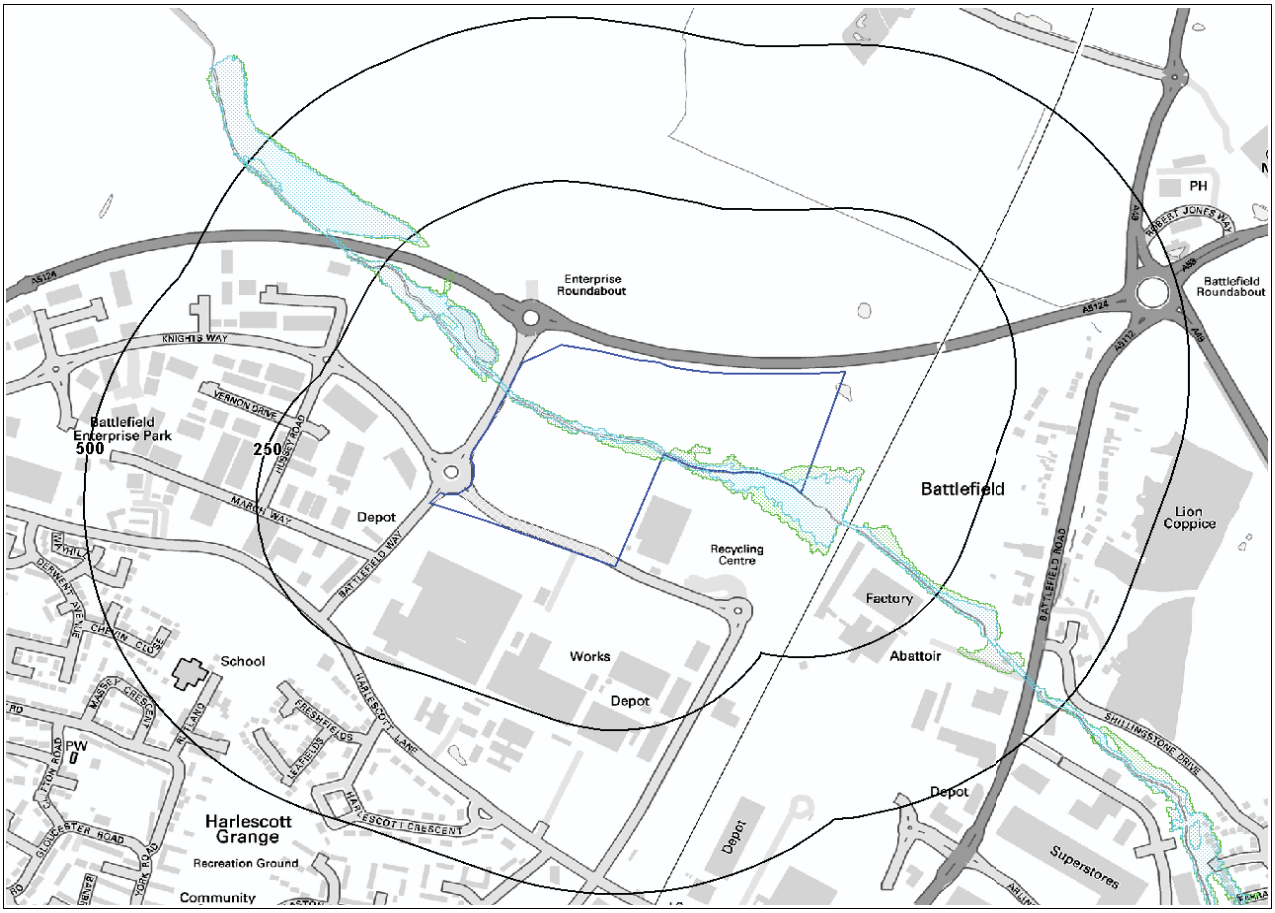
1. Environment Agency Flood Map for Planning (from rivers and the sea)

NW N NE

W E

SW S SE



Environment Agency Flood Map for Planning Legend

Mapping sourced from Ordnance Survey

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- Search Centre
- Search Buffers (m) — 100 — 250
- Zone 2 Floodplain
- Zone 3 Floodplain
- Flood Defences
- Area used for Flood Storage
- Proposed Flood Defence Scheme
- Area Benefiting from Flood Defences

1. Environment Agency Flood Zones

1.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency Zone 2 floodplain? Yes

Environment Agency Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 1 – Flood Map for Planning:

ID	Distance (m)	Direction	Update	Type
1	0.0	On Site	03-Nov-2014	Zone 2 - (Fluvial Models)

1.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency Zone 3 floodplain? Yes

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 1 – Flood Map for Planning.

The following floodplain records are represented as green shading on the Flood Map (1):

ID	Distance (m)	Direction	Update	Type
2	0.0	On Site	03-Nov-2014	Zone 3 - (Fluvial Models)

1.3 River and Coastal Flood Defences

Are there any Flood Defences within 250m of the study site ? No

This search consists only of flood defences present in the dataset provided by the Environment Agency. Any relevant data is represented on Map 1 – Flood Map for Planning.

Database searched and no data found.

1.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

Any relevant data is represented on Map 1 – Flood Map for Planning.

1.5 Areas of Proposed Flood Defences

Are there any Proposed Flood Defences within 250m of the study site? No

* This illustrates the number of households that move from 'very significant' or 'significant' to 'moderate' or 'low' probability of flood risk bands if the proposed flood scheme is to be implemented.

Any relevant data is represented on Map 1 – Flood Map for Planning.

Guidance: This search consists only of proposed flood defences present in the dataset provided by the Environment Agency. Please note that proposed flood defence schemes will not influence the current NaFRA ratings for the site.

1.6 Areas used for Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

Flood Storage Areas are considered part of the functional floodplain, and are areas where water has to flow or be stored in times of flood. Technical Guidance to the National Planning Policy Framework states that only water-compatible development and essential infrastructure should be permitted within flood storage areas, and existing development within this area should be relocated to an area with a lower risk of flooding. Any relevant data is represented on Map 1 – Flood Map for Planning.

Notes on Flood Zone Data:

This data relates solely to flooding from rivers or the sea. The Environment Agency estimate that over 2.5 million properties are at risk of flooding within England and Wales. River flooding occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment. Coastal flooding results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen which can cause serious flooding.

The GroundSure FloodInsight Report comments upon whether a property lies in proximity to Environment Agency Zone 2 and Zone 3 floodplains. The Government's Technical Guidance to the National Planning Policy Framework explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and potential loss of life. The Government looks to planning authorities to ensure that flood risk is properly taken into account in the planning of developments to reduce the risk of flooding and the damage which floods cause.

Flood Zones enable planning authorities to apply the sequential test (see Technical Guidance to the National Planning Policy Framework) for development proposals and prevent inappropriate development.

Technical Guidance to the National Planning Policy Framework defines the flood zones as: -

Zone 1 – little or no risk with an annual probability of flooding from rivers and the sea of less than 0.1%

Zone 2 – low to medium risk with an annual probability of flooding of 0.1-1.0% from rivers and 0.1-0.5% from the sea.

Zone 3 – high risk with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

Flood Zone 3b/Flood Storage Areas - very high risk with the site being used as part of the functional flood plain or as a Flood Storage Area.

The flood zones are the main constraint map underpinning decisions on development and flood risk.

Existing Flood Defences

Flood defences seek to reduce the risk of flooding and to safeguard life, protect property, sustain economic activity and the natural environment. Flood defences are designed to protect against flood events of a particular magnitude, expressed as risk in any one year. For example, defences in urban areas may be built to provide protection against flood events of a size which might occur on average once in one hundred years or less.

Proposed Flood Defences

This information is taken from the Environment Agency's database of Areas to Benefit from New and Reconditioned Flood Defences under the Medium Term Plan (MTP). The dataset contains funding allocation for the first financial year (from April). Funding for the following four financial years is not guaranteed, being only indicative, and will be reviewed annually. Projects within the Medium Term Plan qualify for inclusion in this dataset if:

- the investment leads to a change in the current standard of protection (change projects);
- the investment is a replacement or refurbishment in order to sustain the current the current standard of protection (sustain projects);
- the project has an initial construction budget of £100,000 or more; and
- the project is included within the first five years of the MTP

The data includes all the Environment Agency's projects over £100K that will change or sustain the standards of flood defence in England and Wales over the next 5 years. It also includes the equivalent schemes for all Local Authority and Internal Drainage Boards. The number of households and areas of land contributing to DEFRA's Outcome Measures (OM) are also attributed i.e. could benefit from major work on flood defences.

These data also contain Intermittence Flood Maintenance Programme that show the annual maintenance programme of work scheduled to be carried by the Environment Agency, Local Authority or Internal Drainage Board on flood defences. Data details routine maintenance as well as intermittent work that has been funded for the coming year. The data contains a start and end coordinate defining the relevant river section where work is planned.

Information Warning

Please note that the maps show the areas where investment is being made to reduce the flood and coastal erosion risk and are not detailed enough to account for individual addresses. Individual properties may not always face the same risk of flooding as the areas that surround them. Also, note that funding figures are indicative and any use or interpretation should account for future updates where annual values may change.

Every possible care is taken to ensure that the maps reflect all the data possessed by the Environment Agency and that they have applied their expert knowledge to create conclusions that are as reliable as possible. The Environment Agency consider that they have created the maps as well as they can and so should not be liable if the maps by their nature are not as accurate as might be desired or are misused or misunderstood, despite their warnings. For this reason, they are not able to promise that the maps will always be accurate or completely up to date.

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Flood Storage Areas

Flood Storage Areas may also act as flood defences. A flood storage area may also be referred to as a balancing reservoir, storage basin or balancing pond. Its purpose is to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel. It may also delay the timing of a flood peak so that its volume is discharged over a longer time interval.

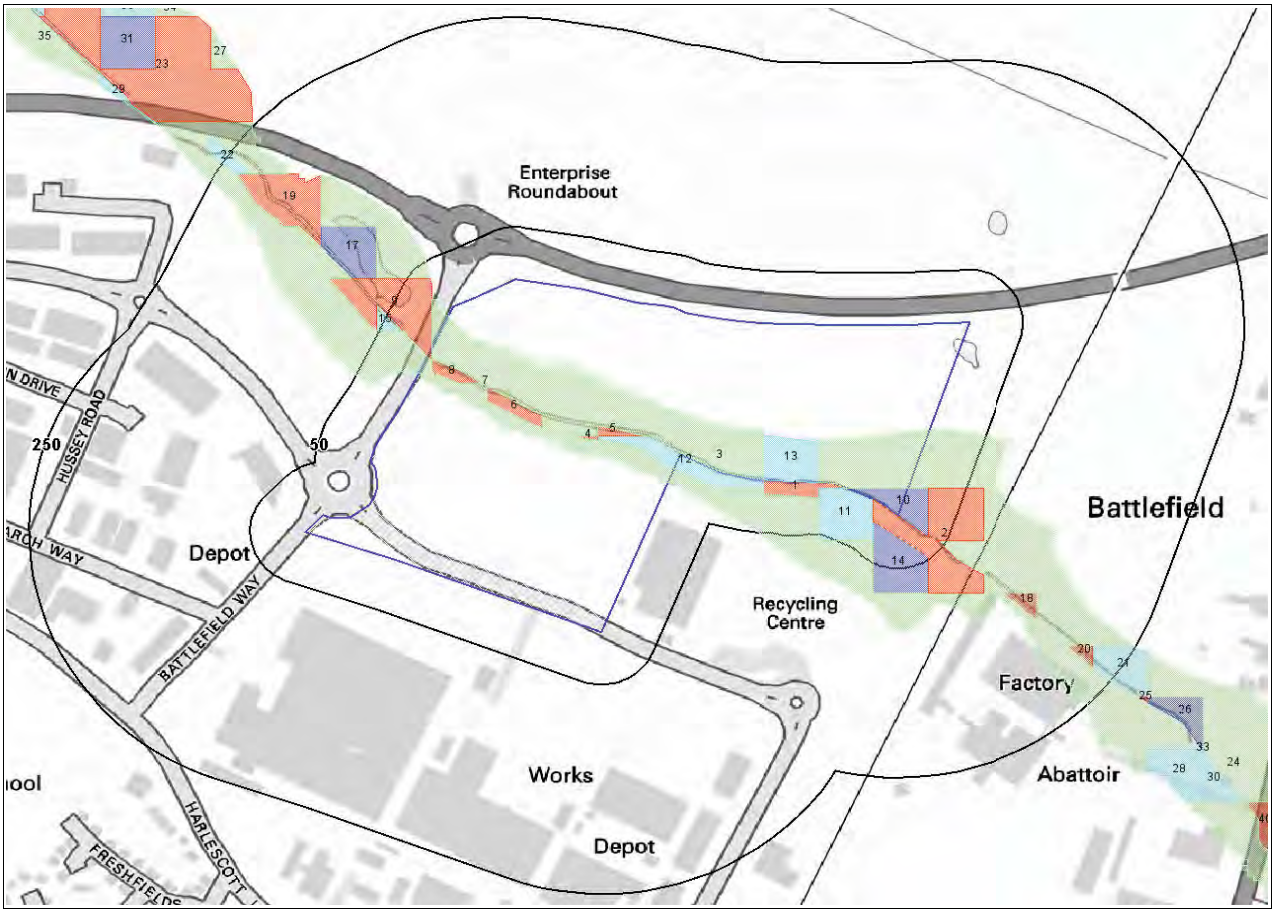
A flood storage area may take the form of a wet or dry reservoir. A wet reservoir is a water storage facility in which storage can be effected by allowing water levels to rise during flood times. A dry reservoir is typically adjacent to a river and comprises an enclosed area that accepts water only at peak times. These areas are also referred to as Zone 3b or 'the functional floodplain' and has a 5% or greater chance of flooding in any given year, or is designed to flood in the event of an extreme (0.1%) flood or another probability which may be agreed between the Local Planning Authority and the Environment Agency, including water conveyance routes. Development within Flood Storage Areas is severely restricted.

2. Environment Agency NaFRA Flooding Map

NW N NE

W E

SW S SE



Environment Agency NaFRA Flooding legend

Mapping sourced from Ordnance Survey

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Site Outline

125 Search Buffers (m)
250

NAFRA Rating

- Very Low
- Low
- Medium
- High

2. Environment Agency National Flood Risk Assessment (NaFRA)

2.1 Environment Agency National Flood Risk Assessment (NaFRA) Flood Rating (River and Coastal)

What is the highest risk of flooding onsite? High

The Environment Agency NaFRA database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

NaFRA data for the study site indicates the property is in an area with a High (1 in 30 or greater) chance of flooding in any given year.

Any relevant data within 250m is represented on the NaFRA Flood map. Data to 50m is reported in the table below.

ID	Distance (m)	Direction	NaFRA Flood Risk
1	0.0	On Site	High
2	0.0	On Site	High
3	0.0	On Site	Very Low
4	0.0	On Site	High
5	0.0	On Site	High
6	0.0	On Site	High
7	0.0	On Site	High
8	0.0	On Site	High
9	0.0	On Site	High
10	0.0	On Site	Medium
11	0.0	On Site	Low
12	0.0	On Site	Low
13	0.0	On Site	Low
14	16.0	SW	Medium
15	31.0	NW	Low
16	34.0	NW	Very Low

Notes on NaFRA data:

This information is based on the very latest Environment Agency National Flood Risk Assessment (NaFRA) data. This data has been created by dividing the flood plain into 50m squares, or smaller areas where a square if intersected by a river or coastline. These are called impact cells. The method then calculates the likelihood that the centre of each impact cell will start to flood using a number of different flood scenarios.

A number of insurance companies providing cover for flood risk use this data as the basis of their risk model, although they may also utilise additional information such as claims histories, which may further influence their decision. Where a high risk of flooding is identified flood risk insurance may be difficult to obtain without further work being undertaken. Property owners of sites within Low and Medium risk areas are still considered to be at risk of flooding and insurance premiums may be increased as a result. Owners of properties within Low, Medium and High risk areas are advised to sign up to the Environment Agency's Flood Warning scheme. The probability estimates for NaFRA risk bands are as follows:

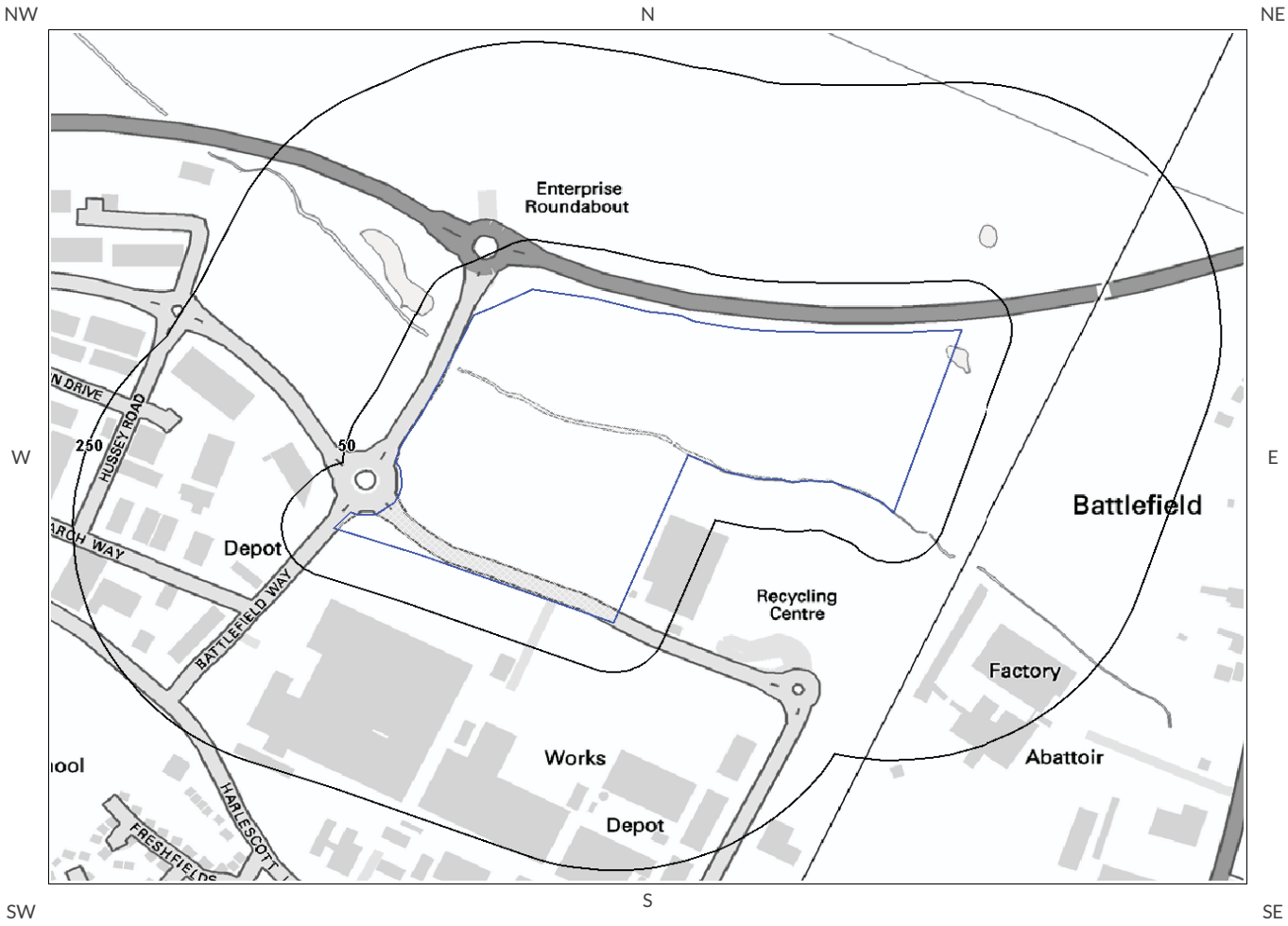
Very Low – the chance of flooding from rivers or the sea is considered to be less than 1 in 1000 (0.1%) in any given year.

Low – the chance of flooding from rivers or the sea is considered to be less than 1 in 100 (1%) but greater than or equal to 1 in 1000 (0.1%) in any given year.

Medium – the chance of flooding from rivers or the sea is considered to be less than 1 in 30 (3.3%) but greater than 1 in 100 (1%) in any given year.

High – the chance of flooding from rivers or the sea is considered to be greater than or equal to 1 in 30 (3.3%) in any given year.

3. Environment Agency Historic Flooding Events Map



Environment Agency Historic Flooding Events legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

Historic Flood Events

3. Environment Agency Historic Flooding Events

3.1 Historic Flood Outlines

Has the site or any area within 250m been subject to historic flooding as recorded by the Environment Agency?
No

This database shows the individual footprint of every flood event recorded by the Environment Agency and previous bodies.

Any records found within the search radius are displayed on Map 3 – Historic Flooding Events.

Notes on Historic Flooding data:

Over 21,000 separate events are recorded within this database, dating back to 1947. This data is used to understand where flooding has occurred in the past and provides details as available. Absence of a historic flood event for an area does not mean that the area has never flooded, but only that the Environment Agency do not currently have records of flooding within the area. Equally, a record of a flood footprint in previous years does not mean that an area will flood again, and this information does not take account of flood management schemes and improved flood defences.

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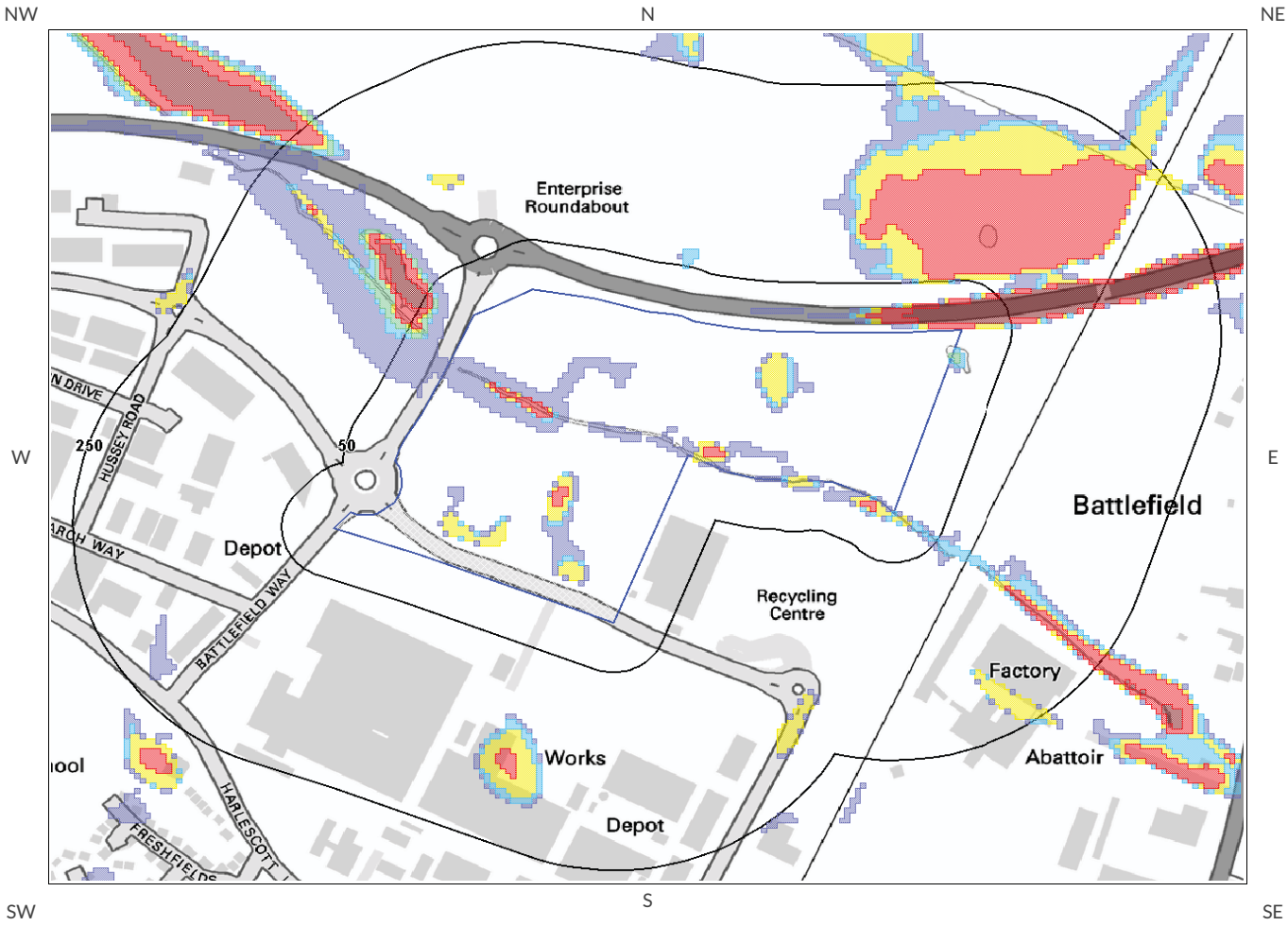
4. JBA Surface Water (Pluvial) Flood Map



JBA Surface Water (Pluvial) Flood Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

Highly Significant
Significant
High
Moderate to High
Moderate
Low to Moderate
Low

4. JBA Surface Water (Pluvial) Flooding

Surface Water (pluvial) flooding is defined as flooding caused by rainfall-generated overland flow before the runoff enters a watercourse or sewer. In such events, sewerage and drainage systems and surface watercourses may be entirely overwhelmed.

Surface Water (pluvial) flooding will usually be a result of extreme rainfall events, though may also occur when lesser amounts of rain falls on land which has low permeability and/or is already saturated, frozen or developed. In such cases overland flow and 'ponding' in topographical depressions may occur.

What is the risk of pluvial flooding at the study site? Significant

Guidance: The site or an area in close proximity has been assessed to be at Significant Risk of surface water (pluvial) flooding. This indicates that this area would be expected to be affected by surface water flooding in a 1 in 75 year rainfall event to a depth of between 0.3m to 1m.

Flood data provided by JBA RISK MANAGEMENT LIMITED Copyright © JBA RISK MANAGEMENT LIMITED 2008-2014

The following pluvial (surface water) flood risk records within 50m of the study site are shown on the JBA Surface Water Flooding Map:

Distance	Direction	Risk
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	High
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low

Distance	Direction	Risk
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
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0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low

Distance	Direction	Risk
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	S	Low
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	S	Low to Moderate
0.0	On Site	Moderate
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant

Distance	Direction	Risk
2.0	E	Low
2.0	SW	Significant
2.0	N	Significant
3.0	S	High
3.0	N	High
4.0	S	Low
4.0	N	Low
4.0	SW	Low to Moderate
4.0	N	Low to Moderate
4.0	E	Low to Moderate
6.0	E	Low
7.0	N	Highly Significant
7.0	SW	Low
8.0	SW	High
9.0	S	Low to Moderate
9.0	N	Significant
10.0	N	High
10.0	SW	Low
10.0	N	Low
10.0	N	Low to Moderate
10.0	SW	Low to Moderate
11.0	SW	Low to Moderate
13.0	E	High
13.0	SW	Low
13.0	E	Low
14.0	N	Low
15.0	N	High
15.0	N	Low to Moderate
16.0	N	Low
18.0	SE	Low
20.0	N	High
20.0	N	Low
20.0	SE	Low to Moderate
20.0	N	Low to Moderate
23.0	N	Significant
24.0	N	High
24.0	E	Low
25.0	N	Low
25.0	N	Low to Moderate
27.0	N	High

Distance	Direction	Risk
27.0	N	Significant
28.0	N	Low
29.0	SE	Low
30.0	NW	Low to Moderate
31.0	SE	Low
32.0	NW	Low to Moderate
32.0	NW	Low to Moderate
32.0	NW	Moderate
33.0	N	Low
33.0	SE	Low to Moderate
34.0	NW	Moderate
34.0	NW	Moderate
35.0	N	Low to Moderate
35.0	NW	Moderate
36.0	SE	Low
37.0	NW	High
37.0	NE	High
37.0	NW	High
38.0	SE	Low
39.0	NW	High
39.0	NW	Low to Moderate
39.0	NW	Significant
39.0	NW	Significant
39.0	NE	Significant
40.0	SE	Low to Moderate
41.0	NW	High
43.0	NW	Highly Significant
43.0	SE	Low
43.0	E	Low to Moderate
44.0	NW	Low to Moderate
46.0	NW	Moderate
46.0	NW	Moderate
47.0	N	High
47.0	N	Low
47.0	N	Low to Moderate
47.0	N	Low to Moderate
48.0	NW	High
49.0	SE	Low
49.0	N	Low
49.0	N	Low to Moderate

Distance	Direction	Risk
49.0	E	Significant
50.0	NW	Low to Moderate
50.0	NW	Significant

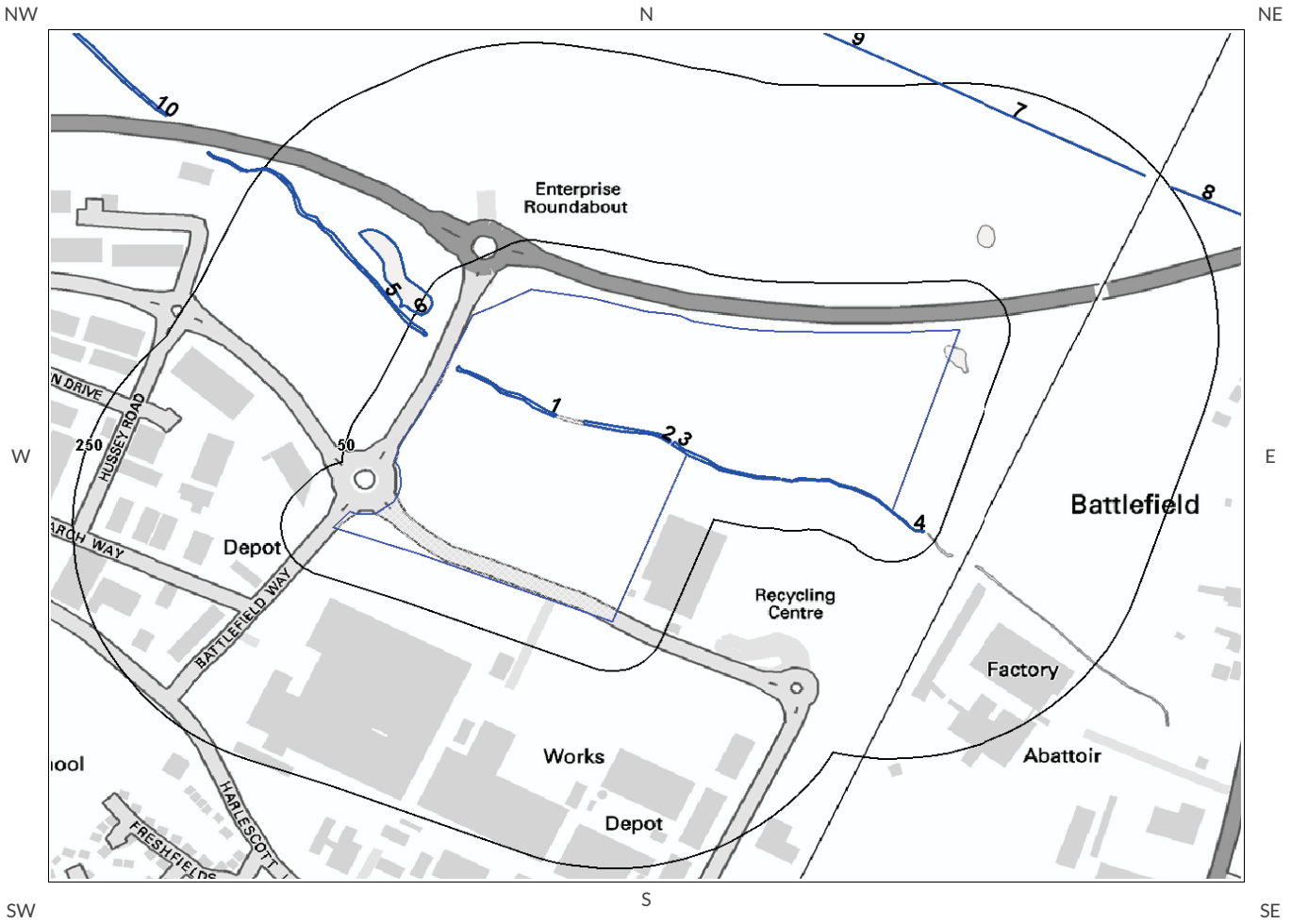
Notes on Surface water (Pluvial) Flooding data:

JBA Consulting surface water flood map identifies areas likely to flood following extreme rainfall events, i.e. land naturally vulnerable to surface water or "pluvial" flooding. This data set was produced by simulating 1 in 75 year, 1 in 200 year and 1 in 1000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though older ones may even flood in a 1 in 5 year rainstorm event.

The model provides the maximum depth of flooding in each 5m "cell" of topographical mapping coverage. The maps include 7 bands indicating areas of increasing natural vulnerability to surface water flooding. These are:-

- **Less than 0.1m in a 1 in 1000 year rainfall event** - Negligible
- **Greater than 0.1m in a 1 in 1000 year rainfall event** - Low
- **Between 0.1m and 0.3m in a 1 in 200 year rainfall event** – Low to Moderate
- **Between 0.3m and 1m in a 1 in 200 year rainfall event –** Moderate
- **Greater than 1m in a 1 in 200 year rainfall event** – Moderate to High
- **Between 0.1m and 0.3m in a 1 in 75 year rainfall event** – High
- **Between 0.3m to 1m in a 1 in 75 year rainfall event** - Significant
- **Greater than 1m in a 1 in 75 year rainfall event** – Highly Significant

5. Surface Water Features map



Surface Water Features legend

Mapping sourced from Ordnance Survey

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Site Outline

Search Buffers (m)

50

250

Surface Water Feature (wider than 5m)

Surface Water Feature (narrower than 5m)

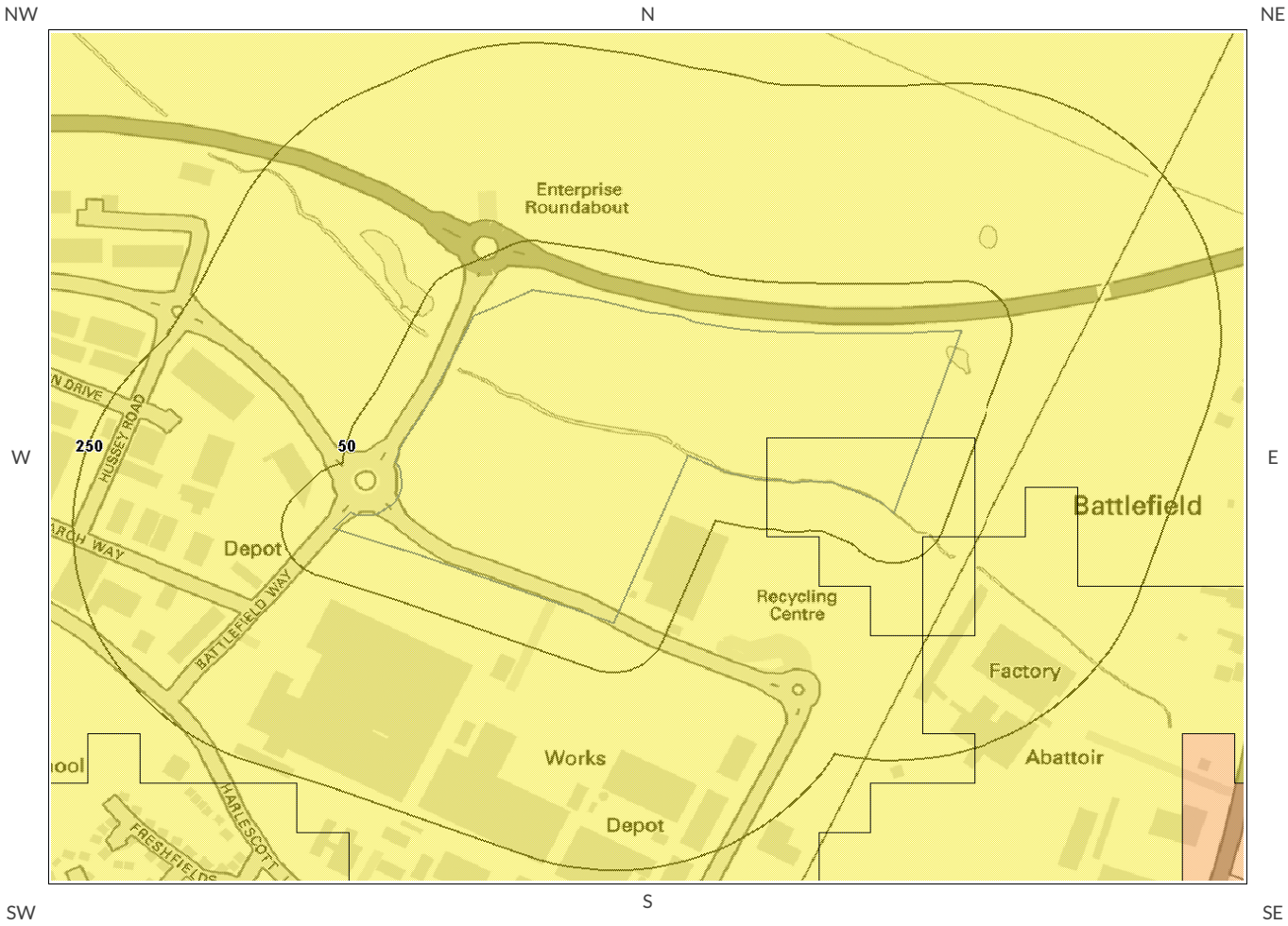
5. Surface Water Features

Are there any surface water features within 250m of the study site? Yes

The following surface water records are represented on mapping:

ID	Distance (m)	Direction
1	0.0	On Site
2	0.0	On Site
3	0.0	On Site
4	0.0	On Site
5	31.0	NW
6	40.0	NW
7	218.0	NE
8	249.0	NE

6. BGS Groundwater Flooding Map



BGS Groundwater Flooding legend

Mapping sourced from Ordnance Survey

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Site Outline

50
250
Search Buffers (m)

Limited potential for groundwater flooding to occur

Potential for groundwater flooding of property below ground level

Potential for groundwater flooding to occur at surface

6. Groundwater Flooding

6.1 Groundwater Flooding Susceptibility Areas

Are there any British Geological Survey groundwater flooding susceptibility flood areas within 50m of the boundary of the study site? Yes

What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions? Limited potential for groundwater flooding

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Clearwater Flooding

Where limited potential for groundwater flooding to occur is indicated, this means that although given the geological conditions there may be a groundwater flooding hazard, unless other relevant information, e.g. records of previous flooding, suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard.

6.2 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Low

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

Notes on Groundwater Flooding data:

The BGS Susceptibility to Groundwater Flooding hazard dataset identifies areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding.

7. BGS Geological Indicators of Flooding

Are there any geological indicators of flooding within 250m of the study site? Yes

This dataset identifies the presence of superficial geological deposits which indicate that the site may be, or have been in the past, vulnerable to inland and/or coastal flooding. This assessment does not take account of any man-made factors such as flood protection schemes, and the data behind the report are purely geological.

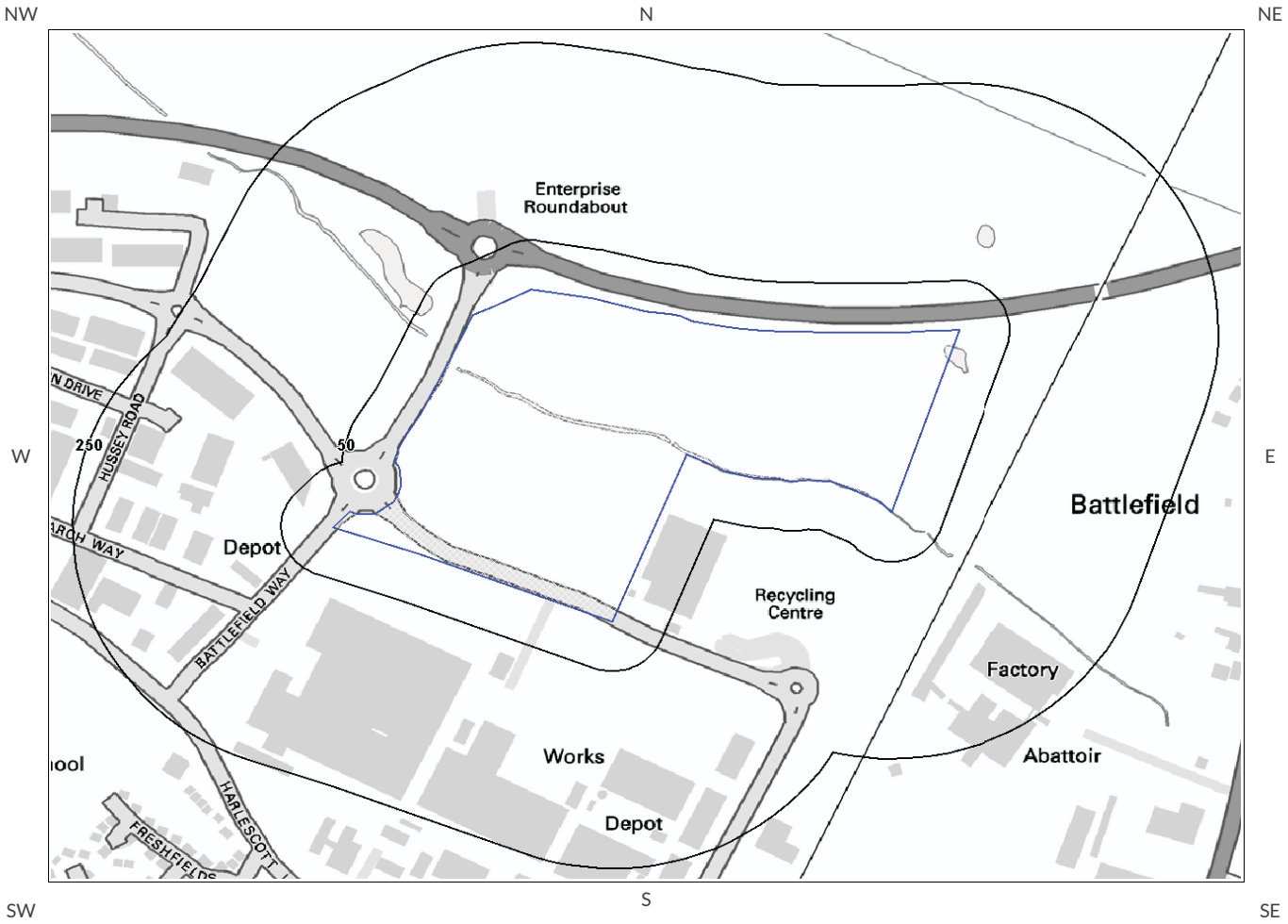
Distance	Direction	Description
0.0	On Site	Higher flood potential from rivers: the first areas to experience the effects of inland flooding in a river catchment.

Notes on BGS Geological Indicators of Flooding data:

The BGS Geological Indicators of Flooding (GIF) data set is a digital map based on the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50). It was produced by characterising Superficial (Drift) Deposits on DiGMapGB-50 in terms of their likely vulnerability to flooding, either from coastal or inland water flow. These Superficial Deposits are considered 'recent' in geological terms, most having been formed in the later parts of the Quaternary geological period (i.e. within the last few tens of thousands of years). Observations made during recent major inland and coastal flooding events have demonstrated that the erosion and deposition of these recent geological sediments have produced subtle topographical variations, resulting in landforms such as fluvial and coastal floodplains. The mapping of these landforms, in conjunction with the fluvial and/or coastal deposits that underlie them, has in turn determined the extent of previous coastal and inland flooding.

On this basis, the floodplains which are at greatest risk from flooding can be both visualised and defined by Superficial Deposits as depicted on geological maps. These include deposits such as river alluvium and lacustrine (lake) alluvium, as well as the First River Terrace or 'Floodplain terrace' (raised flat areas adjacent to or within floodplains, which represent the level of the floodplain prior to the most recent episode of down-cutting). Older and higher river terraces have been excluded as they lie outside the geologically defined floodplain. Areas at risk from coastal inundation are similarly characterised by a range of estuarine or marine deposits that include, for example, tidal flats.

8. JBA Canal Break map



JBA Canal Break legend

Mapping sourced from Ordnance Survey

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Site Outline

50
250
Search Buffers (m)

Areas at risk from Canal Breach

8. JBA Reservoir and Canal Data

8.1 JBA Reservoir Failure Impact Modelling

Is the property located in an area identified as being at potential risk in the event of a reservoir failure? No

JBA consulting have modelled the flooding impact from 1,700 reservoirs in England and Wales, should there be a catastrophic failure of a reservoir wall or embankment. This data is not displayed on mapping.

Guidance: None required

Notes on Reservoir Failure Impact data:

This dataset identified areas that are most likely to flood following the sudden catastrophic failure of a reservoir and is provided by JBA Consulting. JBA has identified over 1,700 reservoirs that pose a risk to people and property. These maps identify properties that would flood in the unlikely event of the failure of the reservoir's dam or embankment. Empirical methods were used to predict the flow that would result from the failure which was then modelled onto high resolution Digital Terrain Models (DTM) using JBA's advanced 2D hydraulic modelling techniques. The model provides the maximum depth of flooding in each cell of the DTM.

8.2 JBA Canal Break Modelling

Is the property located within 500m of an area identified as being at potential risk in the event of a canal break? No

Database searched and no data found.

Notes on Canal Break modelling data

Canal failure mapping includes two types of failure:

- Breach of raised canal embankments - failure of the embankment due to weaknesses; these are typically caused by erosion or animal burrowing but can also arise from poor maintenance.
- Aqueduct failure - an aqueduct is where the canal passes over infrastructure such as roads, railways and subways, or over other canals and rivers. Failures of these are typically caused by the collapse of the underlying culvert.

A length of over 1,700km of canal covering England, Wales and Scotland was modelled. The canal modelling is restricted to the areas where LIDAR is available as the raised embankments are more defined in the LIDAR than in the Photogrammetry data. Each canal is categorised as part of the Merchant Shipping Notice (MSN 1776 (M)). The majority of the modelled canals are categorised as A, with a few exceptions, which fell under category B.

- Category A: narrow rivers and canals where the depth of water is generally less than 1.5m.
- Category B: wider rivers and canals where the depth of water is generally 1.5m or more and where the significant wave height could not be expected to exceed 0.6m at any time.
- Category C: tidal rivers and estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2m at any time.
- Category D: tidal rivers and estuaries where the significant wave height could not be expected to exceed 2m at any time.

The canal map provides flood extent data only and show flooded areas with a depth greater than 0.1m.

Contact Details

GroundSure Helpline

Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:**enquiries@bgs.ac.uk**
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries

Environment Agency

Floodline tel: 0845 988 1188
General enquiry tel: 08708 506 506
Web: www.environment-agency.gov.uk
Email: enquiries@environment-agency.gov.uk

JBA Risk Management

South Barn
Broughton Hall
Skipton
BD23 3AE
Tel: 01756 799919

Ordnance Survey

Adanac Drive, Southampton
SO16 0AS

Tel: 08456 050505
Website: http://www.ordnancesurvey.co.uk/

Local Authority

Authority: Shropshire Council
Phone: 0345 678 9000
Web: http://www.shropshire.gov.uk/
Address: Shirehall, Abbey Foregate, Shrewsbury, Shropshire, SY2 6ND

Getmapping PLC

Virginia Villas, High Street, Hartley Witney
Hampshire RG27 8NW
Tel: 01252 845444
Website: http://www1.getmapping.com/

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This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

I**n these terms and conditions unless the context otherwise requires:**
"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.
"Client" means the party or parties entering into a Contract with GroundSure.
"Commercial" means any building or property which is not Residential.
"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.
"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.
"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.
"Data Reports" means reports comprising factual data with no accompanying interpretation.
"Fees" has the meaning set out in clause 5.1.
"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.
"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.
"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.
"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.
"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.
"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.
"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.
"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.
"Residential" means any building or property used as or intended to be used as a single dwelling.
"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.
"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.
"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.
"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.
"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.GroundSure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.
2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.
2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.
2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.
2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.
2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by GroundSure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.
3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.
3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.
3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.
3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;

(i) the Beneficiary,

(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),

(iv) the first purchaser or first tenant of the Site, and

(v) the professional advisers and lenders of the first purchaser or tenant of the Site.

4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to

(i) full payment of all relevant Fees and

(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.

6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:

(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;

(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);

(iv) not combine the Services with or incorporate such Services into any other information data or service;

(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);

(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and

(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,

6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.

6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:

(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;

(ii) any use made of the Reports, Services, Materials or any part of them; and

(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.

7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.

7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.

7.4 GroundSure shall not be liable for

(i) loss of profits;

(ii) loss of business;

(iii) depletion of goodwill and/or similar losses;

(iv) loss of anticipated savings;

(v) loss of goods;

(vi) loss of contract;

(vii) loss of use;

(viii) loss or corruption of data or information;

(ix) business interruption;

(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;

(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;

(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;

(xiii) loss or damage to a computer, software, modem, telephone or other property; and

(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.

7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.

7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.

8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:

(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or

(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or

(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or

(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.

9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:

(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and

(ii) the Reports and/or Mapping provided under this Contract are
(a) supplied to the Client's specification(s) and in any event
(b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:

(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and

(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract.

11 Anti-Bribery

11.1 The Client warrants that it shall:

(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;

(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and

(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.

11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.

12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.

12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.

12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.

12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.

12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.

12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:

(i) the Client or Beneficiary's failure to provide facilities, access or information;

(ii) fire, storm, flood, tempest or epidemic;

(iii) Acts of God or the public enemy;

(iv) riot, civil commotion or war;

(v) strikes, labour disputes or industrial action;

(vi) acts or regulations of any governmental or other agency;

(vii) suspension or delay of services at public registries by Third Party Data Providers;

(viii) changes in law; or

(ix) any other reason beyond GroundSure's reasonable control.

In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.

12.8 Any notice provided shall be in writing and shall be deemed to be properly

given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.

12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.

12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.

12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.

12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.

12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.

12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.

12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law

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APPENDIX 2

Flood Risk Assessment – Plateau 2, Battlefield Way Shrewsbury
(White Young Green – January 2008)

White Young Green

FLOOD RISK ASSESSMENT

PLATEAU 2, BATTLEFIELD WAY
SHREWSBURY

JANUARY 2008

07 APR 2008

thinking beyond construction

FLOOD RISK ASSESSMENT

PLATEAU 2, BATTLEFIELD WAY, SHREWSBURY

White Young Green

White Young Green
Newstead Court
Little Oak Drive
Sherwood Business Park
Annesley
Nottinghamshire
NG15 0DR

Tel: 01623 684550

Fax: 01623 684551

Project No: E013423-1

Issue No.:	1 (draft)	2 (final)				
Date:	31/01/08	18/02/08				
Prepared by:	D Rotherham	D Rotherham				
Approved by:	R Winn	R Winn				

FLOOD RISK ASSESSMENT

PLATEAU 2, BATTLEFIELD WAY, SHREWSBURY

White Young Green

This report has been prepared for PxP West Midlands Limited Partnership, and any duty of care to any other party is excluded. Any other party using or intending to use this information for any other purpose should seek the prior written consent of White Young Green.

The conclusions reached are those which can reasonably be determined from the sources of information referred to in the report and from our knowledge of current professional practice and standards. Any limitations resulting from the data are identified where possible but both these and our conclusions may require amendment should additional information become available. The report is only intended for use in the stated context and should not be used otherwise.

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Contents

Appendices

1 INTRODUCTION

1.1 Background

This report has been commissioned by PxP West Midlands Limited Partnership in support of a planning application for a proposed new warehouse development to be located on a site to the East of Battlefield Way, Shrewsbury. This Flood Risk Assessment (FRA) is undertaken in accordance with Planning Policy Statement 25 and the accompanying guidance issued by the Department for Communities and Local Government – Development and Flood Risk: A Practice Guide Companion to PPS25.

1.2 Site Location

The site covers a total area of approximately 8.11 ha, approximately centred on grid reference 350943, 316518. A location plan, drawing E013423-1-001, is included in Appendix A.

The site is bounded by Battlefield Link Road to the north, Battlefield Way to the west and agricultural land to the east and south.

1.3 Data Collection

Data sources that have been used for this FRA are:

- Environment Agency website and consultation.
- Previous FRA by Enviros Consulting (April 2003)
- Topographical Survey by Midland Surveying and Engineering (Janauary 2008)
- Strategic Flood Risk Assessment prepared by Halcrow for North Shropshire

1.4 Proposed Development

Although the total site area is approximately 8.11ha, the currently proposed development will only occupy 1.09 ha (plot 2). This FRA addresses flood risk for the whole site, but run off and attenuation considerations are limited to the area of the development.

The proposed development within Plot 2 comprises two blocks of five and one block of three light industrial units with a total floor area of 3820m^2 and associated facilities, including car and lorry parking. An indicative development site layout is included in Appendix C.

2 DATA

2.1 Existing Site and its Environs

The site is divided into five plots, four of which are fallow (plots 1-4) and on the fifth (Plot 5) construction work is underway at the time of writing (January 2008). Battlefield Brook flows from North West to South East through the middle of the site.

An aerial photograph of the site, on drawing E013423-1-004 in Appendix A, shows the majority of the site to be currently fallow land (i.e. greenfield)

A railway line runs in a North South direction past the site some 50m to the east of the site, and the Battlefield Brook is culverted under the railway embankment.

There is a pond adjacent to the North East Corner of the site which is understood to be home to a population of Great Crested Newts. There is also a large pond adjacent to Battlefield Brook upstream of Battlefield Way which appears to be man-made. Both of these ponds are shown on the aerial photograph.

2.2 Topographical Survey

A topographical survey of the site was undertaken in January 2008 and this is included in Appendix A. This shows the site to comprise a series of plateaus at levels of at least 2.9 metres higher than the top of bank of the brook.

2.3 Environment Agency (EA)

The EA website and local office at Shrewsbury were consulted during preparation of this report and the information obtained is summarised below.

2.3.1 Flood Risk

The Environment Agency's website flood risk map was consulted and the site is found to be mainly in flood risk zone 1 (low risk – likelihood of flooding less than 0.1% - 1 in 1000 year return period), but a small proportion through the centre of the site is shown in flood risk zone 2 (medium risk) and zone 3 (high risk).

The area in flood risk zone 3 is on either side of the brook with a maximum width immediately upstream of the railway embankment. About 2/3 of the way across the site the flood risk zone changes to zone 2. The EA flood risk map is shown on drawing E013423-5-002 in Appendix B.

During discussions with the EA, WYG was advised that the EA has no flood levels for the site but a previous FRA, including modelling of the watercourse, has been undertaken. (See Section 2.5 below).

There is a Stage 1 Strategic Flood Risk Assessment (SFRA) available for North Shropshire, which has been consulted, but the information (as is usual with a Stage 1 SFRA) is broad brush and merely reinforces the EA's published information.

2.3.2 Ground Water Protection

Reference to the EA's website groundwater source protection map shows that the whole site is in a total catchment groundwater protection zone, with the nearest inner zone being located some 3km to the South. The EA source protection map is shown on Drawing E013423-5-003 in Appendix B.

2.4 Statutory Authority Drainage

Information from the above mentioned FRA indicates that there are no public surface water sewers on the site and inspection of levels suggests that any highway drainage will not be at an appropriate level for site discharge.

2.5 Enviros FRA (April 2003)

In April 2003 Enviros Consulting Limited prepared a Flood Risk Assessment for the site in accordance with Planning Policy Guidance Note 25, which has now been superseded by PPS25.

During the preparation of this FRA a MIKE 11 hydraulic model of the watercourse was constructed and the results used to produce a more accurate and detailed flood risk map than is available from EA. A copy of the Enviros map is included in Appendix B.

It can be seen that, under the revised mapping, only a very small part of the site is affected by the 100 year flood. The water levels calculated for the site for the 100-year event vary from 69.84m AOD at the Western site boundary to 69.33m AOD at the Eastern boundary.

3 FLOOD RISK ASSESSMENT

3.1 Fluvial Flood Risk

The Environment Agency's website flood risk map indicates that the site lies mainly within Flood Risk Zone 1. As already discussed, there is a strip of higher risk land on either bank of the brook.

As discussed above in April 2003 Enviros Consulting Limited prepared a Flood Risk Assessment which included modelling which yielded levels of 69.33 m AOD at the downstream (Eastern) boundary of the site and 69.84 m AOD at the upstream (Western) site boundary. Inspection of the topographical survey reveals that the site comprises five plateaus at levels that vary from 72.25 m AOD to the North East to 73.5 m AOD in the South West. Comparing the ground levels to the calculated flood levels shows that there is a freeboard of a minimum of 2.9m above 100 year levels. The site is thus considered to be at negligible risk of fluvial flooding.

3.2 Tidal Flood Risk

The site is remote from the coast and at levels in excess of 72m AOD so the site is not at risk of tidal flooding.

3.3 Overland Flow

As the highway to the North of the site is elevated above the site level there could be a risk of overland flow affecting the site. The highway is relatively recent, however, and it is anticipated that adequate drainage is present and that the site will not be at significant risk of flooding from overland flow from the highway.

3.4 Groundwater

Site investigation information for the site is not available, but groundwater levels are likely to be at or around normal water levels in the brook, i.e. at approximately 4 metres below ground level. The site is therefore not at risk of groundwater flooding unless deep basements are constructed.

3.5 Sewer Flooding

The development will be drained by sewers designed in accordance with current best practice so the risk of flooding from sewers is considered to be low.

3.6 Artificial Sources

There is a large pond upstream of the site, which is separated from the site by the Battlefield Road embankment. The height of the embankment and the fact that there is a considerable area of low ground near to the pond's location will, it is considered, be sufficient to accommodate any overflow from the pond.

3.7 Climate Change

In accordance with PPS25, the effects of future climate change have been considered. The effects of climate change are likely to increase flood risk but as the site is considered to be at low risk at present the residual risk after taking into account climate change will remain low. The site drainage will be designed taking climate change into account thereby minimising the risk.

4 SITE DRAINAGE

4.1 Existing site drainage

The existing site comprises fallow land and information regarding existing drainage is not available, although it can reasonably be assumed to be by infiltration and overland flow direct to the watercourse.

4.2 Proposed new development drainage

In accordance with the recommendations in PPS25, the design of the new development will adopt measures to reduce the impact of surface water runoff through the use of sustainable drainage techniques.

It is likely that the EA will require the assessment of the use of sustainable drainage systems using the following hierarchy of techniques.

1. Use of green roofs, rainwater harvesting and grey water re-use within new developments. Details of these can be found in CIRIA 644 and the Interim Code of Practice for Sustainable Drainage Systems.

2. Surface water drainage attenuated through the use of infiltration methods such as soakaways unless ground conditions are proven (through undertaking appropriate tests) to be inappropriate due to insufficient porosity or if gross contamination is present.

3. Surface water drainage attenuated through the use of above ground sustainable drainage techniques such as swales, attenuation ponds (both formal and informal as part of the general landscaping design), green detention areas and/or areas of permeable paving (especially within parking and pedestrian areas). All these methods can be designed into site layouts without the need for permeable ground conditions or where ground contamination is present and would still meet most of the core principles as set out in the Interim Code of Practice and CIRIA609 (p.29). The present proposals for this site have limited space for such provision.

4. If the above cannot contain the full attenuation volumes required, then consideration will be given to their use in a combined system with other attenuation storage techniques.

Generally the EA requires that source control techniques such as rainwater harvesting must be considered for inclusion in the site design. For a light industrial development this is unlikely to be practical or worthwhile, but it will be considered at detail design stage.

The EA emphasises that treatment of surface water is an important component of sustainable drainage, so swales and infiltration drainage are recommended. Infiltration drainage may be appropriate for this site, but would depend on infiltration testing. Should infiltration not prove to be possible for disposal of surface water from the site, then surface water could be discharged, after suitable treatment, to the Battlefield Brook. The headwall for a piped discharge to the watercourse would require consent from the EA.

The development proposals for the site significantly increase the impermeable area from zero at present to approximately 95%. If infiltration drainage is not possible, the EA will require attenuation storage to reduce the runoff to greenfield rates. The volume of storage required can be reduced by the use of permeable paving for parking areas.

If infiltration drainage is not possible, the estimated volume of attenuation storage required for the 100-year event plus 20% is between 531 m^3 and 761 m^3 for Plot 2 only based on a greenfield runoff rate of 5.0 l/s/ha. These figures are based on the preliminary runoff calculations which are included in Appendix D.

The above principles are expected to be included as a condition of any planning permission and will be used during the detailed design process.

5 FLOOD RISK MANAGEMENT

PPS25 recommends that a risk-based approach and sequential test are used in order to determine whether a site is suitable for a particular development. The assessment of risk and sequential test are considered as follows:

At present the proposed development site is shown on the EA flood risk map to be located mainly within Flood Zone 1.

The results of the hydraulic modelling, undertaken by Enviros Consulting Ltd, show that the site is actually entirely within Flood Zone 1. Also, the site is a minimum of 2.8 m above the 100 year flood level, therefore, in accordance with PPS25 the site is considered suitable for the proposed development.

The EA byelaws require that there should be no construction within 8 metres from the top of bank of the watercourse to allow maintenance access. The current proposals are at a minimum of 8.5 metres from the top of bank of the Battlefield Brook.

The development of the site will increase the impermeable area. A reduction in runoff will be managed either by infiltration or attenuation storage to ensure flows are restricted to the Greenfield runoff rate or less. The exact nature of the drainage will be determined at detail design stage.

Finished floor levels for the proposed new development will be set 150 mm above surrounding ground levels in accordance with the Building Regulations so the future risk of flooding from surface water run-off or overland flow will be minimal.

6 CONCLUSIONS

It is concluded that the site is at low risk of fluvial or tidal flooding and in accordance with the requirements of the sequential test in PPS25: Development and Flood Risk, the site is considered suitable for the proposed development.

In accordance with the recommendations in PPS25, the design of the new development will adopt measures to reduce the surface water discharge through the use of sustainable drainage techniques. The maximum runoff rate from the site will be reduced to greenfield rates and is likely to be disposed of directly to the Battlefield Brook unless infiltration proves to be feasible. It is recommended that, if infiltration does not prove practicable, permeable paving is considered for use in parking and vehicular access areas in order to provide attenuation storage within the sub-base below.

This report concludes the site is at low risk of flooding and will not increase flood risk elsewhere in the catchment. Furthermore it is concluded that there is a practical means of surface water management for the site.

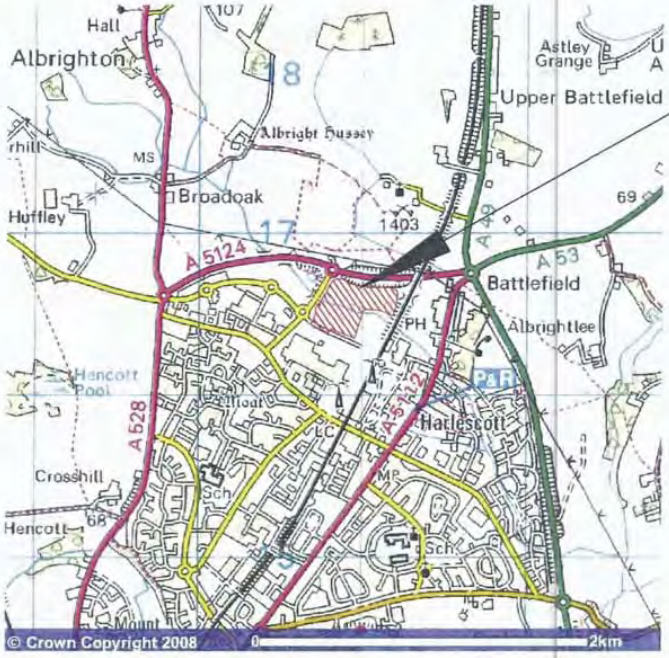
Appendix A

Site Location Plan – E013423-5-001

Aerial photograph – E013423-5-004

Topographical Survey – WYG/MSE/2835-1

SITE LOCATION
POSTCODE
SY1 3EQ



APPROXIMATE SITE
BOUNDARY
OS GRID REF
350943, 316518

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Newstead Court
Little Oak Drive
Sherwood Business Park
Annesley
Notts, NG15 0DR

Tel: 01623 684550
Fax: 01623 684551
e-mail: nottingham@wyg.com
website: www.wyg.com

White Young Green

Consulting Engineers

Civil Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Client
ADVANTAGE WEST MIDLANDS

Project
BATTLEFIELD WAY
SHREWSBURY

Drawing Title
SITE LOCATION PLAN

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	WT	JULY 2008	DR			

Project No.	Office	Type	Drawing No.	Revision
E013423-1	5101	C&S	001	

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

Rev	Description

Saved location path

Appendix B

EA Flood Risk Map – E013423-5-002

EA Groundwater Protection Zone Map – E013423-5-003

KEY

FLOOD RISK ZONES

- Flooding from rivers or sea without defences
- Extent of extreme flood
- Flood defences
- Areas benefiting from flood defences

Rev.	Description	By	Chk	App	Date

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herwood Business Park
nnesley
wotts, NG15 0DR

Tel: 01623 684550
Fax: 01623 684551
e-mail: nottingham@wyg.com
website: www.wyg.com

White Young Green

Consulting Engineers

A Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Client: ADVANTAGE WEST MIDLANDS

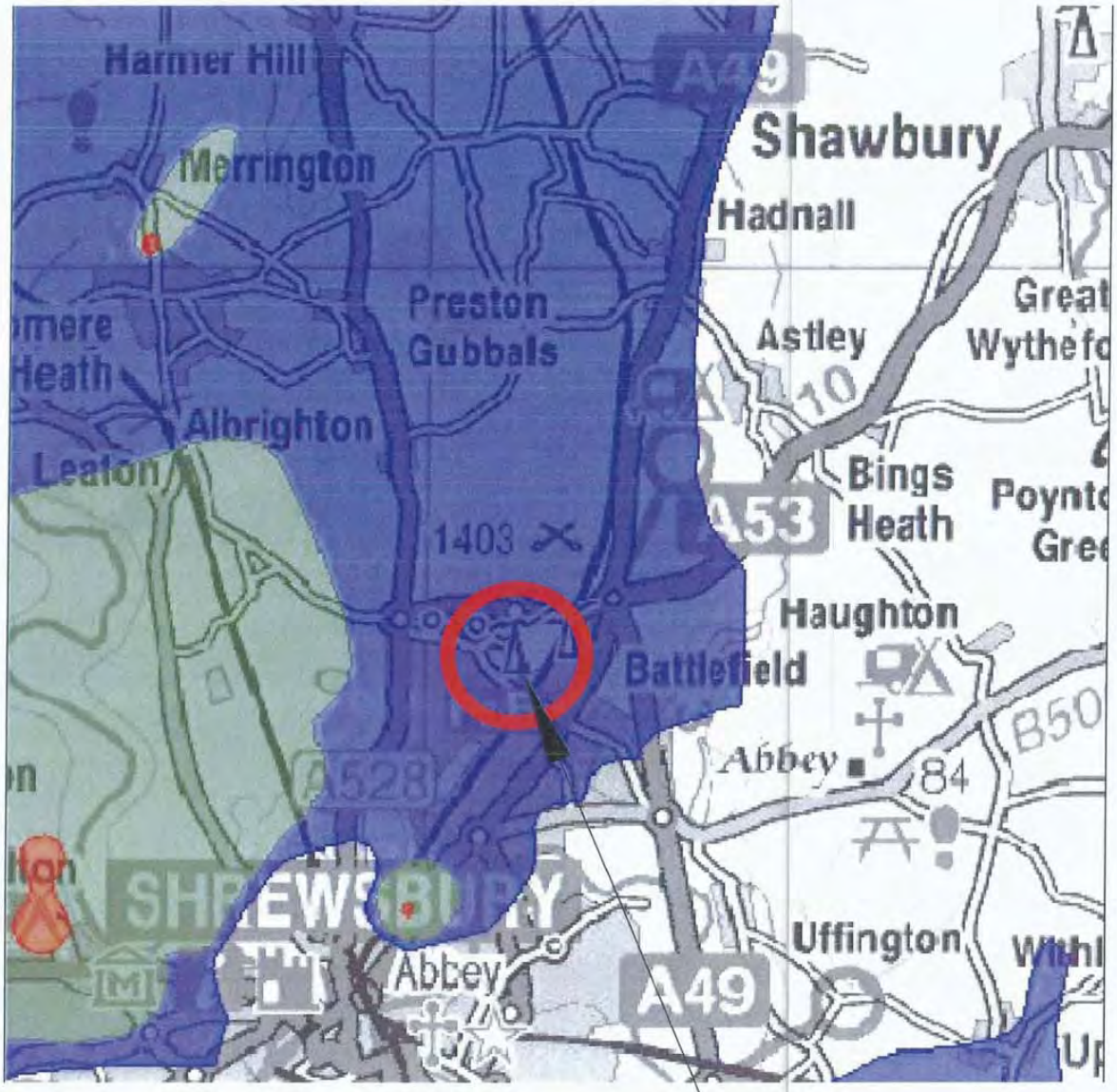
Project: BATTLEFIELD WAY SHREWSBURY

Drawing Title: ENVIRONMENT AGENCY FLOOD RISK MAP

Scale @ A4	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	RT	28.01.2008	DR			

Project No.	Office	Type	Drawing No.	Revision
E013423-1	5101	C&S	002	

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



KEY

GROUNDWATER SOURCE PROTECTION ZONES

- Inner zone
- Outer zone
- Total catchment
- Special interest

Rev	Description	By	Chk	App	Date

Saved location path
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Sherwood Business Park
Annesley
Notts, NG15 0DR

Tel: 01623 684550
Fax: 01623 684551
e-mail: nottingham@wyg.com
website: www.wyg.com

White Young Green

Consulting Engineers

Ind Electrical Environmental Health & Safety Highways Management Services Mechanical Rail Structural Town Planning Transportation

Client: ADVANTAGE WEST MIDLANDS

Project: BATTLEFIELD WAY SHREWSBURY

Drawing Title: ENVIRONMENT AGENCY GROUNDWATER PROTECTION ZONES

Scale at A4	Drawn By	Date	Checked By	Date	Approved By	Date
NTS	RT	29.01.2009	DR			

Project No.	Office	Type	Drawing No.	Revision
E013423-1	5101	C&S	003	

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

Appendix D

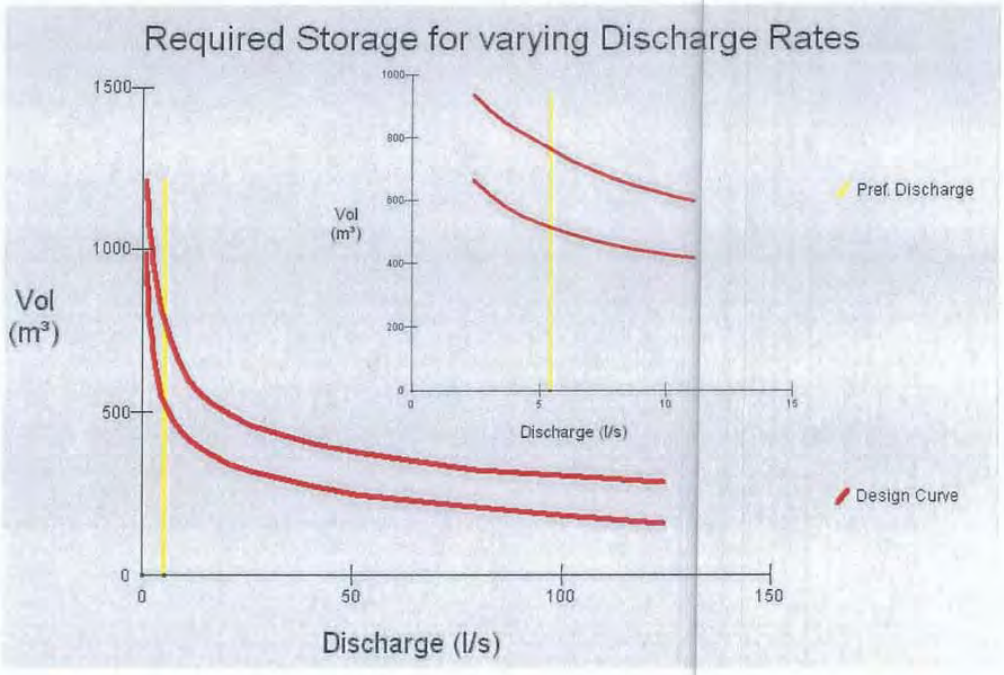
Preliminary surface water attenuation storage calculation

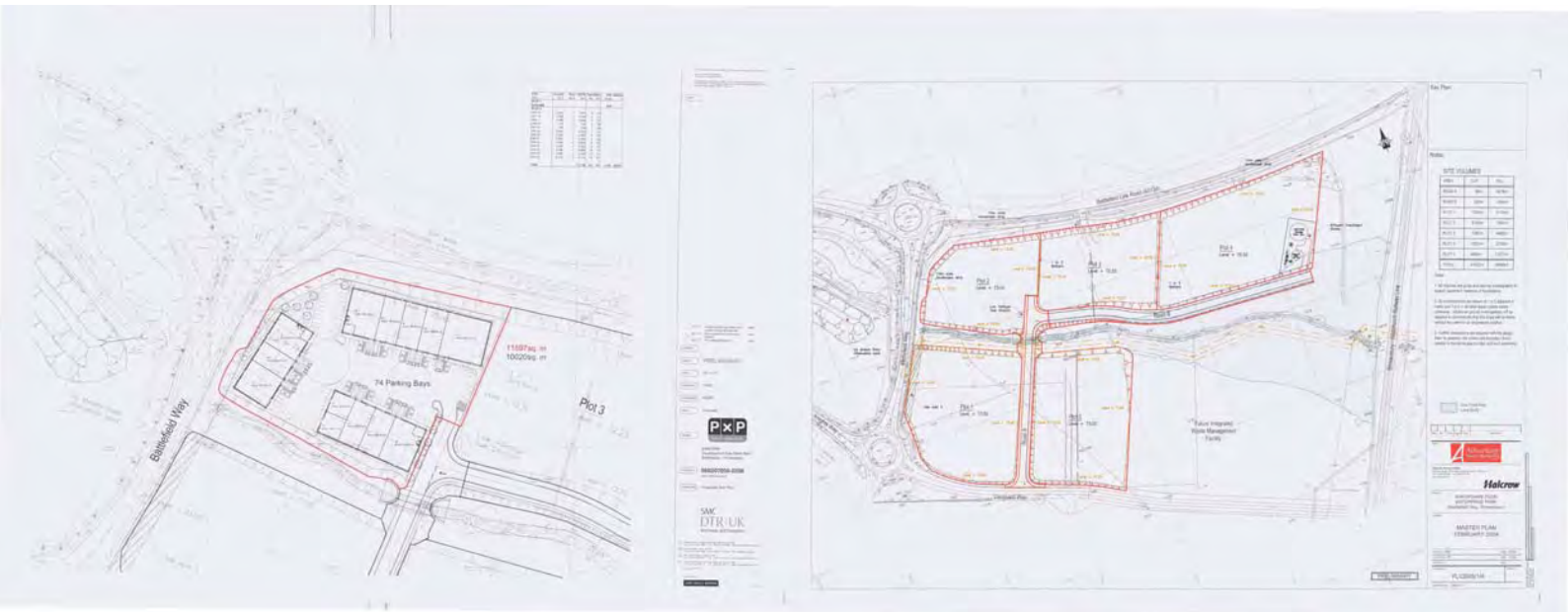
Attenuation Storage calculation -Battlefield Way, Shrewsbury

Region	FEH Rainfall Model	Cv (Summer)	0.750
Return Period (years)	100+20%	Cv (Winter)	0.840
Site Location		Impermeable Area (ha)	1.09
351650 316000 SJ 51650 1600 ...		Maximum Allowable Discharge (l/s)	5.4
C(1km)	-0.026	D3(1km)	0.315
D1(1km)	0.345	E(1km)	0.287
D2(1km)	0.370	F(1km)	2.362

Global Variables require approximate storage of between 513 m³ and 761 m³.

These values are estimates only and should not be used for design purposes.




Battlefield Way
74 Parking Bays
Plot 3
Future Integrated Waste Management Facility
Halcrow

APPENDIX 3

Flood Risk Assessment – Mercedes Benz Dealership, Shrewsbury
(Glanville – July 2012)

Glanville

FLOOD RISK ASSESSMENT

Mercedes Benz Dealership, Shrewsbury

Prepared for: Warwick Holdings Ltd
Issue 2: 19 July 2012
Ref: ST8120424/JR/LR/005

Document History

Issue	Date	Description	Prepared By	Checked By
1	12 Jul. 12	Flood Risk Assessment	Jordan Rayner	Kevin Rayner
2	19 Jul. 12	Flood Risk Assessment	Jordan Rayner	Kevin Rayner

Glanville

Glanville Consultants is a multi-disciplinary consultancy with the following expertise:

- Civil and Structural Engineers
- Building Surveyors
- Highway and Traffic Engineers
- Transport Planners
- Land Surveyors
- Building Investigation Experts
- CDM Co-ordinators

For further advice contact:

Cornerstone House
62 Foxhall Road
Didcot
Oxfordshire OX11 7AD

Telephone: 01235 515550
Fax: 01235 817799

Offices also at:

3 Grovelands Business Centre
Boundary Way
Hemel Hempstead
Hertfordshire HP2 7TE

Telephone: 01442 835999
Fax: 01442 258924

postbox@glanvillegroup.com
www.glanvillegroup.com

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Contents

Figures

Appendices

1.0 Introduction

1.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of Warwick Holdings Ltd in support of a planning application for the construction of a new Mercedes Benz dealership and workshop at Greenhill Enterprise Park, Shrewsbury.

1.2 The purpose of this document is to identify the existing level of flood risk to the site within the context of the redevelopment proposals. The report also outlines a strategy for the disposal of surface water for the site once developed.

1.3 This assessment has been prepared in accordance with the National Planning Policy Framework (March 2012), the Technical Guidance to the National Planning Policy Framework and local policy.

2.0 Existing Site Characteristics

Site Description

2.1 The application site is a vacant plot located within Greenhills Enterprise Park, Shrewsbury at Ordnance Survey grid reference SJ 50679 16529.

2.2 The site is currently undeveloped land located to the east of Enterprise Roundabout and bound to the west by Battlefield Way, to the south by Vanguard Way, to the east by an unnamed access road and to the north by further undeveloped land. The site is roughly rectangular in shape and has an approximate area of 1.3 hectares.

2.3 A site location plan is included within Figure 1 for reference.

Topographical Survey

2.4 A topographical survey of the site is included in Appendix A for reference. The survey shows the site level to be lowest in the northeastern corner of the site at 73.100 AOD and highest at the southern boundary of the site at 73.80 AOD, hence the general fall in level across the site is approximately 0.7m. The site levels are approximately 1m below the road level of the southwestern section of Vanguard Way.

2.5 A fence runs along the southern and western boundaries of the site, a raised soil bund runs along the eastern boundary and a bank of approximately 1 in 3 gradient runs along the northern boundary separating the site from the adjacent undeveloped land.

2.6 The survey shows Battlefield Way to fall in a northeasterly direction away from Enterprise Roundabout. Vanguard Way falls in northwesterly direction towards Enterprise Roundabout and the unnamed road falls in a northeasterly direction.

Existing Surface Water Drainage

2.7 The topographical survey also includes locations and mapping of underground services in and adjacent to the site. The survey shows that no surface water infrastructure was found to be located within the application site boundary.

2.8 The survey shows a 675mm diameter surface water sewer running along the centre of the unnamed road in a northeasterly direction adjacent to the eastern boundary of the site. A 225mm diameter surface water sewer is shown to begin half way up the unnamed road and runs adjacent to the 675mm diameter surface water sewer.

2.9 The survey also shows a 300mm diameter surface water sewer running within the footway adjacent to Battlefield Way and the site in a northeasterly direction. A 225mm diameter surface water sewer located within the Vanguard Way / Enterprise Roundabout junction connects to this 300mm diameter surface water sewer.

Geology

2.10 An intrusive site investigation was undertaken by BRD Environmental Ltd in March 2011 as detailed in report BRD1573-OR1. The intrusive investigation comprised of a mixture of sample boreholes and trial pits evenly spread across the site. The site was found to be underlain by various depths of made ground (0.5m – 1.15m) comprising of either reworked topsoil or reworked natural soils overlying Glacial Till or Glacial Fluvial deposits overlying Wilmslow Sand Formation.

2.11 The Glacial Till deposits were typically described as 'stiff brown slightly sandy gravelly blockily fissured clay' within the report. The sample boreholes and trial pit records show the Glacial Till deposits to typically began at a depth of 1m.

2.12 The Glacial Fluvial deposits were typically described as 'medium dense red brown to yellow brown in parts, clayey, slightly gravelly fine sand' within the report.

2.13 Wilmslow Sand Formation was described as 'very weak red fine grained sandstone' within the report. The sample boreholes and trial pit records show Wilmslow Sand Formation to typically begin at a depth of 3m.

2.14 Infiltration testing was undertaken in three locations across the site, TP101, TP102 and TP103. The tests in TP101 and TP103 were undertaken within the Glacial Fluvial deposits (depth of deposits ranged from 1.20m – 1.35m) and Glacial Till (depth of deposits ranged from 2.80 – 3.10m) respectively. No infiltration was recorded within these locations so an infiltration rate could not be calculated. The test in TP102 was undertaken within the Glacial Fluvial deposits (depth of deposits ranged from 0.9m-1.9m) in the southern end of the site and produced an infiltration rate of 1.05×10^{-6} m/s.

2.15 The intrusive site investigation recommended that if soakaways were to be implemented on the proposed site they would need to subject to be careful placement in the southern end of the site to target the thicker layers of Glacial Fluvial deposits. It was also recommended that storage capacity would need to be provided onsite.

Existing Watercourse

2.16 There are no existing watercourses within the proposed site boundary. The closest watercourse to the site is the Battlefield Brook which is located approximately 100m northeast of the site. The river is classified as a main river by the Environment Agency (EA). The River Severn flows through Shrewsbury and is located approximately 2.5km south of the site.

Groundwater Vulnerability

2.17 The EA publishes plans of indicative Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. The zones define areas where a range of human activities may damage / pollute groundwater. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest.

2.18 Examination of the EA groundwater mapping shows that the proposed development site is not within a source protection zone.

2.19 A review of the EA bedrock aquifer maps indicate that the bedrock underlying the proposed development site is classed as a principal aquifer. This means that the bedrock provides a high level of water storage and may be of some strategic drinking water importance. The previous EA designation for a principal aquifer was a major aquifer.

2.20 A review of the superficial deposits aquifer maps indicate that the superficial deposits underlying the proposed site are not classed within an aquifer designation.

2.21 A review of the ground water zone maps indicate that the development is underlain by ground considered as a major aquifer high.

3.0 Proposed Development

3.1 The current development proposals include the construction of a new Mercedes Benz dealership with a workshop, prep buildings, a rear service area and customer parking areas.

3.2 It is further proposed to access the development by a new junction from an unnamed road off Vanguard Way.

3.3 A proposed site plan prepared by David J Stewart Associates, drawing number 2011/1006/SK10 is included in Appendix B for reference.

4.0 Planning Policy and Guidance

4.1 Set out below is a summary of the national and local policy, legislation and guidance relating to flood risk that are relevant to the development proposals.

National

4.2 At a national level the National Planning Policy Framework and accompanying Technical Guidance ensures that flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest flood risk. The National Planning Policy Framework retains a risk based approach to the planning process and defines three flood zones to be used as the basis for applying the sequential test to consider a development in terms of Flood Risk Vulnerability Classifications, which defines the type of development that is considered appropriate within each Flood Zone.

Local

Shropshire Council, Shrewsbury Surface Water Management Plan (SWMP), Intermediate Report, June 2012

4.3 Hyder Consulting UK was appointed by Shropshire Council to produce a SWMP in order to understand the causes and effects of surface water flooding in Shrewsbury and to establish a long term cost effective action plan to manage surface water flood risk. The SWMP also reviews flooding by other sources such as fluvial, groundwater and sewers.

4.4 The SWMP makes reference to the River Severn Catchment Flood Management Plan, 2008. Shrewsbury is classified within policy unit 4, which is defined as "taking further action to sustain the current level of flood risk into the future."

Shropshire Outline Water Cycle Study, Final Report, June 2010

4.5 This study was produced by Halcrow Group Ltd to inform spatial strategy for Shropshire. The study identifies Shrewsbury as an area of significant fluvial flood risk, but also as a settlement of significant development. The development site was not mentioned specifically as an area of significant risk.

Shropshire Core Strategy, Final Plan Publication, February 2010

4.6 The core strategy sets out Shrewsbury's Council's vision, strategic objectives and the broad spatial strategy to guide future growth. Policy CS18 focus is sustainable water management and states the following:-

"Developments will integrate measures for sustainable water management to reduce flood risk, avoid an adverse impact on water quality and quantity within Shropshire, including groundwater resources, and provide opportunities to enhance biodiversity, health and recreation, by ensuring that:

- Planning applications and allocations in the Site Allocations and Management of Development DPD, are in accordance with the tests contained in PPS25, and have regard to the SFRAs for Shropshire;

- New development is designed to be safe, taking into account the lifetime of the development, and the need to adapt to climate change. Proposals should have regard to the design guidance provided in the SFRAs for Shropshire;
- All development within local surface water drainage areas, as identified by the Water Cycle Study, and any major development proposals, demonstrate that surface water will be managed in a sustainable and coordinated way. Proposals should be supported by either a Surface Water Management Statement or Plan, depending on the scale of the development;
- All developments, including changes to existing buildings, include appropriate sustainable drainage systems (SUDS) to manage surface water. All developments should aim to achieve a reduction in the existing runoff rate, but must not result in an increase in runoff;
- New development improves drainage by opening up existing culverts where appropriate;
- Proposals within areas of infrastructure capacity constraint, as identified by the Water Cycle Study and the Implementation Plan, and any major development, demonstrates that there is adequate wastewater infrastructure in place to serve the development;
- New development enhances and protects water quality, including Shropshire's groundwater resources;
- New development, including changes to existing buildings, incorporate water efficiency measures, in accordance with the sustainability checklist in Policy CS6, to protect water resources and reduce pressure on wastewater treatment infrastructure;"

Shropshire Council, Shrewsbury Strategic Flood Risk Assessment (SFRA), August 2009

4.7 This assessment was produced by Halcrow Group Limited to model the River Severn through Shrewsbury town centre. The site is located within the northeast of Shrewsbury at 73.100 AOD at its lowest, therefore the site is not considered at be at risk flood risk from the River Severn as from a review of ordnance survey maps the River Severn is approximately situated at 50m AOD throughout Shrewsbury's town centre. Therefore the conclusions of this SFRA have no impact on the sites development.

4.8 Chapter 6 of the SFRA provides development control polices and guidance for developments in different flood zones. The recommendations are in line with PPS25 and are in accordance with the broad policies of the "Middle Severn" policy unit. With regards to surface water runoff from new developments, the development control policy states the following:

"Any development must ensure that post development runoff volumes and peak flow rates are attenuated to the Greenfield (post-development) condition with a minimum reduction of 20%."

4.9 The development control polices with chapter 6 also recommends that for site specific flood risk assessments in Shrewsburry:

"The post development runoff volumes and peak flow rates should be attenuated (1 in 100 year + climate change)."

5.0 Sources of Potential Flooding

5.1 Flood risk to the site is considered from all likely sources of flooding, defined in the Technical Guidance to the National Planning Policy Framework.

Tidal / Coastal

5.2 Tidal flooding is not considered an issue for the development of the site as no tidal sources are located within close proximity to the site and the sites lowest elevation is approximately 73.100 AOD. Therefore, tidal flooding is not considering further in this report.

Reservoir

5.3 The EA publish indicative reservoir flood mapping on their website which shows the maximum extent of reservoir flooding. The mapping indicates that the development site is not located within a reservoir flood risk area. An extract from the online EA reservoir flood maps is included in Appendix C for reference.

Groundwater Flooding

5.4 Shrewsbury SWMP states that the Strategy for Flood and Coastal Erosion Risk Management Ground Water Flooding Scoping Study, 2004 conducted by Jacobs did not identify any incidences of groundwater flooding in Shrewsbury's underlying stratum. The SWMP also includes a map which indicates areas susceptible to groundwater flooding and is included in Appendix D for reference. The map shows that the development site is not within an area susceptible to groundwater flooding. Therefore, groundwater flooding is no considered further in this report.

Sewer Flooding

5.5 The topographical survey within Appendix A includes locations and mapping of underground services. The survey shows that no sewers are currently located within the boundary of the site, therefore it is a reasonable to assume that the site is not subject to sewer flooding.

5.6 Severn Trent Water maintains a register of confirmed internal and external sewer flooding locations due to hydraulic overloading. Figure 3-1 of the Shrewsbury SWMP indicates that postcode SY13 (the site is included in this) has had 5 registered confirmed sewer flooding incidences at the time of writing the report. As there are no recorded sewer flooding incidences in the development site, therefore sewer flooding is not considered further in this report.

Surface Water Flooding

5.7 The Shropshire Council's drainage and flooding interactive map does not indicate the site to be within an area subject to surface water flood risk. An extract of the drainage and flooding interactive map is included in Appendix E for reference.

Fluvial

5.8 The online EA fluvial flood maps confirm that the development site is located within Flood Zone 1, an extract from EA flood zone mapping is included in Appendix F for reference. The Technical Guidance to the National Planning Policy Framework Table 1 defines areas of land located within Flood Zone 1 as those areas outside of the flood plain where there is little or no chance of flooding. These are areas with an indicative probability of flooding of 1 in 1000 years of greater (i.e. less than 0.1% chance in any given year) from fluvial sources.

6.0 Flood Risk Assessment

6.1 The National Planning Policy Framework encourages a sequential risk based approach to determine the suitability of land for development. This document advises that sites within Flood Zone 1 should be given preference where available. Table 1 of the Technical Guidance to the National Planning Policy Framework advises that all land uses are appropriate in Flood Zone 1. Therefore, developing the site for residential use is considered appropriate in terms of flood risk.

6.2 As defined in Table 3 of the Technical Guidance to the National Planning Policy Framework, neither the sequential nor the exceptions tests are required in this instance.

Flood Compensation

6.3 Given that the site is located within Flood Zone 1, no development proposals within the curtilage will displace flood waters or result in a loss of flood storage.

6.4 Flood compensation will therefore not be required and re-profiling works will also not be required.

Flood Resilience

6.5 Again, given the site is located within Flood Zone 1, additional flood resilience in the form of raised floor levels are not required.

Safe Access

6.6 New developments are required to provide safe access and egress during a flood event. Safe access and exit is required to enable the evacuation of people from a development during a period of flooding and allow access to emergency services. As the site is within Flood Zone 1, safe access can be taken from Vanguard Way, Battlefield Way or the unnamed road as all are adjacent to the site.

7.0 Surface Water Drainage

7.1 Table 1 in the Technical Guidance to the National Planning Policy Framework defines the policy aims for developments within Flood Zone 1. With regard to surface water drainage, development proposals should include the "appropriate application of sustainable drainage systems." Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible.

7.2 As mentioned in Section 4.6, Shropshire's Core Strategy Policy CS18 states that all developments should include appropriate sustainable drainage systems to manage surface water. It also states that developments should aim to achieve a reduction or maintain the pre development surface water runoff rate.

7.3 Shropshire Council's drainage and flooding interactive map indicates that the use of infiltration sustainable drainage is applicable to the development site and surrounding area.

7.4 Sustainable drainage systems encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume and environmental impact of runoff and include:

- Permeable pavements
- Swales and basins
- Green roofs and rainwater reuse
- Infiltration trenches and filter drains
- Ponds and wetlands

7.5 Infiltration based techniques are high up in the hierarchy of techniques available due to the ability for close to source dispersion of surface water. This best mimics the situation of an undeveloped site.

7.6 Sustainable infiltration techniques include the use of gravel filled trench soakaways, concrete ring soakaways, infiltration trenches, infiltration blanket, swales and permeable paving. When used across a site these techniques control the rate of discharge, attenuate flow, provide storage and recharge groundwater. Storage capacity within infiltration systems can be increased with the use of cellular storage crates.

7.7 As well as allowing infiltration, permeable paving also degrades pollutants such as hydrocarbons, which thereby improves the quality of surface water.

Proposed Surface Water Strategy

7.8 Utilising sustainable infiltration techniques to discharge the proposed development's surface water runoff at source will be considered.

7.9 Porous sub-base will be used in the external display and parking bays across the site and any overflow will discharge into a new gravity surface water drainage system within the site. Even if infiltration is less effective in some areas of the site, the porous sub-base will still attenuate flow and provide additional storage to the system. The surface water drainage system within the site will outfall to the 675mm diameter in

the unnamed road. This would be with the intention to restricted flow rate to match existing green field runoff rates of the site.

7.10 Flow restriction would be achieved by the inclusion of a control chamber manhole (hydrobrake or similar) upstream of the outfall. An indicative drainage strategy is included in Figure 2 for reference.

7.11 It is proposed to harvest rainwater from the showroom and valet buildings and collect it in and underground storage tank within the car park. The water will be reused by the car wash onsite.

Storage Provision

7.12 MicroDrainage software was used to calculate the minimum depth of storage required in the pourous sub-base areas of the site in order to achieve a maximum of 5 l/s discharge (assumed green field rate) to the existing sewer. The storage areas were designed to accommodate flows for a 1 in 100 year rainfall event plus a 30% allowance for climate change, which is in line with the Shropshire Council SFRA for Shrewsbury. All calculations have assumed that there is no ground infiltration in order to provide a robust storage design.

7.13 Results indicate that the use of a hydrobrake to restrict the flow would result in a minimum depth of storage in the sub-base of 500mm. The MicroDrainage calculations are included in Appendix G for reference. The final depth of storage required is subject to confirmation following detailed design.

Future Maintenance

7.14 The Flood and Water Management Act, 2010 encourages the use of sustainable drainage in new developments. The Act allows SUDS assets which serve more than one property to be adopted and maintained by the Local Drainage Authority, which in this case is Shropshire County Council. As all soakaways on site will remain under a single ownership they will remain private and maintenance can be supervised by an appointed management company.

7.15 All new surface water infrastructure would be designed in accordance with Sewers for Adoption (6th Edition) and the Interim Technical Addendum No. 1 where appropriate.

8.0 Summary and Conclusion

Summary

8.1 This Flood Risk Assessment has been prepared in accordance with the National Planning Policy Framework and Technical Guidance to accompany a planning application for the construction of a new Mercedes Benz dealership and workshop at Greenhill Enterprise Park, Shrewsbury.

8.2 This site is located within Flood Zone 1, which defines an area with an indicative probability of flooding of 1 in 1000 years or greater from fluvial sources. The site is therefore considered to be in a suitable zone for development in terms of flood risk.

8.3 As defined in Table 3 of the Technical Guidance to the National Planning Policy Framework, the exception is was not required.

8.4 There are no particular constraints with regard to flood compensation, resilience or dry access that would hinder the development of the site.

8.5 Utilising sustainable infiltration techniques to discharge the proposed development's surface water runoff at source will be considered. Where possible infiltration drainage will be placed within Glacial Fluvial deposits which typically occur at depths between 0.5m to 1m.

8.6 Porous sub-base will be used in the external display and parking bays across the site and any overflow will discharge to a new gravity surface water drainage system within the site. This gravity surface water drainage system will outfall to the 675mm diameter in the unnamed road. This would be with the intention to restricted flow rate to match existing green field runoff rates of the site. This would be achieved by a control chamber manhole.

8.7 It is proposed to incorporate rainwater harvesting and reuse systems into the site via an underground storage tank within the car park collecting the rainwater from the showroom and valet buildings. The water will be reused by the car wash on site. The tank will reduce the volume of water discharged off site.

8.8 MicroDrainage software was used to calculate the minimum depth of storage required in the porous sub-base areas of the site in order to achieve a maximum of 5 l/s discharge (assumed green field rate) to the existing sewer. The storage areas were designed to accommodate flows for a 1 in 100 year rainfall event plus a 30% allowance for climate change. Results indicate that the use of a hydrobrake to restrict the flow would result in a minimum depth of storage in the porous sub-base of 500mm. The final depth of storage required is subject to confirmation following detailed design.

Conclusion

8.9 In conclusion, this Flood Risk Assessment has demonstrated that the proposed development:

- Will not be at unacceptable risk of flooding from any source.
- Will not increase flood risk elsewhere.
- Will employ a surface water drainage design based upon the principles of sustainable drainage.
- Will restrict surface water runoff rate to match existing green field runoff rates.

8.10 On this basis, the proposals are considered to fully comply with national, regional and local planning flood risk policy.

Figures

NOTES

1. This drawing to be read in conjunction with all relevant documents and specifications.
2. Dimensions not to be scaled.

LOCATION

Address: Greenhills Enterprise Park, Shrewsbury, SY13TG

Grid Ref: SJ 50679 16529

N

Rev.	Description	Date	Chkd

Glanville
Cornerstone House
62 Foxhall Road, Didcot
Oxon, OX11 7AD
Tel: (01235) 515550 Fax: (01235) 817799
postbox@glanvillegroup.com www.glanvillegroup.com

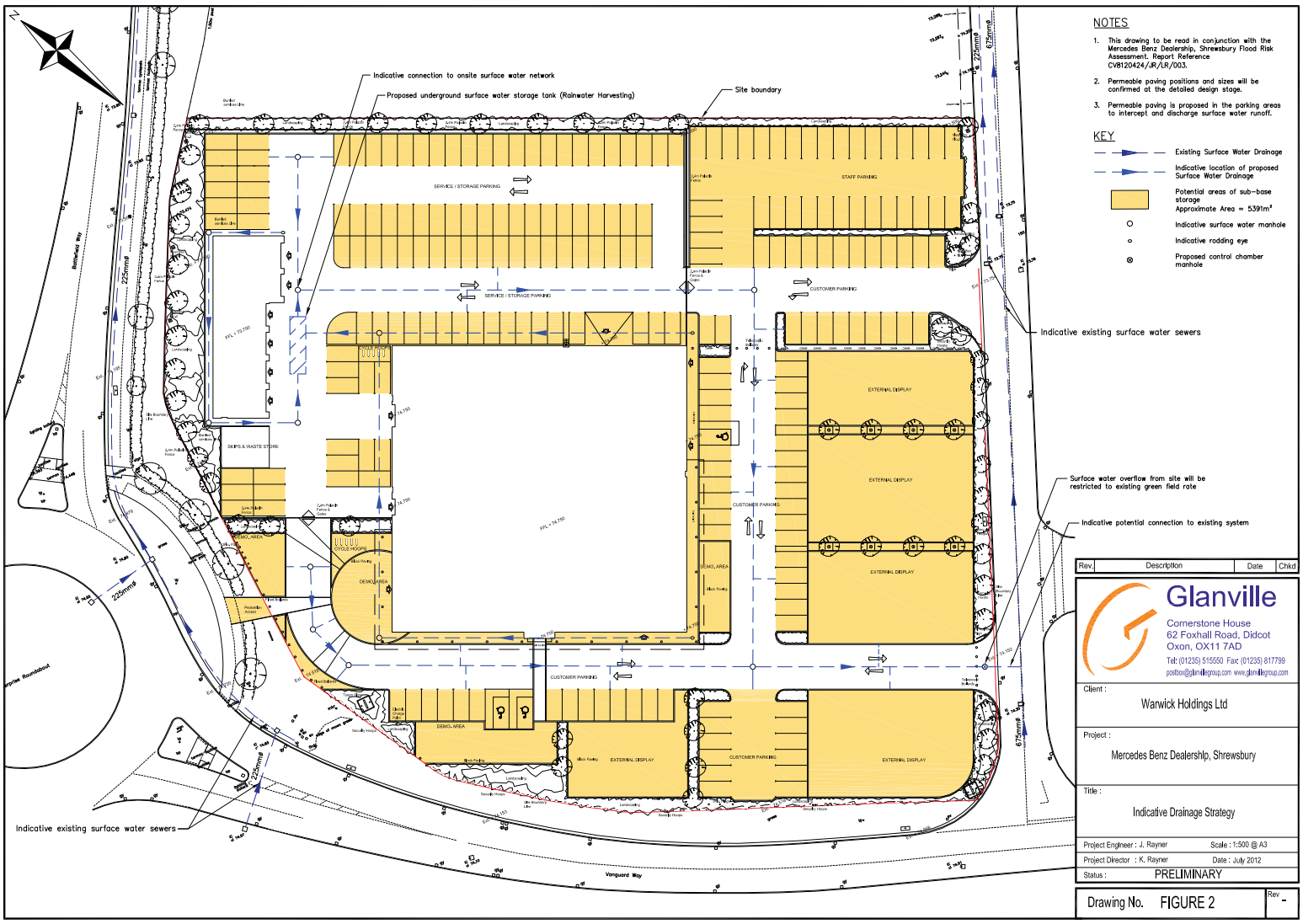
Client : Warwick Holdings Ltd

Project : Mercedes Benz Dealership, Shrewsbury

Title : Site Location Plan

Project Engineer :	J. Rayner	Scale :	Not to scale
Project Director :	K. Rayner	Date :	July 2012
Status :	INFORMATION		

Drawing No. Figure 1 Rev -



NOTES

1. This drawing to be read in conjunction with the Mercedes Benz Dealership, Shrewsbury Flood Risk Assessment. Report Reference CV8120424/JR/LR/003.
2. Permeable paving positions and sizes will be confirmed at the detailed design stage.
3. Permeable paving is proposed in the parking areas to intercept and discharge surface water runoff.

KEY

- Existing Surface Water Drainage
- Indicative location of proposed Surface Water Drainage
- Potential areas of sub-base storage Approximate Area = 5391m²
- Indicative surface water manhole
- Indicative rodding eye
- Proposed control chamber manhole

Rev.	Description	Date	Chkd

Glanville
Cornerstone House
62 Foxhall Road, Didcot
Oxon, OX11 7AD
Tel: (01235) 515550 Fax: (01235) 817799
postbox@glanvillegroup.com www.glanvillegroup.com

Client : Warwick Holdings Ltd

Project : Mercedes Benz Dealership, Shrewsbury

Title : Indicative Drainage Strategy

Project Engineer : J. Rayner — Scale : 1:500 @ A3

Project Director : K. Rayner — Date : July 2012

Status : PRELIMINARY

Drawing No. FIGURE 2 — Rev. -

Appendices

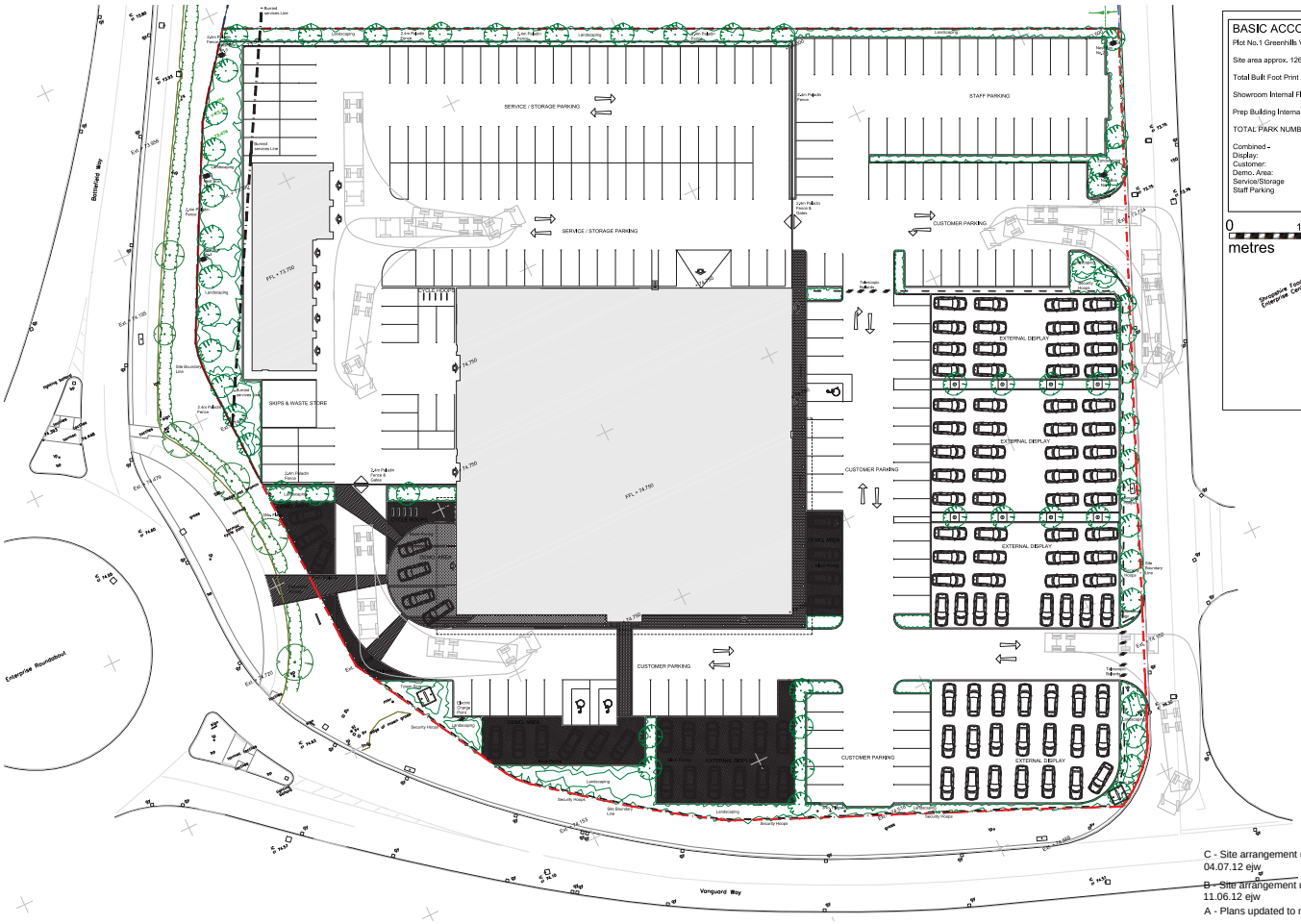
Appendix A

Topographical Survey

Enterprise Roundabout
Vanguard Way
Shropshire Food Enterprise Centre
WE BELIEVE 90mm PE GAS TO RUN IN POSITION AS SHOWN, CONTRADICTING NATIONAL GRID RECORD DRAWINGS (UNABLE TO CONFIRM)
90mm PE GAS MAIN PLOTTED AS SHOWN ON NATIONAL GRID RECORD DRAWINGS.
Topographic Legend
Services Survey Key
Services Survey Notes
Please note surveyed boundaries may not represent the extent of legal ownership of the land.
Contractor should check crucial dimensions on site before commencement of any work.
Grid Orientation: Coordinates related to Ordnance Survey Grid using observations from the OS Commercial RTK Network correction service.
Level Datum: OS values using GPS RTK Commercial Network Service (OSTN02 transformation).
OS NORTH
N
We are not allowed to lift or access BT covers and therefore our survey for BT cables may be restricted. For this reason we advise contacting BT to arrange BT duct location by BT Engineers prior to any excavation.
Non-locatable services not shown on our survey may exist.
Services not electronically located are annotated as follows:
GPR GROUND PROBING RADAR
NL-A NOT LOCATED - plotted in an assumed position
NL-I NOT LOCATED - plotted from on site information
NL-R NOT LOCATED - taken from records
NL-TS NOT LOCATED - plotted from visible trench scars
Depths to services are indicated by 1.00d etc. and are provided as a guidance only and are not infallible. Therefore if critical we advice confirmation by other means.
Drainage chambers depths are inverts from cover level.
Depths to services at chambers are to top of service.
Drainage details have been carried out by non-man entry means, unless otherwise stated. Pipe sizes and depths are as accurate as possible when surveyed from the surface.
rev1 07.03.12 additional notes presentation amendments
rev2 26.03.12 BT Duct/joint box added Assumed gas line added
Revision Date Remarks
Client
David J Stewart Associates
Project Title
Vanguard Way, Shrewsbury, Shropshire, SY1 3TG
Topographic Survey including Location and Mapping of Underground Services.
drawing no. 5807-Vanguard
date 7th March 2012
surveyed JD-OM
drawn JD
chkd AD
scale 1:250
plot A0
TOPOGRAPHIC SURVEYS • GPS • UTILITY SURVEYS • GROUND PROBING RADAR
The Old Stables 70a Oxford Street Rugby Warwickshire CV21 3NE
Tel: 01788 546093
Fax: 01788 546093
mail@rgisurveys.com
www.rgisurveys.com
Cert No. GB2002292
rgi SURVEYS
© COPYRIGHT 2010 RUGBY GROUND INFORMATION LTD (t/a RGI Surveys)
This drawing has copyright and may not be copied in whole or in part or used for any purpose other than that for which it was supplied without written consent

Appendix B

Proposed Site Plan



BASIC ACCOMMODATION SCHEDULE

Plot No.1 Greenhills Vanguard Way Shrewsbury:

Site area approx. 12685 sq m (3.1 acres)

Total Built Foot Print Area :	2362 sqm
Showroom Internal Floor Area:	GF - 2024 sqm FF - 433 sqm
Prep Building Internal Area:	GF - 240 sqm
TOTAL PARK NUMBER :	325 spaces
Combined -	
Display:	89
Customer:	78
Demo. Area:	17
Service/Storage	107
Staff Parking	34

0 10 20 30
metres

Shropshire Food Enterprise Centre

C - Site arrangement updated to cover extended site - 04.07.12 ejw

B - Site arrangement updated to match revised layout - 11.06.12 ejw

A - Plans updated to match elevations - 14.05.12 ejw

David J Stewart Associates
Chartered Architects
The Coach House, 61 Hightown Road,
Banbury, Oxon
OX16 9BE
T: 01295 267565
F: 01295 270427
E: djs@djsa.co.uk

MERCEDES BENZ
VANGUARD WAY SHREWSBURY
PROPOSED SITE PLAN

DRAWING NO.	2011/1006/SK10
DATE	23.04.12
SCALE	1:250

REV: C
CHKD: EW

Appendix C

Environment Agency Reservoir Flood Map Extract

Notes:

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.

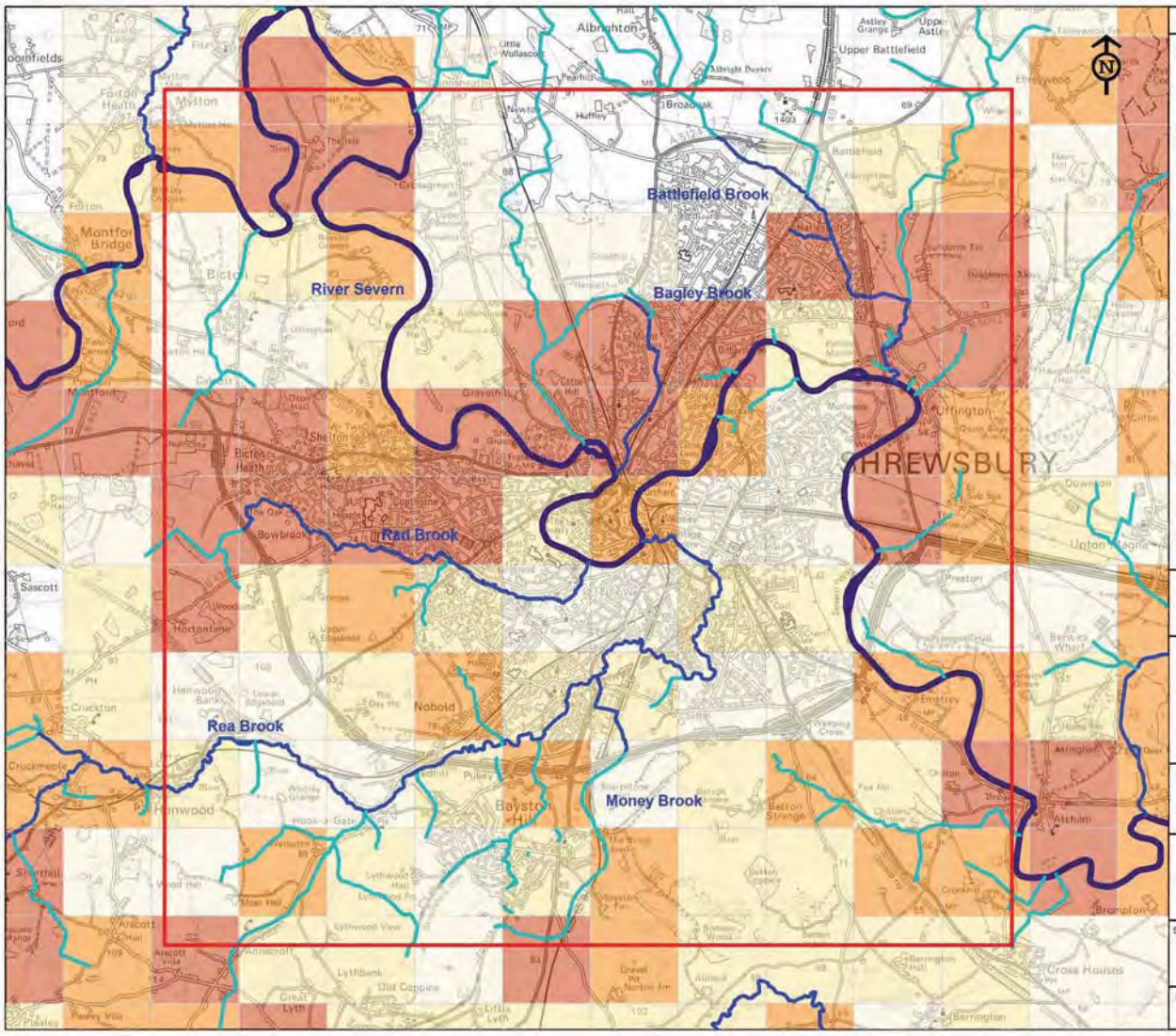
N

Glanville
Cornerstone House
62 Foxhall Road, Didcot
Oxon, OX11 7AD
Tel: (01235) 515550 Fax: (01235) 817799
postbox@glanvillegroup.com www.glanvillegroup.com

Project :	Mercedes Benz Dealership, Shrewsbury				
Title :	Environment Agency Fluvial Flood Map Extract				
Project Engineer :	J. Rayner	Scale :	NTS	Drawing No. Appendix C	Rev -
Project Director :	K. Rayner	Date :	June 2012		

Appendix D

Shrewsbury Surface Water Management Plan Groundwater Flooding Map



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

LEGEND

- SWMP Study Area
- Ordinary Watercourses
- Main Rivers
- River Severn - Main Rivers
- Open Waterbodies

Areas Susceptible to Groundwater Flooding (%)

- < 25
- >= 25 < 50
- >= 50 < 75
- >= 75

This map forms an approximate guide to areas that may be susceptible to groundwater flooding. However, for all new developments, site investigation is required to confirm local groundwater levels and therefore risk of groundwater flooding.

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Hyder

Shropshire Council

Shropshire County Council
Shirehall, Abbey Foregate, Shrewsbury, SY2 6ND

SHREWSBURY SURFACE WATER MANAGEMENT PLAN

FIGURE A4
AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING MAP

SCALE			
N.T.S	Produced	CG	Feb 2012
	Checked	LF	Feb 2012
	Approved	LF	Feb 2012

DRAWING NO.
5044-UA002182-06-BMD-00

Appendix E

Shropshire Council's Interactive Map Extract: Surface Water Flood Risk

Notes:

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.

N

Surface Water Flood Risk
- High
- Medium
- Low

Glanville
Cornerstone House
62 Foxhall Road, Didcot
Oxon, OX11 7AD
Tel: (01235) 515550 Fax: (01235) 817799
postbox@glanvillegroup.com www.glanvillegroup.com

Project :	Mercedes Benz Dealership, Shrewsbury				
Title :	Shropshire Council's Interactive Map Extract: Surface Water Flood Risk				
Project Engineer :	J. Rayner	Scale :	NTS	Drawing No. Appendix E	Rev -
Project Director :	K. Rayner	Date :	June 2012		

Appendix F

Environment Agency Reservoir Flood Map Extract

Notes:

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.

N

Glanville Cornerstone House 62 Foxhall Road, Didcot Oxon, OX11 7AD Tel: (01235) 515550 Fax: (01235) 817799 postbox@glanvillegroup.com www.glanvillegroup.com	Project :	Mercedes Benz Dealership, Shrewsbury			
	Title :	Environment Agency Reservoir Flood Map Extract			
	Project Engineer : J. Rayner	Scale : NTS	Drawing No.	Appendix F	Rev -
	Project Director : K. Rayner	Date : June 2012			

Appendix G

MicroDrainage Calculations

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1319 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	74.436	0.186	0.0	4.5	4.5	241.2	O K
30 min Summer	74.487	0.237	0.0	4.6	4.6	324.4	Flood Risk
60 min Summer	74.541	0.291	0.0	4.6	4.6	410.7	Flood Risk
120 min Summer	74.594	0.344	0.0	4.6	4.6	496.8	Flood Risk
180 min Summer	74.623	0.373	0.0	4.6	4.6	544.2	Flood Risk
240 min Summer	74.642	0.392	0.0	4.6	4.6	574.6	Flood Risk
360 min Summer	74.664	0.414	0.0	4.6	4.6	609.5	Flood Risk
480 min Summer	74.675	0.425	0.0	4.7	4.7	628.1	Flood Risk
600 min Summer	74.682	0.432	0.0	4.7	4.7	638.9	Flood Risk
720 min Summer	74.685	0.435	0.0	4.7	4.7	644.0	Flood Risk
960 min Summer	74.685	0.435	0.0	4.7	4.7	643.2	Flood Risk
1440 min Summer	74.676	0.426	0.0	4.7	4.7	629.5	Flood Risk
2160 min Summer	74.660	0.410	0.0	4.6	4.6	603.7	Flood Risk
2880 min Summer	74.642	0.392	0.0	4.6	4.6	574.4	Flood Risk
4320 min Summer	74.604	0.354	0.0	4.6	4.6	513.2	Flood Risk
5760 min Summer	74.568	0.318	0.0	4.6	4.6	454.2	Flood Risk
7200 min Summer	74.534	0.284	0.0	4.6	4.6	399.9	Flood Risk
8640 min Summer	74.504	0.254	0.0	4.6	4.6	351.0	Flood Risk
10080 min Summer	74.478	0.228	0.0	4.6	4.6	308.6	Flood Risk
15 min Winter	74.456	0.206	0.0	4.6	4.6	273.6	Flood Risk
30 min Winter	74.514	0.264	0.0	4.6	4.6	367.1	Flood Risk
60 min Winter	74.574	0.324	0.0	4.6	4.6	464.2	Flood Risk
120 min Winter	74.634	0.384	0.0	4.6	4.6	561.8	Flood Risk
180 min Winter	74.668	0.418	0.0	4.7	4.7	616.0	Flood Risk
240 min Winter	74.690	0.440	0.0	4.7	4.7	651.0	Flood Risk
360 min Winter	74.715	0.465	0.0	4.8	4.8	692.2	Flood Risk
480 min Winter	74.729	0.479	0.0	4.8	4.8	715.3	Flood Risk
600 min Winter	74.738	0.488	0.0	4.9	4.9	729.8	Flood Risk

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	113.879	19
30 min Summer	75.022	34
60 min Summer	47.182	64
120 min Summer	28.743	124
180 min Summer	21.254	182
240 min Summer	17.069	242
360 min Summer	12.434	362
480 min Summer	9.906	482
600 min Summer	8.310	602
720 min Summer	7.196	720
960 min Summer	5.729	954
1440 min Summer	4.149	1170
2160 min Summer	3.000	1552
2880 min Summer	2.381	1960
4320 min Summer	1.716	2768
5760 min Summer	1.359	3576
7200 min Summer	1.134	4328
8640 min Summer	0.977	5096
10080 min Summer	0.862	5760
15 min Winter	113.879	19
30 min Winter	75.022	33
60 min Winter	47.182	64
120 min Winter	28.743	122
180 min Winter	21.254	180
240 min Winter	17.069	240
360 min Winter	12.434	356
480 min Winter	9.906	472
600 min Winter	8.310	588

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Winter	74.743	0.493	0.0	4.9	4.9	738.0	Flood Risk
960 min Winter	74.746	0.496	0.0	4.9	4.9	742.4	Flood Risk
1440 min Winter	74.736	0.486	0.0	4.9	4.9	725.8	Flood Risk
2160 min Winter	74.714	0.464	0.0	4.8	4.8	690.7	Flood Risk
2880 min Winter	74.689	0.439	0.0	4.7	4.7	650.6	Flood Risk
4320 min Winter	74.635	0.385	0.0	4.6	4.6	562.5	Flood Risk
5760 min Winter	74.581	0.331	0.0	4.6	4.6	475.0	Flood Risk
7200 min Winter	74.530	0.280	0.0	4.6	4.6	393.5	Flood Risk
8640 min Winter	74.487	0.237	0.0	4.6	4.6	323.0	Flood Risk
10080 min Winter	74.452	0.202	0.0	4.6	4.6	266.7	Flood Risk

Storm Event	Rain (mm/hr)	Time-Peak (mins)
720 min Winter	7.196	700
960 min Winter	5.729	924
1440 min Winter	4.149	1340
2160 min Winter	3.000	1664
2880 min Winter	2.381	2128
4320 min Winter	1.716	3024
5760 min Winter	1.359	3864
7200 min Winter	1.134	4616
8640 min Winter	0.977	5360
10080 min Winter	0.862	6048

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.396	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time / Area Diagram

Total Area (ha) 1.270

Time (mins)	Area (ha)
0-4	1.270

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Model Details

Storage is Online Cover Level (m) 74.750

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	73.4
Membrane Percolation (mm/hr)	1000	Length (m)	73.4
Max Percolation (l/s)	1496.5	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	74.250	Cap Volume Depth (m)	0.000

Hydro-Brake® Outflow Control

Design Head (m) 0.500 Hydro-Brake® Type Md5 SW Only Invert Level (m) 74.250
Design Flow (l/s) 5.0 Diameter (mm) 106

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	0.800	6.1	2.000	9.6	4.000	13.5	7.000	17.9
0.200	4.6	1.000	6.8	2.200	10.0	4.500	14.3	7.500	18.5
0.300	4.5	1.200	7.4	2.400	10.5	5.000	15.1	8.000	19.1
0.400	4.6	1.400	8.0	2.600	10.9	5.500	15.9	8.500	19.7
0.500	4.9	1.600	8.6	3.000	11.7	6.000	16.6	9.000	20.3
0.600	5.3	1.800	9.1	3.500	12.7	6.500	17.2	9.500	20.8

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Glanville

Cornerstone House, 62 Foxhall Road,
Didcot, Oxon OX11 7AD

Tel: (01235) 515550
Fax: (01235) 817799

Postbox@glanvillegroup.com
www.glanvillegroup.com

- Civil and Structural Engineers
- Building Surveyors
- Highway and Traffic Engineers
- Transport Planners
- Land Surveyors
- Building Investigation Experts
- CDM Co-ordinators

APPENDIX 4

Reclamation Assessment for Proposed Industrial Development Site at Shropshire Food Enterprise Park, Shrewsbury (White Young Green – July 2008)

White Young Green

DRAFT

Reclamation Assessment
For
Proposed Industrial Development Site at Shropshire Food Enterprise Park, Shrewsbury

PxP West Midlands Limited Partnership

PxP WEST MIDLANDS

thinking beyond construction

Reclamation Assessment
For
Proposed Industrial Development Site at Shropshire Food Enterprise Park, Shrewsbury

PxP West Midlands Limited Partnership

DRAFT

WHITE YOUNG GREEN ENVIRONMENTAL LIMITED				
REPORT: E013423-1/TN/ARB/20070901 V3 Draft				
Issue: -		**Prepared by:**	**Checked by:**	**Verified by:**
V3	**Date**			
Draft	**July 08**	**Andrew Bayliss**	**Andrew Bayliss**	**Kevin Onions**
		Principal	**Principal**	**Regional Director**
File Ref: J:\E013423 PXP\Project-wide matters\R07056 E013423-1 V3 draft 20070901.doc				

White Young Green Environmental, Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Telephone 0121 233 1833, Facsimile 0121 212 8330
enviro.birmingham@wyg.com www.wyg.com

Reclamation Assessment For Proposed Industrial Development Site at Shropshire Food Enterprise Park, Shrewsbury

CONTENTS

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EXECUTIVE SUMMARY

Current Site Status	The site is located within the Battlefields Enterprise Park, adjacent to the A5124 on the north side of Shrewsbury and is accessed from the A5124 off the A49. The site comprises a series of level soil platforms bisected by a stream, with a pond in the extreme north east corner. A great crested newt fence is currently in place to present a barrier between the pond and immediately adjacent habitat to the east and the remodelled site. A new electrical substation is present in the centre of the site and an older construction gas distribution facility occupies the south western corner. A high pressure gas pipeline is inferred to cross the site.
Site History	The site has remained largely undeveloped land adjacent to the Crewe-Shrewsbury railway line until enabling works commenced in late 2006.
Geology	The site is underlain by glacial sand and gravels and boulder clay, overlying solid strata belonging to the Triassic Sherwood Sandstone Group and comprising soft red sandstones The DETR Radon Guidance on Protective Measures for New Dwellings (BRE, 1999) indicates that less than 1% of homes are above the Action level and therefore no radon protection measures are necessary in the construction of new dwellings or extensions The Coal Authority online search database indicates that the site does not lie within an area likely to be influenced by coal mining or brine extraction and that a Coal Mining & Brine Report is not required.
Hydrogeology	The site lies on a major aquifer. The soils are classified as being of high, class H2, leaching potential. There are no groundwater abstractions within 1km of the site. There are twelve groundwater abstractions between 1km and 2km from the site. A Zone 3 Source Protection Zone was recorded at the site.
Hydrology	A stream flows west to east through the centre of the site. No River Quality data was available in the Envirocheck report. Two surface water abstractions were recorded between 1km and 2km from the site According to the environmental database search undertaken 4 discharge consents have been authorised within 1km of the site The likelihood of flooding is described in one of three categories, low, moderate or significant, as used by the insurance industry.
Previous Investigations/ Works	The site was investigated by Geotechnics Ltd in January 2003. with the addition of an area to the immediate north east of the site between the current site boundary and the existing railway boundary. The object of this investigation was to obtain information on ground and groundwater conditions to assist road pavement and earthworks design. This site investigation comprised 21No machine dug trial pits across the site to depths of between 1.5 and 3.5m below ground level (mbgl) and 14No dynamic cone penetration tests across the site to depths of approximately 0.80mbgl. A suite of geotechnical and geo-chemical testing was also undertaken.
WYGE Site Investigation Works	Supplementary site investigation works were undertaken by WYGE on 26th October 2007 and 14th January 2008. In total the works comprised the following: • 15 no. trial pits (TP1 to TP7 and TP1A to TP8A) to a maximum depth of 4.0m bgl. • 12 no. soil samples were selected for geotechnical laboratory analysis.
Encountered Ground Conditions	Made Ground or possible Made Ground was encountered in all exploratory holes with the exceptions of TP01A and TP08A. The upper 0.3-0.4m of this consisted of topsoil. Underlying the topsoil in TP2, TP3, TP4 and TP7 was cohesive Made Ground ranging in thickness from 1.2 to 2.3m. TPs 6A and 7A were excavated in the area of Plot 1 and encountered predominantly granular Made Ground below the topsoil. Glacial Deposits were encountered in all exploratory holes. The solid geology was encountered in exploratory holes TP2, TP4 and TP2A. This was weathered Sherwood Sandstone and typically comprised red-brown fine grained sand with much gravel size fragments of weak and very weak sandstone. Solvent odours were noted in TP5A at 1.60m and TP6A at 1.30m.

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	Groundwater was encountered during excavation as seepages between 0.40m and 3.70m No obstructions were encountered during the ground investigation works.
Laboratory Testing	Eight samples of clay tested had a range of moisture contents between 9.8% and 18%, with an average of 15%. Liquid limits of eight samples of clay ranged between 27% and 39%, with plastic limits between 12% and 21%. Four samples taken from 3no. trial pits (TP1, TP4 and TP5) were scheduled for wet sieving. Four organic content tests were carried out on selected samples taken from TP2, TP3 and TP4 at depths between 1.40m and 3.20m. For TP3 and TP4 the organic content ranged from 0.12% to 1.24%. The organic content reported for TP2 at a depth of 1.70m was 2.06%; this is marginally above the criteria for Highways Capping Layers.
Ground Contamination Assessment	A number of previous investigations have been undertaken at the site. Where these included chemical analysis of site soils, no problems were identified. In addition, none of the investigations undertaken to date at the site have identified any visual or olfactory evidence of contamination. On the basis of this information no further assessment in terms of land contamination is considered necessary.
Ground Engineering Considerations	The site is in an area which may not be affected by coal mining and where there are no Shallow mining hazards. It is considered that foundations could be utilised within the granular glacial drift deposits taken down to virgin ground levels up to a bearing capacity of 80kN/m2, settlement calculations for this material indicate a total settlement of approximately 5mm for such a loading. To address differential settlement it is recommended that ground improvement be undertaken in the form of vibro compaction or vibro stone columns across the building plots to allow for a ground bearing slab to be constructed. It is expected that ground improvement would need to be extended into the granular glacial deposits at a depth of approximately 2.5 to 3.0m below existing ground level. For foundation loads in excess of 100kN/m2 it is recommended that foundations be extended to the underlying weathered Wildmoor Sandstone Formation, approximately 4.0m bgl. It is expected that building foundations if required adjacent to the brook will need to be extended to the approximate existing depth of the brook to avoid potential slope stability problems caused by surcharging the brook bank. It is recommended that in-situ CBRs be carried out at the depth of pavement formation to inform the pavement design. The Design Sulphate Class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1s in accordance with BRE Special Digest 1. The investigations undertaken have indicated that the site comprises natural soils with low organic content thus a Characteristic Situation 1 (CS1) may be assumed (Wilson and Card, 1999). According to CIRIA C665 no special protection measures are required for an office/commercial/industrial development that is classified as a CS1.
Recommendations	During previous investigations chemical analysis of site soils identified no problems. In addition, no visual or olfactory evidence of contamination has been identified. On the basis of this information no further assessment in terms of land contamination is considered necessary. It is recommended that further building plot specific site investigation be undertaken prior to detailed foundation design, which would include in-situ testing and confirmation of the BRE Special Digest 1 concrete class. The Coal Authority online search database indicates that the site does not lie within an area likely to be influenced by coal mining or brine extraction and that a Coal Mining & Brine Report is not required. It is recommended that further badger monitoring of this sett is carried out at three month intervals prior to any development. Should these setts be found to be active, a badger disturbance licence would be required if work is to take place within 30m of this sett. It is recommended that further water vole survey work is carried out on the ditches should they be affected by any proposed development within 10m of the banks although this would not be considered necessary should a stand-off of 10m be implemented.

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This sheet is intended as a summary of the assessment of the site in relation to ground contamination. It does not provide a definitive engineering analysis.

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1.0 INTRODUCTION

1.1 Instruction

White Young Green Environmental is commissioned by PxP West Midlands Limited Partnership to undertake a geo-environmental investigation of the Organic Centre site at Battlefields Industrial Park, Shrewsbury.

The investigation necessarily is focused on three geo-environmental aspects, including:

- Substantiation of a bearing capacity of or exceeding 80kN on areas requiring this loading as shown on the March 2007 Development Plan.
- Soils/substrates suitable for retention on the site with respect to the proposed end use.
- Identify ecological constraints apparent at the time of the initial survey; undertake appropriate Phase 2 surveys, and give advice regarding appropriate mitigation and further surveys where necessary.

1.2 Scope of Services

- Undertake a site visit.
- Review existing data provided to WYGE;
- Carry out an ecology Phase 1 Habitat Survey;
- Carry out a preliminary ground investigation if required by the Client;
- Produce a preliminary geo-environmental constraints plan showing the constraint issues raised in the reports;
- Produce a preliminary remediation strategy to facilitate abnormal costing for geotechnical, contamination and ecology as defined in 4.1, 4.2 and 4.3 below;
- Prepare and submit draft reports setting out the Consultant's findings, conclusions and recommendations to the Client and shall discuss and agree with the Client the contents and drafting thereof prior to issue by the Consultant of the final reports.
- Produce, execute and issue to the Client a final report.
- Liaise with WYGC to agree on appropriate indicative foundation strategy for each of the Sites;
- Liaise with AYH plc on costs for each of the Sites; and
- Perform any other additional services necessary and connected to the Services.

The Services are an assessment of the following criteria from the known information:

(1) have a minimum ground bearing pressure of not less than 80kn Sq m required by the Buyer's Business Plan;
(2) be remediated sufficiently to enable development to proceed without the need for any contamination removal or measures to counteract contamination or gas occurring in, on or under each of the Sites; and

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(3) identify ecological constraints apparent at the time of the initial Phase 1 survey; undertake appropriate Phase 2 surveys and advice regarding further survey work and appropriate mitigation if required.

To be performed to enable the Sites to be developed in accordance with the development proposals contained in the relevant Buyer's Business Plans AT 31 March 2007 attached to Limited Partnership Agreement (as defined in the Agreement between (1)Advantage West Midlands, (2) Advantage (GP) Limited and Advantage (Nominee) Limited (as trustee on behalf of the PXP Limited Partnership) and (3) Langtree Midwest Limited dated 17 April 2007) and on the basis that (but without limitation) each of the Sites, save where in the professional opinion of WYGE or WYGC it is impracticable to comply with the following criteria, or deemed financially or environmentally preferable to undertake an alternative remedial solution. The information will then be discussed with the Client and AYH for the purposes of assessing the potential remediation costs with respect to the above criteria.

1.3 Proposed Development/End Use

The site is to be developed for use as industrial premises for the production of organic food products. The proposed development plan is provided in Appendix B.

1.4 Term and Conditions

Attention is drawn to the report conditions, included in Appendix A, and the terms and conditions of the engagement.

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2.0 SITE DETAILS

2.1 General

The site and surrounding area reconnaissance was undertaken by WYGE during late 2006

A Site Location Plan is included in Appendix B as Fig.01.

2.2 Site Location

The site is located within the Battlefields Enterprise Park, adjacent to the A5124 on the north side of Shrewsbury and is accessed from the A5124 off the A49.

Table 2.1 – Site Location

SITE ADDRESS	Battlefields Enterprise Park, Shrewsbury, SY1 3TF
ACCESS DETAILS	Off Vanguard Way from the A5124
NGR (Centre of Site)	SJ509164

2.3 Site Description and Walkover

During the walkover the site was undergoing enabling works to prepare the site for construction. These works include the remodelling of levels on the former gently sloping pastureland and the installation of services. Landscape tree planting has been carried out on the north and west

A new electrical substation has been constructed within an oval brick building in the centre of the site. Arterial roads were being prepared, entering the site from Vanguard Way. The majority of the site comprises flat land at various levels which was heavily waterlogged following prolonged heavy rainfall immediately prior to the site inspection.

A stream bisects the site, entering the site via two culverts along the western border and, with the exception of the culvert beneath the arterial road, flowing eastwards in open channel. At the time of the inspection the water was heavily discoloured by sediment.

A gas distribution facility occupies a small brick building at the extreme south west corner of the site, south of Vanguard Way. The accurate location and wayleave of any high pressure gas mains is not currently known.

A shallow pond lies at the north eastern corner of the site, discharging via an intermittent drain southwards to the easterly flowing stream. It is understood that great crested newts are present in this area. A plastic angled great crested newt fence has been installed, shielding the pond and preventing newt access to the remainder of the site from the pond. This will require ongoing maintenance. It is not clear if this responsibility lies with Shropshire County Council or Advantage West Midlands. From the residual presence of a number of plastic buckets in this area, it is inferred that a great crested newt trapping scheme had been operated and preceded the ground remodelling works to the south west of the great crested newt fence.

2.4 Surrounding Land Uses

Current surrounding land uses are summarised as follows:

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Table 2.2 – Surrounding Land Uses

Boundary	Description
North	A5124 in cutting
North East	Pasture land leading to railway embankment
South East	Waste Recycling / Transfer Station
South	Battlefields Enterprise Park
West	Undeveloped land forming part of Battlefields Enterprise Park

Information relevant to the site surrounds has been obtained from the undertaking of an environment database search for the site. Relevant information is summarised below.

Waste Management

The environmental database search undertaken indicated the following **Landfill, Waste Transfer and Disposal Sites** within 1km of the site boundary:

Table 2.3 – Landfill, Waste Transfer and Disposal Sites within 1km

Licence Holder	Type of facility	Authorised Waste	Licence Reference & Status	Approx. distance (m) and direction from site boundary
Licensed Waste Management facilities				
Shropshire Waste Management Ltd, Vanguard Way, Battlefield, Shrewsbury	Household, Industrial and commercial Waste Transfer Station	Not Supplied	47155 Issued	0
Loosemores Ltd, Battlefield	Transfer station	Non biodegradable waste.	47106,47028 Issued	855 NE
Registered Waste Transfer Sites				
Loosemores Ltd, Battlefield	Transfer	Degradable Commercial, household, industrial waste. Inert materials.	Eawml47106 Operational	814 NE

2.5 Discharge Consents

The Envirocheck report identified 3 discharge consents within 1km of the site.

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Table 2.3 – Discharge Consents

Operator	Discharge Type	Licence Reference & Status	Receiving Water	Approx. distance (m) and direction from site boundary
Severn Trent Water Ltd	Sewage Discharge, storm sewage outflow	S/02/21581/O S/02/21022/O	Tributary of Battlefield Brook Tributary of River Severn	707 S
Arlington Securities Plc, Shrewsbury Retail Park, Battlefield Road	Discharge of other matter – surface water	S34/Sw/1/14 Pre National Rivers Authority Legislation	Battlefield Brook	947 SE
Mr F Subbiani Abright Hussey Hotel, Shrewsbury	Sewage and trade combined	S/02/55033/T Post National Rivers Authority Legislation	Tributary of Battlefield Brook	958 NW

[1] Although the position of the discharge is given as within the site, this may be due to the accuracy of the reference, given to within 100m.

2.6 Industrial Pollution Controls

Name & Location	Process Type	Description	Approx. distance (m) and direction from site boundary
Spel Products Lancaster Road, Shrewsbury	Integrated Pollution control	Not given	855 SW
Anglo Beef Processors Ltd Battlefield Road, Shrewsbury	Integrated Pollution Prevention and Control	0.0 Associated Process	238 SE
Burnt Tree Group Ltd, Burnt Tree house, Knights way, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/34 Respraying of road vehicles	90 NW
ABP Meatplant, Battlefield Road, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/1 Animal by-product rendering	239 SE
Stafford By Products, Unit 5, Battlefield Industrial Estate, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/1 Animal by-product rendering	411 SE
Esso Petroleum Co, Harlescott Lane, Shrewsbury	Local Authority Pollution Prevention and Control	PG1/14 Petrol filling station	490 SW
The Shrewsbury Garage/Furrows Ltd, Benbow Business Park, Harlescott Lane, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/34 Respraying of road vehicles	587 S

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William A Lewis Engineering Ltd, Harlescott Lane, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/34 Respraying of road vehicles	685 S
Inchcape Volkswagon Featherbed Lane, Harlescott, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/34 Respraying of road vehicles	766 S
SPEL Products, Lancaster Road, Shrewsbury	Local Authority Pollution Prevention and Control	PG4/2 Process for the manufacture of fibre reinforced plastics	855 SW
William A Lewis Engineering Ltd, Harlescott Lane, Shrewsbury	Local Authority Pollution Prevention and Control	PG6/34 Respraying of road vehicles	873 SE

Health and Safety

One control of major accident hazard sites for Firmin Coates & Sons Ltd was recorded 252m south west of the site and is of active status. One planning hazardous substance consent for Firmin Coates & Sons Ltd was recorded 683m south of the site.

Sites of Ecological Importance

The Envirocheck report indicates that the site is in a Nitrate Vulnerable zone. A pond on the site provides habitat for great crested newts which benefit from statutory protection. A great crested newt fence is currently in place, to restrict the movement of newts from the pond to the development site. This fence will require ongoing maintenance.

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3.0 SITE HISTORY

3.1 Introduction

The following primary sources were used to research the history of the site and the surrounding area:-

- Historical Ordnance Survey (OS) plans supplied by Envirocheck.
- Selected historical aerial photographs where available.

3.2 Review of Historical Ordnance Survey Maps

Reference is made below only to those editions which show significant features/changes:

1902-1903 1:10,560 The site is open fields the Crewe and Shrewsbury Railway runs approximately 80m east of the site. A stream divides the southern and northern parts of the site.

1938 1:10,560 A small residential development has been constructed approximately 300m south west of the site along a new road named Harlescott Crescent.

1954 1:10,560 A large Engineering Works has been constructed approximately 200m south of the site, to the north of Harlescott Lane. Further buildings have been constructed to the east of the site and the railway.

1968 1:10,560 A small collection of buildings comprising Brick Hill Farm has been constructed in the south west corner of the site and to the west of the site boundary. The area south of Harlescott Crescent has developed extensively as a residential housing area. The area south of Featherbed Lane has also been developed extensively in what appears to be residential housing. The buildings to the east of the engineering works and the railway have been demolished and various other buildings constructed.

1971 1:2,500 A Meat packing factory and public abattoir have been constructed approximately 200m east of the site on the eastern side of the railway, works have been constructed further south east of this.

1973 1:10,000 The Engineering Works have been extended further to the west. A Livestock market has been constructed to the south east of the abattoir (now labelled Factory). Extensive residential development has taken place to the south of Harlescott and Featherbed Lane.

1973-1980 1:10,000 The area to the east of the abattoir/factory has further developed industrially/commercially.

2000 1;10,000 The area south west of the farm buildings to the west of the site has been developed into Battlefield Enterprise Park.

2002-2005 1:10,000 An access road with associated roundabouts to the Battlefield Industrial Park has been constructed adjacent to the northern and western site boundaries.

3.3 Summary

The site has remained largely undeveloped land adjacent to the Crewe-Shrewsbury railway line until enabling works commenced in late 2006.

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4.0 DOCUMENT REVIEW

4.1 Review of Existing Information

In assessing the existing information with regard to consideration of potential for contamination, assessment of geological and geotechnical conditions encountered and recommendations for further works, the documents consulted included the following;

- Ground Investigation at Food Enterprise Centre, Battlefield, Shropshire. Geotechnics Limited, Project No: PC020015. January 2003
- Ground Investigation at Food Enterprise Centre, Battlefield, Shropshire. Geotechnics Limited. Project No: PC062483. July 2006.
- Plot 5, Shropshire Food Enterprise Park, Battlefield, Shrewsbury, Shropshire. Desk study and Ground Investigation Report. Mouchel Parkman Reference 755401/R/001. August 2006.
- Desk Study Report. Land at Battlefields Enterprise Park, Shrewsbury, Shropshire. Development Asset AWM4643. White Young Green Environmental. November 2006. E010315-1.
- Certificates of in-situ testing for Plots 1 to 5.

4.2 Previous Site Investigations

Geotechnics Ltd January 2003

The area of the red line boundary (as shown in the Site Layout Plan presented in Appendix B as figure 02) was investigated during the Geotechnics Ltd site investigation of January 2003, with the addition of an area to the immediate north east of the site (between the current site boundary and the railway boundary). The object of this investigation was to obtain information on ground and groundwater conditions to assist road pavement and earthworks design.

This site investigation comprised:

- 21 No. machine dug trial pits across the site to depths of between 1.5m below ground level (mbgl) and 3.5mbgl
- 14 No. dynamic cone penetration tests across the site to depths of approximately 0.8mbgl.
- Geotechnical and chemical testing was undertaken.

Mouchel Parkman August 2006

The Mouchel Parkman site investigation report of August 2006 was concerned only with Plot 5 of the site and comprised of a desk study, an evaluation of previous site investigations and the factual information from the Geotechnics Ltd site investigation report of July 2006. The object of the report is stated as being to determine the sub surface ground and groundwater conditions at the site.

Site investigations comprised:

- 5 No. Cable percussive holes to depths of between 3.36mbgl and 4.84mbgl.
- 15 No. machine dug trial pits to depths of between 0.7mbgl and 4.4mbgl.
- 5 No. dynamic cone penetration tests were carried out at the site a depths of between 0.35mbgl and 1.0mbgl.
- Slotted standpipe instrumentation was installed in 3 No. boreholes and subsequently monitored.
- Geotechnical and chemical testing was also undertaken.

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4.3 Published Geological Conditions

The geology is taken from the British Geological Survey 1:50,000 scale geological solid and drift map number 152 "Shrewsbury" (S&D) and the Institute of Geological Sciences Hydrogeological map of England and Wales, supplemented by data from the Landmark Envirocheck report.

The site is underlain by glacial sand and gravels and boulder clay, overlying solid strata belonging to the Triassic Sherwood Sandstone Group and comprising soft red sandstones.

According to the British Geological Survey and National geoscience information service there is a moderate potential for compressible ground stability hazards, a low potential for running sand ground stability hazards and a very low potential for landslide and shrinking or swelling clay ground stability hazards.

Radon

The DETR Radon Guidance on Protective Measures for New Dwellings (BRE, 1999) indicates that less than 1% of homes are above the Action level and therefore no radon protection measures are necessary in the construction of new dwellings or extensions

Mining

The site is in an area which may not be affected by coal mining and where there are no Shallow mining hazards.

The Coal Authority online search database indicates that the site does not lie within an area likely to be influenced by coal mining or brine extraction and that a Coal Mining & Brine Report is not required.

4.4 Hydrogeology

Details of the hydrogeology underlying the site have been obtained from the following sources:

- Institute of Geological Sciences Hydrogeological 1:625,000 scale map of England and Wales
- Environment Agency 1:100,000 scale groundwater vulnerability map sheet 21, West Shropshire;
- Environment Agency website

Groundwater Vulnerability Classification

Under the auspices of its Policy and Practice for the Protection of Groundwater, the Environment Agency has published a series a groundwater maps which provide classifications of both groundwater and soil vulnerability for England and Wales. The groundwater vulnerability map, sheet 21, West Shropshire, has been used to determine the groundwater and soil vulnerability classification for the area encompassing the site.

This map confirms that the site lies on a major aquifer (highly permeable formations usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes). The soils are classified as being of high, class H2, leaching potential. Soils with high leaching potential characteristically are those with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater. The sub-classification H2 indicates deep, permeable coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.

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Groundwater Abstractions

There are no groundwater abstractions within 1km of the site. There are twelve groundwater abstractions between 1km and 2km from the site.

Groundwater abstraction licences are required for all abstractions in excess of 20m^3/day and hence private domestic groundwater abstractions may not require licensing. The local authority has a statutory duty routinely to monitor the quality of potable groundwater abstractions, including unlicensed private abstractions, within its area of jurisdiction. Registers of such potable sources are maintained by the local authority but these should not be relied upon as comprehensive records. Hence unrecorded unlicensed private groundwater abstractions may be present within the study area.

Groundwater Protection

The Environment Agency has defined Source Protection Zones (SPZs) for many groundwater sources such as wells, boreholes and springs used principally for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The Agency has prepared a series of maps that show three main zones (inner, outer and total catchment) and a fourth zone of special interest which is occasionally applied to a groundwater source.

The Agency uses the zones in conjunction with its Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk, and to monitor the activities of potential polluters nearby. There may be restrictions on various forms of development within such zones.

A Zone 3 Source Protection Zone was recorded at the site.

4.5 Hydrology

Details of the hydrology of the area have been obtained from the following sources:

- 1:25,000, Ordnance Survey Explorer Map of Birmingham Walsall, Solihull and Redditch (No. 220).
- Environment Agency website.
- An environmental database search undertaken.

Water Courses

A stream flows west to east through the centre of the site.

Surface Water Quality

No River Quality data was available in the Envirocheck report.

Surface Water Abstractions

Two surface water abstractions were recorded between 1km and 2km from the site.

Table 4.1 – Surface Water Abstraction Within 2km

Operator	License Number	Abstraction Use & Rate	Details	Distance & Direction
Mr BC Archer	18/54/02/0570	Amenity Not Supplied	Heathgates -River Severn	1,946m (S)
GH Davies (Farms) Ltd	18/54/02/0578	General Agriculture Not Supplied	Land at Monkmoor & Bicton – River Severn	1,985m (S)

Discharges

According to the environmental database search undertaken 4 discharge consents have been authorised within 1km of the site.

Table 4.2 – Discharges within 1km

Operator	Reference	Discharage Type & Environment	Status	Distance & Direction
Severn Trent Water Limited	S/02/21581/O	Sewrage Discharges Freshwater Stream / River	Post National Rivers Authority Legislation where issue date > 31/08/1989	707m (SE)
Severn Trent Water Limited	S/02/21022/O	Public Sewage Freshwater Stream / River	Post National Rivers Authority Legislation where issue date > 31/08/1989	707m (SE)
Arlington Securities Plc	S34/Sw/1/14	Discharge of other matter Freshwater Stream / River	Pre National Rivers Authority Legislation where issue date > 31/08/1989	947m (SE)
Mr F Subbiani	S/02/55033/T	Sewage and Trade Combined Freshwater Stream / River	Post National Rivers Authority Legislation where issue date > 31/08/1989	958m (NW)

Flood Potential

A national flood risk assessment was completed by the Environment Agency in 2004, which used ground levels, predicted flood levels, information on flood defences, and local knowledge. The likelihood of flooding is described in one of three categories, low, moderate or significant, as used by the insurance industry.

Indicative flood plain maps are subject to change following refinements in modeling and modifications to the hydrological characteristics of the catchment upstream of the site and may be revised by the Environment Agency with respect to the site at the time of new planning applications.

The site lies in an area indicated to be susceptible to extreme flooding from rivers without defenses.

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A Flood Risk Assessment Report (FRA) has been prepared for Plot 2 of the site. The White Young Green FRA of January 2008 refers to a previous Stage 1 SFRA which indicates that there are no public surface water sewers on the site and inspection of the levels suggests that there are no surface water or highway sewers that could be utilized for site drainage. It is therefore likely that the most appropriate discharge location for Plot 2 will be directly to the stream that flows adjacent to the southern boundary. The flow rate of any such discharge will be restricted to Greenfield runoff rates as specified by the EA. Additionally the headwall on the outfall pipe will require formal consent from the EA, as will any other structure in the stream.

The WYG FRA of January 2008 states:
"The development proposals for the site significantly increase the impermeable area from zero at present to approximately 95%. If infiltration drainage is not possible, the EA will require attenuation storage to reduce the run off to Greenfield rates. The estimated volume of attenuation storage required for the 100 year event plus 20% is between 531m^3 and 761m^3 for Plot 2 only based on a Greenfield runoff rate of 5.0l/s/ha. These figures are based on preliminary runoff calculations".

The volume of storage required can be reduced by the use of permeable paving for parking areas. This can be used even if the underlying ground is impermeable (e.g. clay) as a layer of permeable material is installed under the parking area and water arriving on the surface of the parking area infiltrates to the permeable layer and discharge from the permeable layer is restricted to the desired rate. It is possible that all the attenuation requirements for the plot could be provided in this manner. By way of flood risk management, finished floor levels for the proposed new development will be set 150mm above surrounding ground levels in accordance with the Building Regulations, i.e. at a minimum level of 73.2 m AOD, so the future risk of flooding from surface water runoff or overland flow will be minimal

Pollution Incidents

According to the environmental database search undertaken 10 Category 3 pollution incidents occurred within 1km of the site.

4.6 Materials Encountered

The following general materials and sequence were encountered by the previous site investigations of 2003 and 2006.

Table 4.3 – Summary of Encountered Ground Conditions

Material	Depth (m)	Maximum Thickness (m)
Topsoil	GL – 0.30	0.30
(Possible) Made Ground	GL – 2.10	2.10
Glacial Deposits	0.3 – 3.50	2.95
Weathered Sandstone	0.70 – Not Proven	3.20
Sandstone	2.50 – Not Proven	1.30

Topsoil

Strata described as topsoil were not encountered during the Geotechnics site investigation. Mouchel Parkman described topsoil in the area of Plot 5 as being encountered in all trial pit locations to depths of between 0.05m and 0.3m.

Made Ground

Geotechnics encountered possible Made Ground in the form of firm / stiff sandy gravely clay and clayey gravely sands to depths of between 1.1mbgl and 1.2mbgl. It is suggested that these strata were re-deposited in the area following the construction of the adjacent A5124.

The majority of exploratory holes in the Mouchel Parkman investigation encountered Made Ground with a stratum thickness ranging between 0.3m and 0.8m. The strata were recorded as gravely fine to coarse sands. The gravel component was described as fine to coarse fragments of quartzite, sandstone, dolerite and mudstone with occasional fragments of brick, concrete, ash and bitumen.

Probable Made Ground was also identified within the cable percussive boreholes and comprised silty / clayey slightly gravely to gravely fine to coarse sands, the gravel components were largely in line with the Made Ground encountered. Plant rootlets were also encountered.

A single recompacted California Bearing Ratio (CBR) test was undertaken on a shallow sample. The results indicated CBR values of 24% and 23%.

A single dynamic cone penetrometer was undertaken at a depth of 0.35m which recorded a minimum CBR value of 8.75%.

A particle size distribution test was undertaken on a sample obtained from 0.3mbgl to 0.8mbgl, which indicated the Made Ground content to be 35% silt and clay, 52% sand and 13% gravel.

Spoil heaps at the south western corner of the site were investigated as part of this investigation. These soil heaps were found to comprise primarily gravely fine to coarse sand with occasional cobbles. A single roofing tile was identified within in these heaps, which was tentatively identified as asbestos cement.

Glacial Deposits

The Geotechnics investigation identified glacial deposits at depths of up to 3.5m. The strata were shown to be variable, ranging from cohesive to non-cohesive materials.

Moisture contents for the cohesive material ranged from 14% to 32% with a stated average of 20%. Atterberg limit tests showed the material to be of low to intermediate plasticity with one results indicating a high plasticity.

Remoulded CBR tests undertaken on shallow samples of the cohesive material indicated CBR values of 0.5% to 2.8% with and average of 2.0%. 1 No. compaction was undertaken which indicated an optimum moisture content of 15% with a maximum dry density of 1.85 Mg/m^3. the natural moisture content for this sample was 19%.

Moisture contents of the granular material ranged from 11% to 15%. A compaction test carried out on the material indicated an optimum moisture content of 11% with a maximum dry density of 1.95Mg/m^3. The natural moisture content of the sample was 11%.

A remoulded CBR undertaken on the non-cohesive material indicated a CBR value of 13% and 16%. Particle size distribution testing was also carried out on these samples.

The Mouchel Parkman investigation encountered both cohesive and granular glacial deposits to maximum depths of between 0.9m and 3.65m. Cohesive glacial deposits were described as being predominantly stiff (soft and firm in places).

8 No. near surface samples were tested for natural moisture contents and Atterberg limits. The NMC of the samples ranged between 4.4% and 16%, plasticity indices ranged between 15% and 18% indicating that the clays are of low shrinkage potential. Single stage undrained triaxial testing of 5 No samples indicated shear strengths of between 32 and 98kPa.

CBR testing on 5 No. samples indicated CBR values between 3.5% and 37%.

Compaction testing was undertaken on 2 No. samples, the maximum dry densities were 1.71Mg/m3 and 1.92Mg/m3 with optimum moisture contents of 15% and 13% respectively.

Chemical analyses of the strata were undertaken for BRE Special Digest 1 determination. Water soluble sulphate levels ranged between 0.02g/l and 0.07g/l with an associated pH range of 6.6 to 7.8.

A single in-situ hand shear vane was undertaken in TP1 at 1.2m depth, the average shear strength of the soil at this depth was recorded as being 120kPa which indicated a stiff soil.

4 No. dynamic cone penetrometer tests were undertaken, three of which were within the glacial deposits at the proposed finished development level. Tentative CBR values of 2.72%, 5.67% and 6.58% were obtained.

Sandstone

Sandstone was encountered in TP 17 and TP 18 below depths of 1.7m and 1.8m of the Geotechnics investigation. This stratum was encountered in the form of red brown silty sands and yellow grey sands with weakly cemented sandstone layers.

Weathered Sandstone was encountered in all exploratory holes of the Mouchel investigation with the exception of TP1. This strata was encountered as medium dense gravely fine to medium sand, below this strata were more competent sandstone strata comprising very weak to weak sandstone which was recovered as sandy gravel.

Surface and Buried Structures

No surface or buried structures were encountered during either investigation.

4.7 Groundwater

During drilling and excavation, groundwater was noted as seepages or traces between depths of 1.2mbgl and 2.5mbgl. The majority of exploratory holes in both investigations remained dry during drilling and investigation.

4.8 Contamination

The results of the contamination testing undertaken as part of the Geotechnics investigation fell below the appropriate Soil Guideline Values for a commercial land use scenario.

No visible or olfactory evidence of contamination was identified during the Mouchel investigation.

4.9 Ground Improvements Undertaken

Certificates of in-situ testing on the site following ground improvement have been viewed for Plots 1 to 5. The testing undertaken included:

- Particle size distribution BS1377:Part 2 Cl 9.2 and 3.2
- Soil Density BS1377:Part 9 Cl 2.5
- Moisture Content of Soil BS1377:Part 2 Cl 3

- Hand Shear Vane Testing in accordance with manufacturers instructions
- Liquid and Plastic Limits BS1377:Part 2 Cl 3.2, 4.3 and 5.3
- MCV / Moisture Content Relation of Soil BS1377:Part 4 Cl 5
- Particle Density BS1377:Part 2 Cl 8
- Dry Density / Moisture Content Relationship 2.5kg Rammer Method BS1377:Part 4 Cl 3

Preliminary bearing capacity calculations have been undertaken utilising these results, deriving phi values from the published relationship between the angle of shearing resistance, dry density and material class as described under the unified system and modified after the US Navy, 1982.

The results of these tests and calculations are presented in Table 3.2 below:

Table 4.4 – Summary of Ground Improvements

Plot No	Layer	Class	Bulk Density (Kn/m^3)	Dry Density (Mg/m^3)	Φ (Degrees)	Cu (kN/m^2)	Bearing Capacity (kN)
1	3	SW	19.67	1.91	35	-	400
1	5	SM	-	1.90	39	-	-
2	Formation	SW/C	19.19	1.82	35	-	390
2	8	C	20.44	1.83	-	-	-
2	9		20.55	1.83	-	-	-
2	10	C	19.47	1.75	-	136	740*
2	11		19.34	1.78	-	148	740*
2	12	C	18.87	1.65	-	119	740*
3	4	SM	20.83	1.89	35	-	420
4	B1	C	20.20*	-	-	110*	600*
4	B2	C	20.20*	-	-	110*	600*
4	2	C	20.20*	-	-	110*	600*
5	1	SP	18.45	1.79	34	-	330*
5	2	SM	18.24	1.77	35	-	330*
5	3	SM	19.53	1.85	37	-	330*
5	4	SM	19.06	1.82	37	-	330*
5	5	SM	19.12	1.84	38	-	330*
5	6	-	20.83	2.02	-	-	330*
5	7	-	19.63	1.87	-	-	330*
5	8	-	19.12	1.81	-	-	330*

* - Averaged over the class.

4.10 Discussion

Levels on the site may have changed since the above site investigations were conducted and a final design level is not at present known by WYG. It is clear from the in-situ and laboratory testing results from between September and November 2006 that a considerable amount of earthworks remediation was undertaken at the site.

It is known that the site was covered by a layer of Made Ground up to 2.1m in depth; this in turn was underlain by glacial deposits of a maximum encountered thickness of 2.95m which in turn is underlain by Sandstone of the Sherwood Sandstone Formation. The sandstone was encountered as a weathered weakly cemented material at a minimum depth of 0.7m becoming more competent material by 2.5mbgl.

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4.11 Recommendations for supplementary investigation

It is recommended that preliminary settlement calculations be carried out for the site and further detailed bearing capacity calculations are undertaken once a development scheme for the site has been finalised. It is also recommended that a limited number of trial pits be excavated across the site to confirm the findings of the previous validation testing and provide information to further inform the bearing and settlement calculations at the site once a detailed development scheme has been finalised.

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5.0 WYGE SITE INVESTIGATION WORKS UNDERTAKEN

5.1 Fieldworks

Supplementary site investigation works were undertaken by WYGE on 26th October 2007 and 14th January 2008.

In total the works comprised the following:

- 15 no. trial pits (TP1 to TP7 and TP1A to TP8A) to a maximum depth of 4.0m bgl.
- 12 no. soil samples were selected for geotechnical laboratory analysis, as detailed below.

Detailed engineering logs are presented as Appendix C and a summary of the encountered ground conditions is provided in below. The exploratory hole locations are shown on Fig. 03 in Appendix B, and has been superimposed on the proposed development plan.

5.2 General

The strata encountered by WYGE were logged in general accordance with BS 5930:1999 'Code of Practice for Site Investigations'. A summary of the ground conditions encountered during the site investigation works is presented below, with detailed information presented in the exploratory hole logs included in Appendix C and details of each strata presented in subsequent sections.

Table 5.1 – Encountered Geological Conditions

Strata	Depth to Surface (mbgl)	Depth to Base (mbgl)	Thickness (m)
Made Ground	0.0	0.3 – 2.3	0.3 – 2.3
Buried Top/Subsoil	1.2 – 2.3	1.4 – 2.6	0.2 – 0.3
Glacial Deposits	0.3 – 2.6	2.2 – >3.9	1.0 – >2.9
Sand (Weathered Sherwood Sandstone)	2.2 – 3.8	>4.0	>0.7

5.3 Made Ground

Made Ground or possible Made Ground was encountered in all exploratory holes with the exceptions of TP01A and TP08A. The upper 0.3-0.4m of this consisted of topsoil.

Underlying the topsoil in TP2, TP3, TP4 and TP7 was cohesive Made Ground ranging in thickness from 1.2 to 2.3m. This generally consisted of stiff to very stiff red-brown clay with rare to some rounded gravel. It is assumed that this Made Ground was placed in order to level the site to facilitate future development.

TPs 6A and 7A were excavated in the area of Plot 1 and encountered predominantly granular Made Ground below the topsoil comprising fine and medium grained SAND with varying amounts of clay, gravel and cobbles.

Table 5.2 – Summary of Made Ground Encountered

Exploratory Hole	Thickness (m)	Made Ground Description
All	0.3 – 0.4	Topsoil.
TP2, TP3, TP4 and TP7	1.2 – 2.3	Very stiff red-brown CLAY with rare to some rounded gravel.
TP6A and TP7A	1.2 - 1.65	Fine and medium SAND with varying amounts of clay, gravel and cobbles.

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5.4 Superficial Deposits

Glacial Deposits were encountered in all exploratory holes. The Glacial Deposits were overlain in three locations (TP2, TP3 and TP4) by 0.2 to 0.3m of buried top/subsoil. The buried top/subsoil consisted of brown to dark brown very clayey very silty sand with some to many rootlets. The glacial deposits comprised glacial till (boulder clay) and sands & gravels. The glacial till generally consisted of firm to stiff brown and red-brown clay with some gravel. The glacial sands & gravels generally consisted of orange, brown and red-brown sand, occasionally with some gravel.

These are summarised in Table 5.3.

Table 5.3 – Summary of Superficial Deposits Encountered

Exploratory Hole	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)	Stratum
TP1	0.30	> 3.10	> 2.80	Glacial Deposits
TP2	1.60	1.90	0.30	Buried top/subsoil
	1.90	3.10	2.20	Glacial Deposits
TP3	2.30	2.60	0.30	Buried top/subsoil
	2.60	> 3.90	> 1.30	Glacial Deposits
TP4	1.20	1.40	0.20	Buried top/subsoil
	1.40	3.80	2.40	Glacial Deposits
TP5	0.30	> 3.20	> 2.90	Glacial Deposits
TP6	0.30	> 3.00	> 2.70	Glacial Deposits
TP7	2.20	> 3.20	> 1.00	Glacial Deposits
TP1A	0.00	> 1.20	> 1.20	Glacial Deposits
TP2A	0.50	2.20	1.70	Glacial Deposits
TP3A	0.35	> 3.00	> 3.00	Glacial Deposits
TP4A	0.50	> 2.90	> 2.90	Glacial Deposits
TP5A	0.40	> 3.20	> 3.20	Glacial Deposits
TP6A	2.20	> 4.00	> 4.00	Glacial Deposits
TP7A	2.10	> 3.00	> 3.00	Glacial Deposits
TP8A	0.00	> 3.70	> 3.70	Glacial Deposits

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5.5 Sandstone

The solid geology was encountered in exploratory holes TP2, TP4 and TP2A. This was weathered Sherwood Sandstone and typically comprised red-brown fine grained sand with much gravel size fragments of weak and very weak sandstone.

5.6 Observed Potential Contamination

Solvent odours were noted in TP5A at 1.60m and TP6A at 1.30m in the northern part of Plot 1.

5.7 Groundwater

A summary of the groundwater levels recorded during the siteworks is presented as follows.

Table 5.4 – Groundwater Noted During Site Investigation

Exploratory Hole	Water Strikes		
	Strike Depth (mbgl)	Strata	Comments
TP4	3.70	Glacial Deposits	Slight seepage in all faces
TP5	1.50	Glacial Deposits	Seepage in all faces
TP6	1.50	Glacial Deposits	Seepage in all faces
TP3A		Glacial Deposits	Seepage in all faces
TP5A		Glacial Deposits	Slight seepage at southern end of pit.
TP6A	2.00	Glacial Deposits	Damp
TP7A	1.20	Made Ground	Seepage in all faces
TP8A	0.40	Glacial Deposits	Seepage in all faces

5.8 Obstructions Encountered

No obstructions were encountered during the ground investigation works.

5.9 In Situ Testing

In situ testing was carried out during the ground investigation works using a hand vane and a hand penetrometer. The results are given in the table below.

Table 5.5 – In Situ Testing Results

Exploratory Hole	Depth (m bgl)	Hand Vane (kg/cm^2)	Hand Penetrometer (kg/cm^2)	Inferred Shear Strength (KN/m^2)	Stratum
TP1	1.20	1.8, 2.5, 3.5, 1.2, 0.9	-	18	Glacial Deposits
TP3	0.60	-	3.8, 4.2, 3.8, 4.2, 5.0	400	Made Ground
	2.40	-	3.8, 2.1, 3.8, 2.8, 3.2	330	Buried top/subsoil
TP5	2.00	-	1.15, 1.95, 1.60	160	Glacial Deposits
TP6	1.50	-	1.0, 1.2, 1.4	120	Glacial Deposits
	2.00	-	1.6, 1.8, 2.0	180	Glacial Deposits

5.10 Laboratory Analysis

Chemical Laboratory Testing

No samples were submitted for chemical laboratory testing.

Geotechnical Laboratory Testing

Geotechnical soil testing was undertaken by Geotechnics Ltd, a UKAS accredited laboratory based in Coventry.

The following testing was undertaken:

- 8no. Atterberg limit tests.
- 8no. moisture content tests.
- 4no. wet particle size distribution tests.
- 4no. organic matter content tests.

Full copies of the geotechnical laboratory testing results are included in Appendix D.

Moisture Content

Eight samples of clay tested had a range of moisture contents between 9.8% and 18%, with an average of 15%. Of the eight samples tested, six returned moisture contents below their respective plastic limits indicating a desiccated soil.

Atterberg Limits Tests

Liquid limits of eight samples of clay ranged between 27% and 39%, with plastic limits between 12% and 21%. This gives a plasticity index range between 12% and 19% classifying the clay as low to intermediate plasticity with a low to medium swelling potential.

Particle Size Distribution

Four samples taken from 3 no. trial pits (TP1, TP4 and TP5) were scheduled for wet sieving. Samples from TP1 and TP5, taken at depths of 0.50m and 0.8m, had a reported gravel content of 3% and 2%, sand content of 90% and 96%, with silt/clay content of 7% and 2% respectively. The particle distributions of these samples show a strong correlation indicating similar geology, with classifications of medium sand and sand respectively.

Two samples from TP4 and TP5, taken at depths of 3.20m and 3.00m, had a reported gravel content of 26% and 23%, sand content of 52% and 74%, with silt/clay content of 22% and 3% respectively. The geology of these samples can be classified as clayey gravelly sand, and gravelly sand respectively, due to the higher clay composition of the TP4 sample.

Organic Matter Content

Four organic content tests were carried out on selected samples taken from TP2, TP3 and TP4 at depths between 1.40m and 3.20m. For TP3 and TP4 the organic content ranged from 0.12% to 1.24%. The organic content reported for TP2 at a depth of 1.70m was 2.06%; this is marginally above the criteria for Highways Capping Layers.

5.11 Preliminary Geotechnical Engineering Assessment

It is understood that the site is to be developed for use as industrial premises suitable for use for both food and non-food related industries. The proposed development plan is provided in Appendix B as fig. 03.

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5.12 Mining

No mining report has been obtained from the Coal Authority for this Report, however the site is in an area which may not be affected by coal mining and where there are no Shallow mining hazards.

The Coal Authority online search database indicates that the site does not lie within an area likely to be influenced by coal mining or brine extraction and that a Coal Mining & Brine Report is not required.

5.13 Excavations

Excavations within the clay deposits are likely to remain stable with Made Ground and granular superficial deposits being generally unstable.

Should excavations be required to remain open for a period of time, or where collapse may threaten existing or proposed works, plant or equipment, or where man entry is proposed, trench support will be required. Support to excavations should follow guidance given in CIRIA Report 97 'Trenching Practice'.

Groundwater has previously been encountered within the glacial deposits generally at 1.5m depth, however, in one location (TP8A), groundwater was encountered within the glacial deposits at 0.40m, groundwater control methods are therefore likely to be required during excavation.

5.14 Foundation Options

We understand that with regard to plot 2 loadings of 100kN/m2 is expected for foundations and 50kN/m2 are expected for the slab both with settlement criteria of 25mm overall and 10mm differential settlement. 80kN/m2 is expected across the rest of the site. Consideration has been given to the exploratory holes previously drilled and excavated across the site as well as the two trial pit investigations conducted by WYGE and the original Desk Top Survey. SPTs undertaken within the weathered sandstone and granular glacial drift deposits at Plot 5 indicate a typical conservative N value of 23. It is considered that foundations could be utilised within the granular glacial drift deposits taken down to virgin ground levels up to a bearing capacity of 80kN/m2, settlement calculations for this material indicate a total settlement of approximately 5mm for such a loading. To address differential settlement it is recommended that ground improvement be undertaken in the form of vibro compaction or vibro stone columns across the building plots to allow for a ground bearing slab to be constructed. It is expected that ground improvement would need to be extended into the granular glacial deposits at a depth of approximately 2.5 to 3.0m below existing ground level. For foundation loads in excess of 100kN/m2 it is recommended that foundations be extended to the underlying weathered Wildmoor Sandstone Formation, approximately 4.0m bgl.

It is expected that building foundations if required adjacent to the brook will need to be extended to the approximate existing depth of the brook to avoid potential slope stability problems caused by surcharging the brook bank.

The above foundation recommendations are based on material descriptions of the exploratory holes excavated, which have then been related to quantitative data obtained from the nearby Plot 5; it is recommended that further Plot specific site investigation be undertaken prior to detailed foundation design.

It is recommended that in-situ CBRs be carried out at the depth of pavement formation to inform the pavement design.

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5.15 Sub-Surface Concrete

No obstructions were encountered during the WYGE ground investigation works. No laboratory testing was scheduled on soil samples for determination of concrete classification under BRE Special Digest 1.

The Mouchel Parkman Desk Study and Ground Investigation Report Reference: 755401/R/001 for Plot 5 of the site August 2006 states

"Laboratory testing carried out on samples of made ground and glacial material indicates near neutral conditions with pH in the range 6.91 to 7.82. Measured concentrations of water soluble sulphate (as SO_3) were 0.02 to 0.07 g/l.

"Based on these results and assuming mobile groundwater conditions for natural soils, the Design Sulphate Class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1s in accordance with BRE Special Digest 1."

5.16 Land Gas Protection Measures

The investigations undertaken have indicated that the site comprises natural soils with low organic content thus a Characteristic Situation 1 (CS1) may be assumed (Wilson and Card, 1999). According to CIRIA C665 no special protection measures are required for an office/commercial/industrial development that is classified as a CS1.

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6.0 GROUND CONTAMINATION ASSESSMENT

6.1 Legislation

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a new regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on The Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the regulatory authority, by reason of substances within or under the land that:

- significant harm is being caused or there is significant possibility of such harm being caused; or
- pollution of controlled waters is being, or is likely to be, caused.

The guidance defines "risk" as the combination of:

- the probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- the magnitude (including the seriousness) of the consequences.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- a **source**, i.e. a substance that is capable of causing pollution or harm;
- a **pathway**, i.e. a route by which the contaminant can reach the receptor.
- a **receptor** (or target), i.e. something which could be adversely affected by the contaminant; and

If one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

6.2 Contamination Assessment

The historic map review (Section 3.2) indicates that the site is essentially Greenfield, having never been previously developed. Therefore, no potential sources of contamination were identified from the historic map review.

The site walkover (Section 2.3) did not identify any potential sources of contamination.

A number of previous investigations have been undertaken at the site. Where these included chemical analysis of site soils, no problems were identified. In addition, none of the investigations undertaken to date at the site have identified any visual or olfactory evidence of contamination.

On the basis of the information summarised above, no potential sources of contamination are considered to exist at the site. No further assessment in terms of land contamination is considered necessary.

This interpretation is based on the proposed end use of the site as shown in the March 2007 Development Plan.

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7.0 ECOLOGICAL ASSESSMENT

7.1 General

An ecologist from WYGE visited the site on 19th November 2007 when the following surveys were carried out:

7.2. Protected Fauna Species

A reconnaissance survey for evidence of the presence of protected species and an assessment of the suitability of the habitats present to support such species were undertaken. In particular, the following protected species were considered:

7.2.1 Badger

The site was surveyed for evidence of badger setts or other badger activity, such as paths, latrines or signs of foraging. The survey and evaluation methodologies used were according to published criteria (Harris, Cresswell & Jefferies, 1989). The site was surveyed at a suitable time of year to record badgers when the vegetation has died back and any setts would be more readily visible.

7.2.3 Water Vole

The brook flowing through the site was appraised for its suitability to be used by water vole and any evidence of water vole, such as burrows, latrines and feeding stations, was recorded. The survey was carried out outside the water vole breeding season when they are less active and leave few field signs representing a constraint to the survey.

7.2.4 Great Crested Newt

Two ponds located adjacent to/outside the site boundary were assessed for their potential to support breeding great crested newts in accordance with the *Great Crested Newt Conservation Handbook* (2001).

7.3 Field Survey Results

7.3.1 Badger

A badger sett was located on the south bank of the brook under a large hawthorn bush opposite the eastern end of the fencing demarcating the northern boundary of the warehouse to the south. This sett was composed of three holes with compacted spoil mounds outside and small amounts of leaves in their entrances. These holes were linked by paths that were clear of vegetation and leaves. Some footprints were present in the mud although none were considered to have been of recent creation. No badger hairs were found on the spoil mounds or on any of the paths and there was no evidence to suggest that this sett had been recently active.

The brook had been in spate at some point during the summer as evidenced by debris caught in overhanging branches and this had noticeably weakened the bank at points directly below the holes with wide cracks evident at the time of the survey. The level of the flooding was estimated to be at least 1m above the level of the banks.

No further evidence of badgers was found elsewhere on the site. Holes in the eastern perimeter hedgerow (just outside the 30m buffer zone) and along the western embankment had been made by rabbits. The grassland within and adjacent to the site provides suitable badger foraging habitat.

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The railway embankment is located approximately 50m to the east of the eastern survey area perimeter and was outside the scope of the survey. It is considered possible that badger setts could be located along the railway embankment. Casual use of the site for foraging by badgers cannot entirely be ruled out.

7.3.2 Water Vole

No evidence of water voles was found along the brook although the habitat was considered suitable. Both banks of the brook were steep or vertical and composed of clay and earth, being up to 2m in height providing abundant burrowing potential. Slumping of the banks had occurred in the past, possibly as a result of recent flooding.

The banks of the pond in the extreme north east corner of the surveyed area were extremely low and of a shallow gradient which did not afford suitable burrowing potential for water voles. The pond was well vegetated and provides suitable foraging habitat.

7.3.3 Great Crested Newt

Both ponds are considered to provide suitable breeding habitat for great crested newts and are surrounded by good quality terrestrial habitat including grassland and hedgerows. The seasonal nature of at least one of these ponds means that fish are unlikely to be present making them more attractive to amphibians. Provided that sufficient water remains in these ponds into June, long-term viable breeding populations of newts could be supported.

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8.0 PRELIMINARY SERVICES ASSESSMENT

8.1 Introduction

Table 8.1 below constitutes a preliminary assessment of the available utilities service plans for the site following detailed searches and enquiries to the Utilities companies. The information contained within the table is intended to indicate where there may be a possible impact by existing services on the development site and where further investigation is required to determine the nature and extent of the impact. It should be noted that capacity information or details relating to wayleaves or easements were not available at this stage.

8.2 Scope

WYG have undertaken a preliminary review of readily available statutory undertakers utility service plans, private supply service plans have not been obtained for the purposes of this assessment.

The principal utilities for which details have been obtained include the statutory water undertaker, this being Severn Trent Water. The incumbent gas transporter is National Grid Gas, Central networks is the host electricity company. British telecommunications and a cable TV operator also operate utility services within the vicinity of the subject site.

For this assessment only those existing services directly encroaching into the subject site have been noted. Further constraints associated with this type of development, which lie outside the current scope of this assessment, are definable as follows;

- Will the anticipated new water and energy demand trigger network reinforcement by the incumbent utility operators?
- Are there any existing services within or adjacent to the site that may have to be diverted or abandoned as part of the re-development?
- Are there any legal, technical or commercial factors preventing each of the new units from being connected to the existing utility operators' networks?

Table 8.1 Preliminary Services Assessment

Service Type	Issues
Electric	Central Networks plans show that 11kV cables & LV cables cross the site
Gas	MP (medium pressure) gas mains (180 and 90 PE) on site and on the boundary of the site
Water	180mm HPPEP water supply onto site and along boundary
Drainage	300mm foul sewer crosses the site S104 adopted sewer (new development) shown on Severn Trent Water plan which crosses the site No easement details available
BT	Underground plant along Vanguard Way which is shown as being part of the site

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9.0 PRELIMINARY INDICATIVE REMEDIAL STRATEGY

9.1 Introduction and objectives

This section presents an assessment of the obtained information and proposes a remediation strategy for future development of the site.

In general terms the phasing of the remediation works is likely to be as follows:

- Remediation / treatment of affected soils across the site

9.2 Works to be Undertaken Prior to Reclamation Works

Environmental Monitoring

It is assumed that monitoring of air pollution, particulates and noise will be undertaken prior to commencement of any works on site to establish background levels and set suitable environmental performance criteria.

Site Clearance

The site should be cleared of fly-tipped material, topsoil and vegetation prior to the commencement of the main reclamation works

Service Cut Off / Diversions

The preliminary Services Assessment has identified five principal services on the site; these being electricity, Medium Pressure Gas Main, Water Mains, underground BT plant and gravity foul sewers. Dependent on the final development plan for the site, initial mains diversions may be required.

The location of the services as provided by the Statutory Undertakers has been indicated for information purposes on Figure E013423-6 004 in Appendix B, and does not relieve the appointed remediation contractor of their obligations to locate and services on the site; neither would this necessarily display private supplies within the site boundary. It is recommended that during the site setup works the contractor is to fully investigate all existing services at the site.

The contractor is to ensure that any drains within the site are sealed prior to commencement of the works to ensure that any contamination does not enter the local drainage systems. If services are to be diverted during the reclamation works, the Contractor should be responsible for ensuring that these works are carried out with the approval of the relevant authorities.

It is recommended in areas where cables are to be laid directly into the ground, care should be taken that no large, sharp or heavy objects are left in the soil or with soils used to backfill these trenches.

Preliminary Groundworks

The site was undeveloped pasture land until 2006 and the only works to have been undertaken at the site have been enabling works for the installation of infrastructure for the future development.

Main Earthworks

During any excavation works at the site, it is recommended that a suitably qualified experienced Engineer should examine the areas where the excavation works are on-going to check for visible and olfactory evidence of contamination.

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Should contamination be identified during the earthworks, it shall be removed by excavation and stockpiled for remediation on site or for removal from site to a suitably licenced waste treatment or landfill site.

Verification Report

It is recommended that during site remediation works that a Resident Engineer be available throughout the duration of the site works to maintain a watching brief on all of the remediation works. The base of any excavations and formation levels should be inspected visually by the Resident Engineer and any suspected areas of contamination sampled and tested. It is also recommended that continuous consultations with the relevant Regulators and stakeholders throughout the remediation works are undertaken.

In the event of any unforeseen circumstances (e.g. encountering unexpected contamination or variations to remediation methodology), the Regulatory Bodies should be notified immediately. If necessary, changes to the remediation strategy should be made. Testing of materials should be carried out and the materials dealt with according to the levels of contamination recorded.

9.3 Ground Improvement and Foundation Design

The construction of structures for the proposed development do not form part of this preliminary remediation strategy, this will be subject to separate planning applications and contracts. The remediation strategy has been discussed with the client and with WYGC.

However, the construction of the overall scheme will be dependent on the site conditions provided by the reclamation scheme and we would make such following comments.

Further ground improvement at the site may be required for specific development structures. This will depend on the specific structural requirements with regard to the bearing capacity and tolerable settlements.

For the proposed 80kN/m2 bearing capacity trench foundations will be adequate, although they can only typically be used to depths of 3.50m where they become increasingly uneconomical and technically difficult. To address differential settlement it is recommended that ground improvement be undertaken in the form of vibro compaction or vibro stone columns across the building plots to allow for a ground bearing slab to be constructed

It is expected that building foundations if required adjacent to the brook will need to be extended to the approximate existing depth of the brook to avoid potential slope stability problems caused by surcharging the brook bank.

The investigations undertaken have indicated that the site comprises natural soils with low organic content thus a Characteristic Situation 1 (CS1) may be assumed (Wilson and Card, 1999). According to CIRIA C665 no special protection measures are required for an office/commercial/industrial development that is classified as a CS1.

The CBR and frost susceptibility values will be dependent on the materials present at the formation levels of the development. If a highway or car park is located on granular fill which has been compacted then a design CBR value of >15% may be assumed, for cohesive materials a CBR value of 5% may be expected. For design purposes at this site a CBR Design Value of 5% should be assumed.

The Mouchel Parkman Desk Study and Ground Investigation Report Reference: 755401/R/001 for Plot 5 of the site August 2006 states

"Laboratory testing carried out on samples of made ground and glacial material indicates near neutral conditions with pH in the range 6.91 to 7.82. Measured concentrations of water soluble sulphate (as SO_3) were 0.02 to 0.07 g/l.

"Based on these results and assuming mobile groundwater conditions for natural soils, the Design Sulphate Class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1s in accordance with BRE Special Digest 1."

If excessive groundwater is encountered then de-watering will be a likely requirement to maintain the stability of sidewalls and allow for suitable conditions for the pouring of concrete. This should be allowed for in the planning / costing of the foundation construction works.

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10.0 SUMMARY & CONCLUSIONS

- Previous contamination testing has not identified concentrations of contaminants likely to require remedial action due to human health or controlled water pollution risks, based on the proposed commercial / industrial development of the site.

- The area of the red line boundary as shown in the Site Layout Plan presented in Appendix B as figure 02 was investigated during the Geotechnics Ltd site investigation of January 2003. with the addition of an area to the immediate north east of the site between the current site boundary and the existing railway boundary. The object of this investigation was to obtain information on ground and groundwater conditions to assist road pavement and earthworks design.

- The Geotechnics Ltd site investigation of July 2006 was concerned wholly with Plot 5 of the development.

- The Mouchel Parkman site investigation report of August 2006 was concerned only with Plot 5 of the site and comprised of a desk study, an evaluation of previous site investigations and the factual information from the Geotechnics Ltd site investigation report of July 2006. The object of the report is stated as being to determine the sub surface ground and groundwater conditions at the

- The generalised geological sequence of the site has been shown to be Topsoil overlying Made Ground, overlying Glacial Deposits overlying Highly Weathered Sandstone grading to more competent Sandstone.

- It is considered that foundations could be utilised within the granular glacial drift deposits taken down to virgin ground levels up to a bearing capacity of 80kN/m2, settlement calculations for this material indicate a total settlement of approximately 5mm for such a loading. To address differential settlement it is recommended that ground improvement be undertaken in the form of vibro compaction or vibro stone columns across the building plots to allow for a ground bearing slab to be constructed.

- It is recommended that further site investigation be undertaken prior to detailed foundation design.

- One badger sett was found on the southern bank of the brook comprising three holes. No evidence was found to suggest recent occupation of this sett by badgers and recent flooding had caused bank instability in close proximity to these holes. They were also considered likely to have been submerged during the same flood event.

- It is expected that building foundations if required adjacent to the brook will need to be extended to the approximate existing depth of the brook to avoid potential slope stability problems caused by surcharging the brook bank.

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11.0 RECOMMENDATIONS

- A number of previous investigations have been undertaken for the whole site. Plot 2 has been covered by a site investigation undertaken in 2003 by Geotechnics and a supplementary investigation undertaken by WYGE in 2007. Where these included chemical analysis of site soils, no problems were identified. In addition, none of the investigations undertaken to date at the site have identified any visual or olfactory evidence of contamination. On the basis of this information no further assessment in terms of land contamination is considered necessary.

- The Coal Authority online search database indicates that the site does not lie within an area likely to be influenced by coal mining or brine extraction and that a Coal Mining & Brine Report is not required.

- It is considered that foundations could be utilised within the granular glacial drift deposits taken down to virgin ground levels up to a bearing capacity of 80kN/m2, settlement calculations for this material indicate a total settlement of approximately 5mm for such a loading. To address differential settlement it is recommended that ground improvement be undertaken in the form of vibro compaction or vibro stone columns across the building plots to allow for a ground bearing slab to be constructed. It is expected that ground improvement would need to be extended into the granular glacial deposits at a depth of approximately 2.5 to 3.0m below existing ground level. For foundation loads in excess of 100kN/m2 it is recommended that foundations be extended to the underlying weathered Wildmoor Sandstone Formation, approximately 4.0m bgl.

- It is expected that building foundations if required adjacent to the brook will need to be extended to the approximate existing depth of the brook to avoid potential slope stability problems caused by surcharging the brook bank.

- The investigations have indicated that the site comprises natural soils with low organic content thus a Characteristic Situation 1 (CS1) is indicated (Wilson and Card, 1999). According to CIRIA C665 no special protection measures are required for an office/commercial/industrial development that is classified as a CS1.

- Based on the results from Plot 5 and assuming mobile groundwater conditions for natural soils, the Design Sulphate Class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) class is AC-1s in accordance with BRE Special Digest 1.

- The above foundation recommendations are based on material descriptions of exploratory holes excavated across the site, which have then been related to quantitative data obtained from the nearby Plot 5, it is recommended that further building specific site investigation be undertaken prior to detailed foundation design which would include in-situ testing and confirmation of the BRE Special Digest 1 concrete class.

- It is recommended that further badger monitoring of this sett is carried out at three month intervals prior to any development. Should these setts be found to be active, a badger disturbance licence would be required if work is to take place within 30m of this sett.

- It is recommended that further water vole survey work is carried out on the ditches should they be affected by any proposed development within 10m of the banks although this would not be considered necessary should a stand-off of 10m be implemented.

- Should further development work need to take place within this site, it is recommended that further newt surveys are undertaken to determine presence / absence of great crested newts. This should be in accordance with the *Great Crested Newt Mitigation Guidelines* (2001) and involve a minimum of four visits during the newt breeding season (March to June inclusive) of which two should be during the optimum period to record newts (mid April to mid May) when they

are most likely to be present in the ponds. Survey methods should employ at least two techniques including bottle trapping, night time torch surveys and egg searches.

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12.0 ABNORMALS ASSESSMENT

The Following assessment is taken from the AYH Site Abnormals Appraisal – Second Draft, dated January 2008.

Battlefields – Shrewsbury

Foundations
Deep strip foundations to part of Plot 2, 2 units only, expressed as an extra over traditional foundations. This to overcome deep made ground without the need for piling.

Foundations for Plots 3 & 4

It is difficult to appraise the likely costs for these plots until a site layout is confirmed, however an allowance has been made.

Piled Foundations to Plot 1

Assumed area for treatment, depth of pile taken to approximately 10m.

Extra over conventional pad foundations for pile caps.

Suspended Slab for Plot 1

Suspended slab for Plot 1, as an extra over ground bearing slab.

Organic Buried Material

WYG's report has identified a small amount of organic material within substrate, whilst this may not be site wide, an allowance has been made for its' removal locally.

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13.0 KEY REFERENCES

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APPENDICES

Figures

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APPENDIX A

REPORT CONDITIONS

WHITE YOUNG GREEN ENVIRONMENTAL

REPORT CONDITIONS

GEO-ENVIRONMENTAL SITE INVESTIGATION

This report is produced solely for the benefit of PxP West Midlands Limited and no. liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise. This report has been produced for the purpose as detailed by the commission and should not be used for any other purpose without the express permission of White Young Green Environmental.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, the physical investigation as detailed, information supplied by those parties referenced in the text, and preliminary discussions with local and statutory authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. The test results that are available can only be regarded as a limited but likely representative sample assessed against current guidelines. The impact of our assessment on other aspects of the development requires evaluation by other involved parties.

WYGE take no responsibility for conditions that have not been revealed by the borings, or which occur below or between the borings. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site or the possibility of encountering ground conditions at variance with our exploratory hole logs elsewhere on the site cannot be discounted. Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy.

Groundwater and ground gas readings taken are those appertaining to the period of investigation only. It should be noted that groundwater levels may be subject to tidal, seasonal and diurnal changes, whilst ground gas emission rates are affected by atmospheric temperature and pressure and groundwater levels.

With reference to ground contamination, whilst the findings detailed within this report reflect our best assessment, because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by authorities or funds without question as such bodies have unpublished, more stringent objectives. This report is prepared and written for the purposed uses stated in the report and should not be used in a different context without reference to WYGE. In time, improved practices or amended legislation may necessitate a re-assessment.

The report is limited to the geotechnical and environmental aspects specifically reported on, and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief, the nature of geology and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further research will be required before the effects can be better determined.

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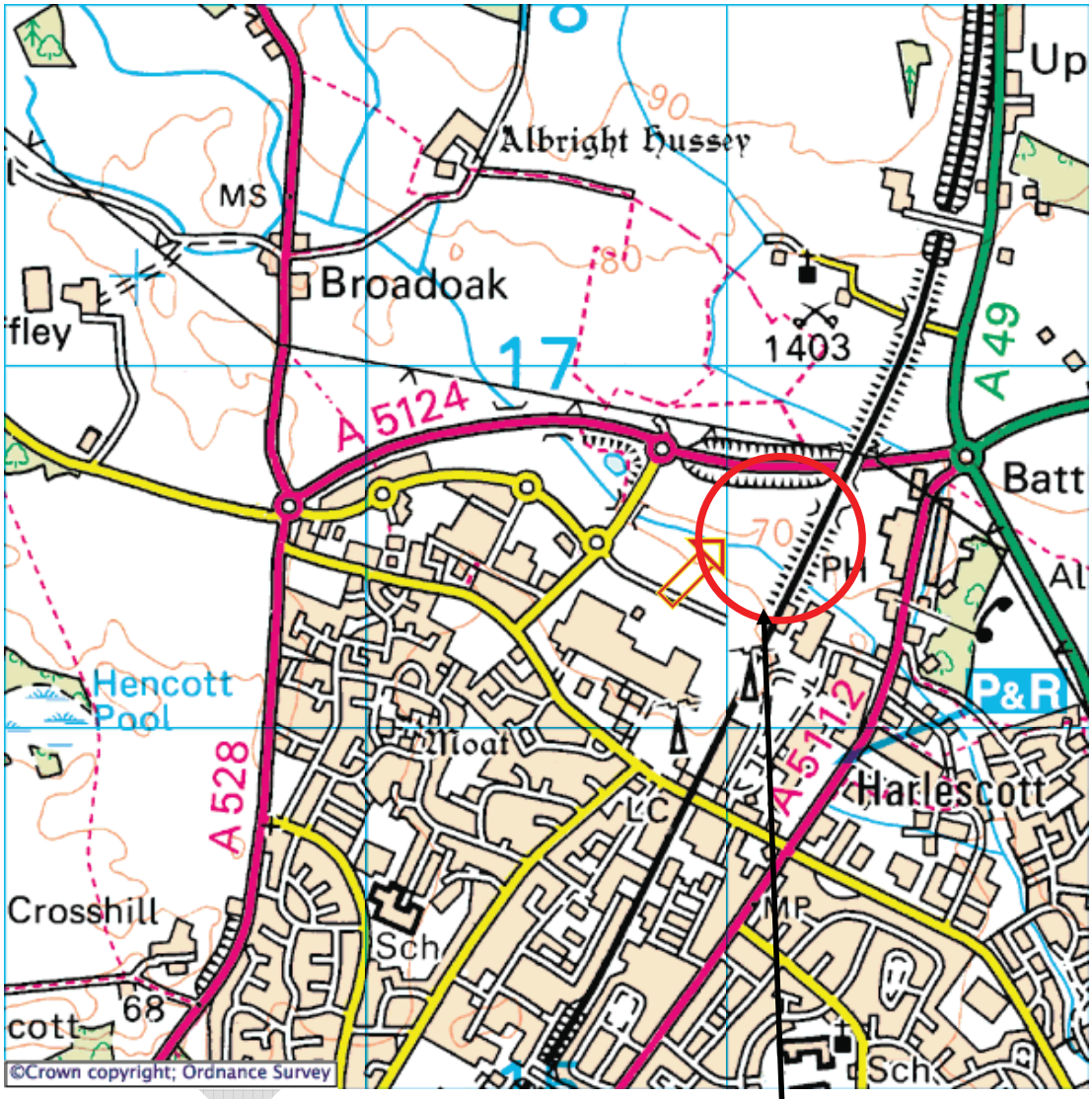
APPENDIX B

FIGURES AND DRAWINGS


Albright Hussey
MS
Broadoak
fley
1403
A 5124
A 49
Batt
Hencott Pool
Moat
A 528
A 5112
Harlescott
P&R
Crosshill
Sch
cott
68
©Crown copyright; Ordnance Survey
SITE LOCATION

PLOT 2

PRP Speculative Scheme

2a	11,580 sq ft
2b	8,952 sq ft
2c	4,146 sq ft
2d	13,251 sq ft
Total	**37,929 sq ft**

PLOT 3

PRP Speculative Scheme

3a	8,805 sq ft
3b	17,423 sq ft
3c	12,680 sq ft
Total	**38,908 sq ft**

1,000 to 1,500 sq ft
1,500 to 2,000 sq ft
2,000 to 2,500 sq ft
2,500 to 3,000 sq ft
3,000 to 3,500 sq ft

PLOT 5a

Food Enterprise Centre
Net Site **2.48 acres**

PLOT 1

Land Sale
Net Site **4.03 acres**
Potential 72,270 sq ft

PLOT 4

Land Sale
Net Site **4.38 acres**
Potential 46,040 sq ft

PLOT 5b

Land Sale
Net Site **1.14 acres**
Potential 28,470 sq ft

N

Advantage West Midlands

AWM PRP PROJECT

Development Site AWM4643: **Shrewsbury**

Proposed Site Plan 1:2000

Lp06244/0207

langtree

SMC

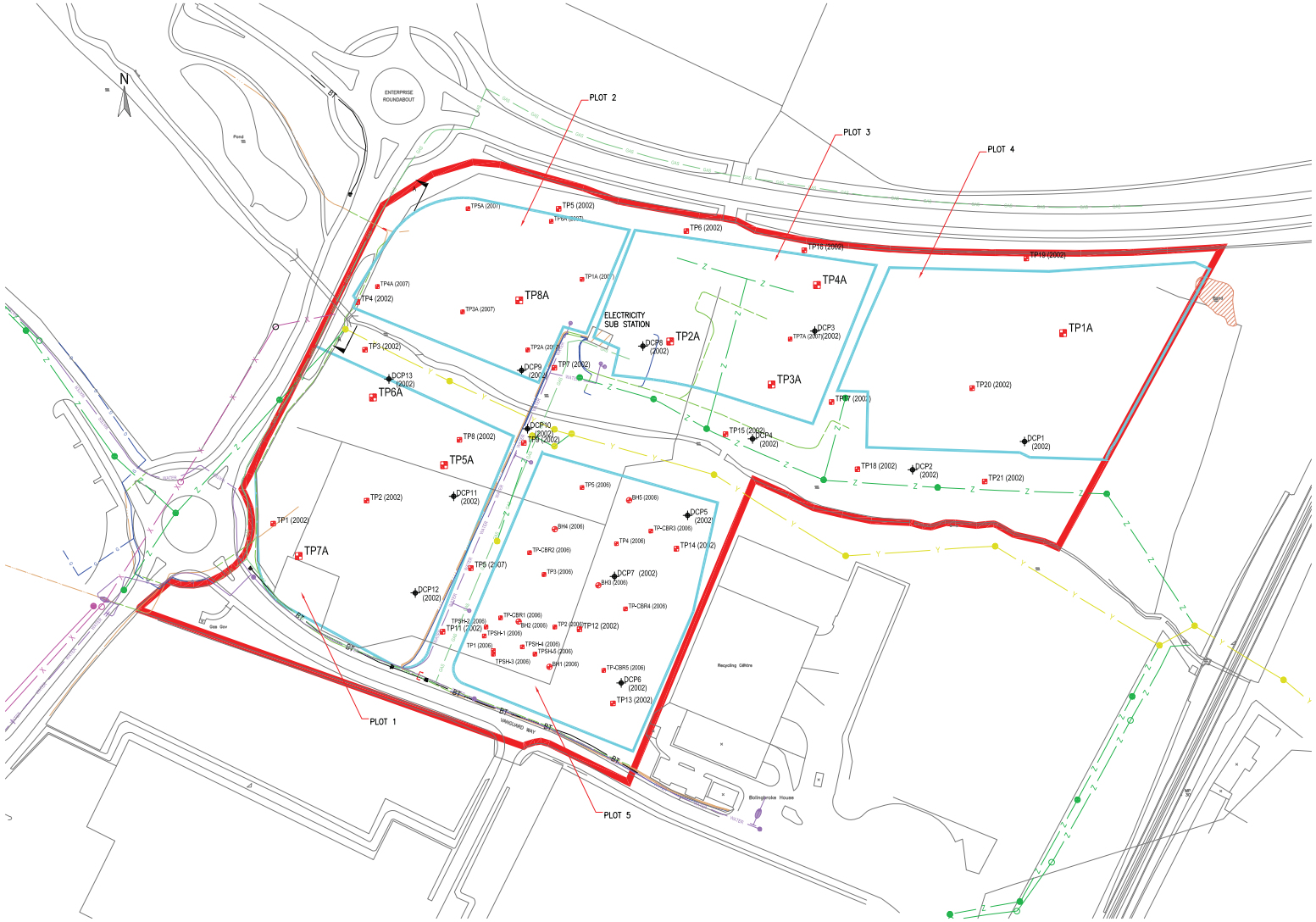
DTR:UK

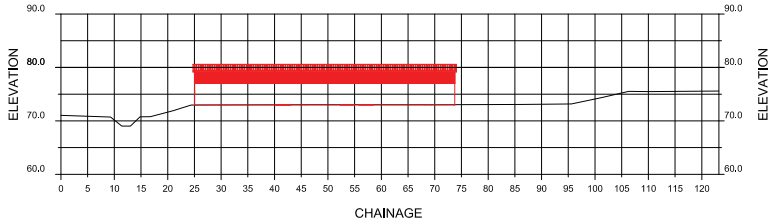

ORGANICS CENTRE
BATTLEFIELDS
SHREWSBURY
King Sturge

DO NOT SCALE; Contractor to check all dimensions and report any omissions or errors

GENERAL NOTES, SURVEY NOTES & SERVICES NOTES.

1. DO NOT SCALE. ALL DIMENSIONS ARE IN MILLIMETRES
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT CONTRACT DRAWINGS
3. ALL LEVELS ARE IN METRES (A.O.D.)
4. THE SURVEY INFORMATION USED IN THE PREPARATION OF THE DRAWING IS NOT WARRANTED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS SURVEY INFORMATION PROVIDED.
5. ALL SITE INVESTIGATION DATA IS PROVIDED FOR INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY PRIOR TO COMMENCEMENT OF THE WORKS.
6. DETAILS SHOWN FOR GUIDANCE ONLY. EXACT LOCATIONS SHOULD BE SOUGHT FROM THE RELEVANT STATUTORY AUTHORITY BY THE CONTRACTOR
7. EXTENT OF 'LIVE' SERVICES AND DRAINAGE ON THE SITE, FOR INFORMATION ONLY





SECTION A - A

SCALE 1:500

ELECTRICITY CABLES
- 11kV CABLE RUN
- CONDUIT
- SERVICES

BT CABLES
- UNDERGROUND PLANT
- JOINT POINT

GAS MAINS
- LP MAINS
- MP MAINS

WATER MAINS
- DISTRIBUTION MAIN
- WATER ISOLATION VALVE (OPEN)
- REVENUE METER
- MANHOLE COVER

SEWERS
- PRIVATE SURFACE WATER GRAVITY SEWER
- PUBLIC FOUL GRAVITY SEWER
- SECTION 104 SEWER
- COMBINED USE MANHOLE
- SURFACE WATER MANHOLE

DEVELOPMENT CONSTRAINTS
- SITE BOUNDARY
- DEVELOPMENT PLOTS
- GREAT CRESTED NEWT RESERVATION
- BH1 (2002) BOREHOLE NUMBER WITH YEAR OF EXCAVATION
- TP1 (2006) TRIAL PIT NUMBER WITH YEAR OF EXCAVATION
- DCP1 (2002) DYNAMIC CORE PENETRATION WITH YEAR OF EXCAVATION

REPRODUCED FROM ORDNANCE SURVEY LAND-LINE.PLUS DATA WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. ORDNANCE SURVEY AND LAND-LINE.PLUS ARE REGISTERED TRADEMARKS.
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Rev	Description	By	Chk	App	Date
C	THIRD ISSUE - TP 1-8 added	LM	LM		07.08
B	SECOND ISSUE	MJ			11.07
A	FIRST ISSUE	MJ			10.07

PXP West Midlands Limited Partnership

Engineering
Management
Environmental
Planning

Aqua House
20 Lionel Street
Birmingham
B3 1AQ
Tel: 0121 233 1833
Fax: 0121 212 8330

www.wyg.com
e-mail: birmingham@wyg.com

White Young Green
Consulting

Project:
PXP Battlefield

Drawing Title:
Geo-Environmental Constraints Plan

Scale at A1	Drawn By	Date	Checked By	Date	Approved By	Date
1:1250	MJ	11.08.07				

Project No.	Office	Type	Drawing No.	Revision
E013423-1	26/01	E	003	C

0 12.5 25 37.5 50 62.5 m
SCALE 1:1250 @ A1; 1:2500 @ A3

APPROVAL ☐ INFORMATION ☒ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

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APPENDIX C

Exploratory Hole Records

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP1**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350833E - 316641N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
POSSIBLE MADE GROUND: Light brown to brown slightly sandy SILT/CLAY with rootlets throughout (TOPSOIL).			0.30					
Orange, grey and red-brown fine to medium SAND (GLACIAL DEPOSITS).			0.95			0.50	B	
Soft to very soft red brown CLAY (GLACIAL DEPOSITS).			1.70			1.20	B HV	
Firm to stiff brown CLAY with some rounded gravel (GLACIAL DEPOSITS).			2.95			2.00	B	
Orange fine to coarse SAND (GLACIAL DEPOSITS).			3.10					
Trial Pit completed at 3.10m bgl								

Stability: Stable.

Groundwater Observations: None.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 270°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP2**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350803E - 316602N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
MADE GROUND: Light brown very silty SAND with rootlets throughout (TOPSOIL).			0.30					
MADE GROUND: Very stiff red-brown friable CLAY with rare rounded gravel.			1.00			0.50	B	
MADE GROUND: Red-brown very clayey SAND.			1.40					
MADE GROUND: Very stiff red-brown friable CLAY with rare rounded gravel.			1.60			1.70	B	
Brown to dark brown very clayey very silty SAND with many rootlets (BURIED TOP/SUBSOIL?).			1.90					
Light brown slightly gravelly fine to medium grained SAND. Gravel is fine to coarse angular to rounded (GLACIAL DEPOSITS).			3.10					
Red brown clayey to very clayey fine grained SAND (WEATHERED SHERWOOD SANDSTONE).			3.80					
Trial Pit completed at 3.80m bgl								

Stability: Stable.

Groundwater Observations: None.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 306°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP3**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350767E - 316623N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
MADE GROUND: Light brown very silty SAND with rootlets throughout (TOPSOIL).			0.30					
MADE GROUND: Stiff to very stiff red-brown CLAY with rare rounded gravel.						0.60	B HP	-
			2.30					
Brown to dark brown firm to stiff slightly sandy silty CLAY with rare rounded gravel. Some rootlets and plant remains present (BURIED TOP/SUBSOIL?).			2.60			2.40	B HP	-
Brown to light brown slightly silty slightly clayey SAND (GLACIAL DEPOSITS).								
			3.70					
Orange slightly gravelly fine grained SAND with rare angular to subangular cobbles. Gravel is fine to coarse angular to subangular (GLACIAL DEPOSITS).			3.90					
Trial Pit completed at 3.90m bgl								

Stability: Stable.

Groundwater Observations: None.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 290°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP4**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350720E - 316637N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
MADE GROUND: Light brown silty SAND with rootlets throughout (TOPSOIL).			0.30					
MADE GROUND: Stiff to very stiff red-brown CLAY.			1.20					
Brown to dark brown very clayey very silty SAND with some rounded gravel. Some to many rootlets present (BURIED TOP/SUBSOIL?).			1.40			1.30	B	
Light brown to brown very clayey very silty SAND with some rounded gravel. Few rootlets present (GLACIAL DEPOSITS).			2.70					
Light brown to grey clayey gravelly SAND. Gravel is fine to coarse angular to rounded. Some black discolouration and rotted wood fragements present, which appear to be natural (GLACIAL DEPOSITS).			3.70			3.20	B	
Firm red-brown very sandy CLAY with rare rounded gravel (GLACIAL DEPOSITS).			3.80					
Red-brown to orange fine grained SAND (WEATHERED SHERWOOD SANDSTONE).			4.00					
Trial Pit completed at 4.00m bgl								

Stability: Stable.

Groundwater Observations: Slight seepage in all faces at 3.7m bgl.

Other Observations:

Pit Dimensions:
Length: 1.5m
Width: 0.6m
Orientation: 112°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP5**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350770E - 316680N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
POSSIBLE MADE GROUND: Dark brown very silty very clayey SAND with rootlets throughout (TOPSOIL).			0.30					
Red-brown to orange fine grained SAND (GLACIAL DEPOSITS). Light brown and black coarse SAND.			1.50					
Stiff to very stiff red-brown CLAY with some subangular to subrounded coarse gravel and cobbles (GLACIAL DEPOSITS).			2.70			2.00	HP	
Light orangey brown slightly gravelly SAND. Gravel is fine to coarse subangular to rounded. Becomes redder with depth (GLACIAL DEPOSITS).			3.20					
Trial Pit completed at 3.20m bgl								

Stability: Stable.

Groundwater Observations: Seepage in all faces at 1.5m bgl.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 150°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP6**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350816E - 316673N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
POSSIBLE MADE GROUND: Brown to dark brown very silty very clayey SAND with rootlets throughout (TOPSOIL).			0.30					
Red-brown to orange fine SAND (GLACIAL DEPOSITS).			0.60					
Light brown and black coarse SAND (GLACIAL DEPOSITS).			1.50			1.50	HP	-
Firm to stiff red-brown CLAY with rare rounded gravel (GLACIAL DEPOSITS). Becoming stiff.						2.00	HP	-
Boulder. Could not be excavated. Some rounded cobbles present.			2.70					
Light orangey brown slightly gravelly SAND. Gravel is fine to coarse subangular to rounded (GLACIAL DEPOSITS).			3.00					
Trial Pit completed at 3.00m bgl								

Stability: Stable.

Groundwater Observations: Seepage in all faces at 1.5m bgl.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 98°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP7**

Sheet 1 of 1

Scale 1:50

Project :**Battlefields**

Client :

Method: **JCB 3CX**

Co-ordinates: 350948E - 316608N

Ground Level :

Start Date: 26/10/07

Finish Date: 26/10/07

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
MADE GROUND: Light brown very silty very clayey SAND with rootlets throughout (TOPSOIL).			0.40					
MADE GROUND: Light brown very gravelly clayey SAND.			0.70					
MADE GROUND: Stiff red-brown friable CLAY with some rounded gravel.			2.20					
Red-brown to red gravelly SAND with some rounded cobbles. Gravel is fine to coarse subrounded to rounded (GLACIAL DEPOSITS).			3.20					
Trial Pit completed at 3.20m bgl								

Stability: Stable.

Groundwater Observations: None.

Other Observations:

Pit Dimensions:

Length: 1.5m

Width: 0.6m

Orientation: 110°

JOB NUMBER

Logged By : TJC

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP01**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method: **CAT 460**

Co-ordinates:

Ground Level :

Start Date: 14/01/08

Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Very soft to soft, light brown and brown, slightly sandy CLAY. With grass coverring and many rootlets and occasional sub-rounded gravel of varying lithologies.			0.40					
Firm to stiff, red-brown, slightly sandy CLAY. With some gravel of varying lithologies.			1.20					
Trial Pit completed at 1.20m bgl								

Stability: Stable on all sides

Groundwater Observations: TP abandoned due to excess surface groundwater.

Other Observations:

Pit Dimensions:
Length: 2.6m
Width: 0.9m
Orientation:

JOB NUMBER

Logged By : BEJ

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP02**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method: **CAT 460**

Co-ordinates:

Ground Level :

Start Date: 14/01/08

Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Soft to firm, light brown and brown clayey TOPSOIL. With rare gravel of varying lithologies.			0.50					
Loose to moderately compacted, light brown and brown, fine to medium grained SAND. With occasional gravel and rare rootlets.			1.10					
Medium dense, red, fine to medium grained SAND.			2.20					
Medium dense to dense, red, fine to medium grained SAND. With some to much gravel of very weak to weak weathered sandstone.			2.40					
Trial Pit completed at 2.40m bgl								

Stability: No stability issues

Groundwater Observations: No groundwater encountered.

Other Observations:

Pit Dimensions:

Length: 2.9m

Width: 0.9m

Orientation:

JOB NUMBER

Logged By : BEJ

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP03**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method: **CAT460**

Co-ordinates:
Ground Level :

Start Date: 14/01/08
Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Light brown to brown, slightly sandy clayey TOPSOIL.			0.35					
Loose to medium dense, yellow-brown, fine to medium grained, slightly gravelly SAND. With gravel of varying lithologies.			0.80					
Stiff to very stiff, yellow-brown, slightly sandy CLAY. With rare gravel of varying lithologies.			1.00					
Stiff to very stiff, red-brown with localised mottled grey, slightly sandy CLAY. With rare to occasional cobbles of quartz, some gravel of varying lithologies and some mudstone lithorelicts. Occasional boulders of sandstone, some black fines and cobbled sized fragments of igneous rock.			2.50					
Medium dense to dense, red-brown SAND. With much gravel and some cobbles of varying lithologies.			3.00					
Trial Pit completed at 3.00m bgl								

Stability: No stability Issues
Groundwater Observations: Moderate groundwater seepage in all faces
Other Observations:

Pit Dimensions:
Length: 3.1m
Width: 0.9m
Orientation:

JOB NUMBER
Logged By : BEJ
Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP04**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method:

Co-ordinates:
Ground Level :

Start Date: 14/01/08
Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Light brown to brown, slightly sandy clayey TOPSOIL. With some gravel of varying lithologies.			0.50					
			1.10					
Trial Pit completed at 2.90m bgl								

Stability:
Groundwater Observations:
Other Observations:

Pit Dimensions:
Length: -
Width: -
Orientation:

JOB NUMBER
Logged By :
Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ

Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP07**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method: **CAT 480**

Co-ordinates:

Ground Level :

Start Date: 14/01/08

Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Soft to firm, grey-brown, clayey TOPSOIL. With occasional rootlets and occasional to some gravel.			0.60			0.25	D	
MADE GROUND: Comprising of firm to stiff, red-brown, slightly sandy clay. With some gravel of varying lithologies. black fines and occasional fine to medium lenses of sand.			0.90					
MADE GROUND: Comprising of loose to medium dense, fine to medium grained sand. WIth some to much gravel of varying lithologies and occassional sub-rounded to rounded cobbles of varying lithologies.			2.10					
Medium dense, Orange-red, medium to coasre grained SAND. With some to much gravel of varying lithologies and occasional sub-rounded to rounded cobbles of varying lithologies.			2.80					
Medium dense to dense, dark red, fine to medium grained, slightly clayey SAND. With some to much gravel and some cobbles of highly weathered sub-rounded sandstone.			3.00					
Trial Pit completed at 3.00m bgl								

Stability: Major collpase in Face D.

Groundwater Observations: Groundwater Seepage encountered in Faces B and D at 1.20m Depth

Other Observations:

Pit Dimensions:

Length: 2.9m

Width: 0.9m

Orientation: 10°

JOB NUMBER

Logged By :

Checked By :

FIG. NO.

WHITE YOUNG GREEN ENVIRONMENTAL

Ground Technologies and Investigations

Aqua House, 20 Lionel Street, Birmingham, B3 1AQ
Tel: 0121 233 1833 Fax: 0121 212 8330

Trial Pit Number **TP08**

Sheet 1 of 1

Scale 1:50

Project :**PxP Battlefields, Shrewsbury**

Client : **PxP West Midlands**

Method: **CAT 480**

Co-ordinates:

Ground Level :

Start Date: 14/01/08

Finish Date: 14/01/08

Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Backfill	Sample Test Depth (m)	Sample Test Type	Notes
Soft to firm, light brown to brown, fine grained sandy CLAY. With occasional rootlets and some gravel of varying lithologies.			0.40			0.30	D	
Firm to stiff, red-brown, fine to medium grained sandy CLAY. With some sub-angular to angular gravel and cobbles of varying lithologies.			2.55					
Medium dense, yellow and light-brown, fine to medium grained SAND.			2.90					
Firm to stiff, red-brown with localised mottled grey, fine grained sandy CLAY. With some gravel and cobbles of varying lithologies and occasional rootlets.			3.70					
Trial Pit completed at 3.70m bgl								

Stability: No stability issues

Groundwater Observations: Minor seepage from topsoil / Made Ground Interface.

Other Observations:

Pit Dimensions:
Length: 3.0m
Width: 0.9m
Orientation:

JOB NUMBER

Logged By :

Checked By :

FIG. NO.

DRAFT

APPENDIX D

Geotechnical Laboratory Testing Results

LABORATORY RESULTS - Classification and Strength

Project LABORATORY TESTING **Project No:** PC073200

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1 - \sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
TP1	1.20 (1.20)	B	C84240	Brown slightly gravelly sandy CLAY.*	CL	15 (17%)	27	12	18						
TP1	2.00 (2.00)	B	C84244	Brown slightly gravelly sandy CLAY.*	CL	12 (17%)	28	16	14						
TP2	0.50 (0.50)	B	C84241	Brown slightly gravelly sandy CLAY.*	CL	13 (38%)	29	16	9.8						
TP2	1.70 (1.70)	B	C84249	Brown slightly gravelly sandy CLAY.*	CI	19 (29%)	39	20	15						
TP3	0.60 (0.60)	B	C84246	Brown slightly gravelly sandy CLAY.*	CI	19 (7%)	36	17	18						
TP3	2.40 (2.40)	B	C84248	Dark brown slightly gravelly sandy CLAY.*	CL	15 (19%)	34	19	16						
TP4	1.40 (1.40)	B	C84247	Dark brown slightly gravelly sandy CLAY.*	CI	17 (22%)	38	21	15						
TP5	2.00 (2.00)	B	C84242	Brown sandy slightly gravelly CLAY.*	CL	14 (17%)	33	19	14						

Remarks Tests performed in accordance with BS 1377: 1990

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LABORATORY RESULTS - Chemical Analysis

Project LABORATORY TESTING **Project No:** PC073200

Sample					Sulphate			pH	Organic Content	Loss on Ignition	Chloride		
					In Soil		In Water				In Soil		In Water
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Acid Soluble %	Water Soluble g/l	g/l		%	%	Acid Soluble %	Water Soluble g/l	g/l
TP2	1.70 (1.70)	B	C84249	Brown slightly gravelly sandy CLAY.*					2.06				
TP3	2.40 (2.40)	B	C84248	Dark brown slightly gravelly sandy CLAY.*					1.24				
TP4	1.40 (1.40)	B	C84247	Dark brown slightly gravelly sandy CLAY.*					1.13				
TP4	3.20 (3.20)	B	C84243	Brown clayey gravelly SAND.*					0.12				

Remarks Tests performed in accordance with BS 1377: Part 3: 1990
Sulphate reported as SO3, results in brackets reported as SO4

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LABORATORY RESULTS - Particle Size Distribution

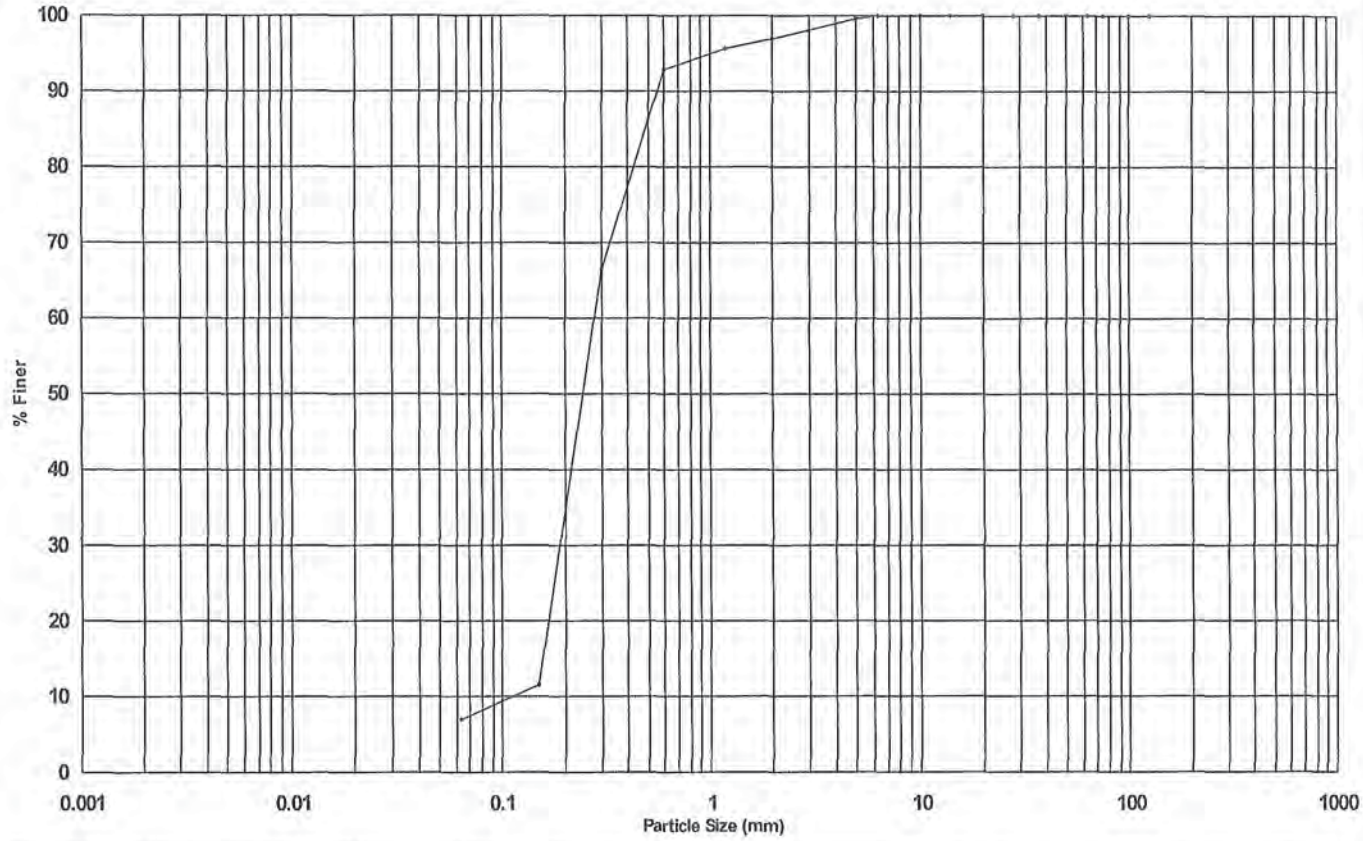
Project: LABORATORY TESTING

Project No: PC073200

Hole TP1
Sample Depth 0.50m
Sample Type B
Sample Ref C84250

Sample Description

Brown medium SAND. **



Classification		Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	7
SAND	90
GRAVEL	3
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
28mm	100
20mm	100
14mm	100
10mm	100
6.3mm	100
5mm	100
3.35mm	-

Size	Percentage Finer
2mm	97
1.18mm	96
600μm	93
425μm	-
300μm	67
212μm	-
150μm	12
75μm	-
63μm	7
20μm	-
6μm	-
2μm	-

Uniformity Coefficient	
2.87	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Test performed in accordance with BS 1377: Part 2: 1990

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LABORATORY RESULTS - Particle Size Distribution

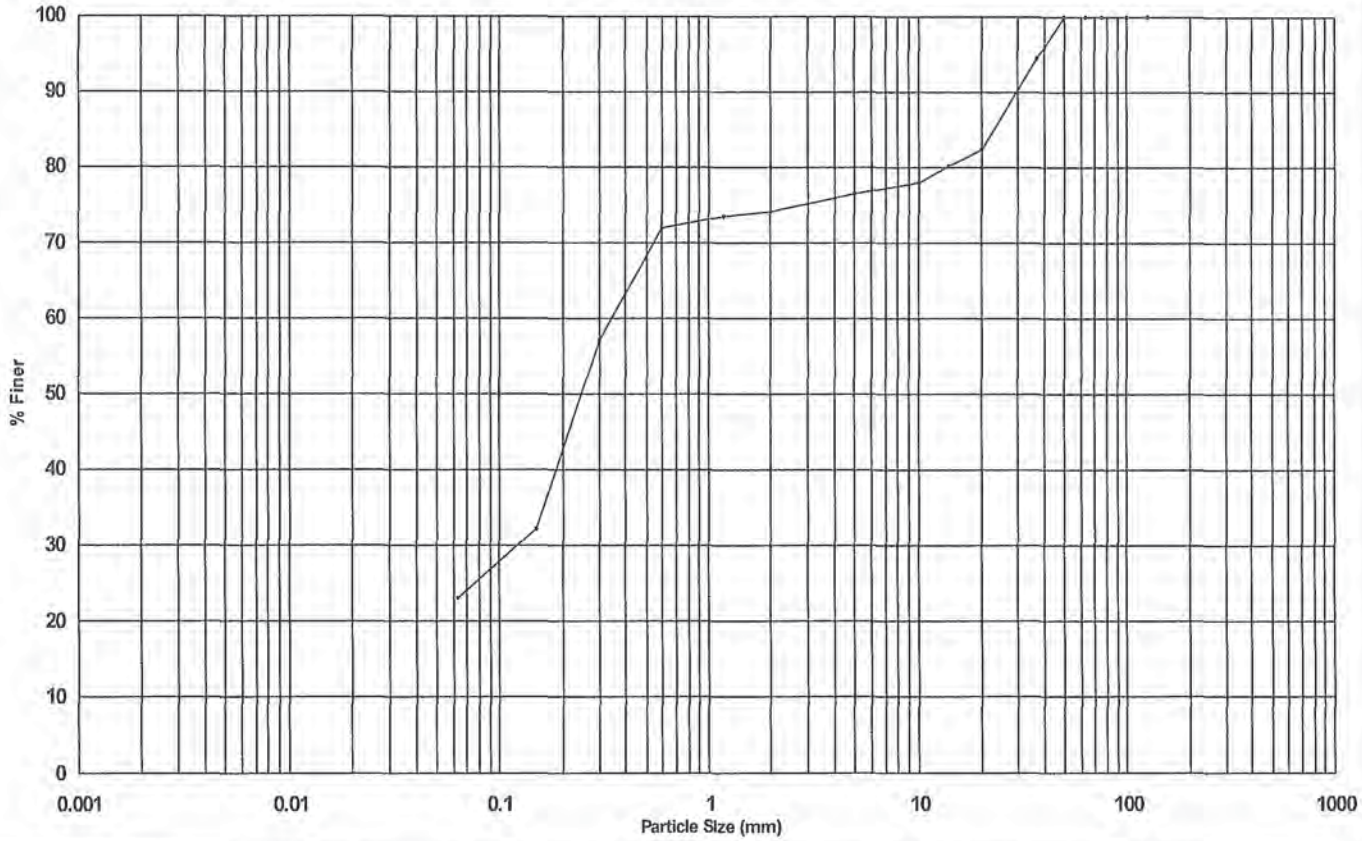
Project: LABORATORY TESTING

Project No: PC073200

Hole	TP4
Sample Depth	3.20m
Sample Type	B
Sample Ref	C84243

Sample Description

Brown clayey gravelly SAND. **



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	22
SAND	52
GRAVEL	26
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	95
28mm	-
20mm	82
14mm	80
10mm	78
6.3mm	-
5mm	76
3.35mm	-

Size	Percentage Finer
2mm	74
1.18mm	73
600μm	72
425μm	-
300μm	57
212μm	-
150μm	32
75μm	-
63μm	23
20μm	-
6μm	-
2μm	-

Uniformity Coefficient	
Not Available	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Test performed in accordance with BS 1377: Part 2: 1990

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LABORATORY RESULTS - Particle Size Distribution

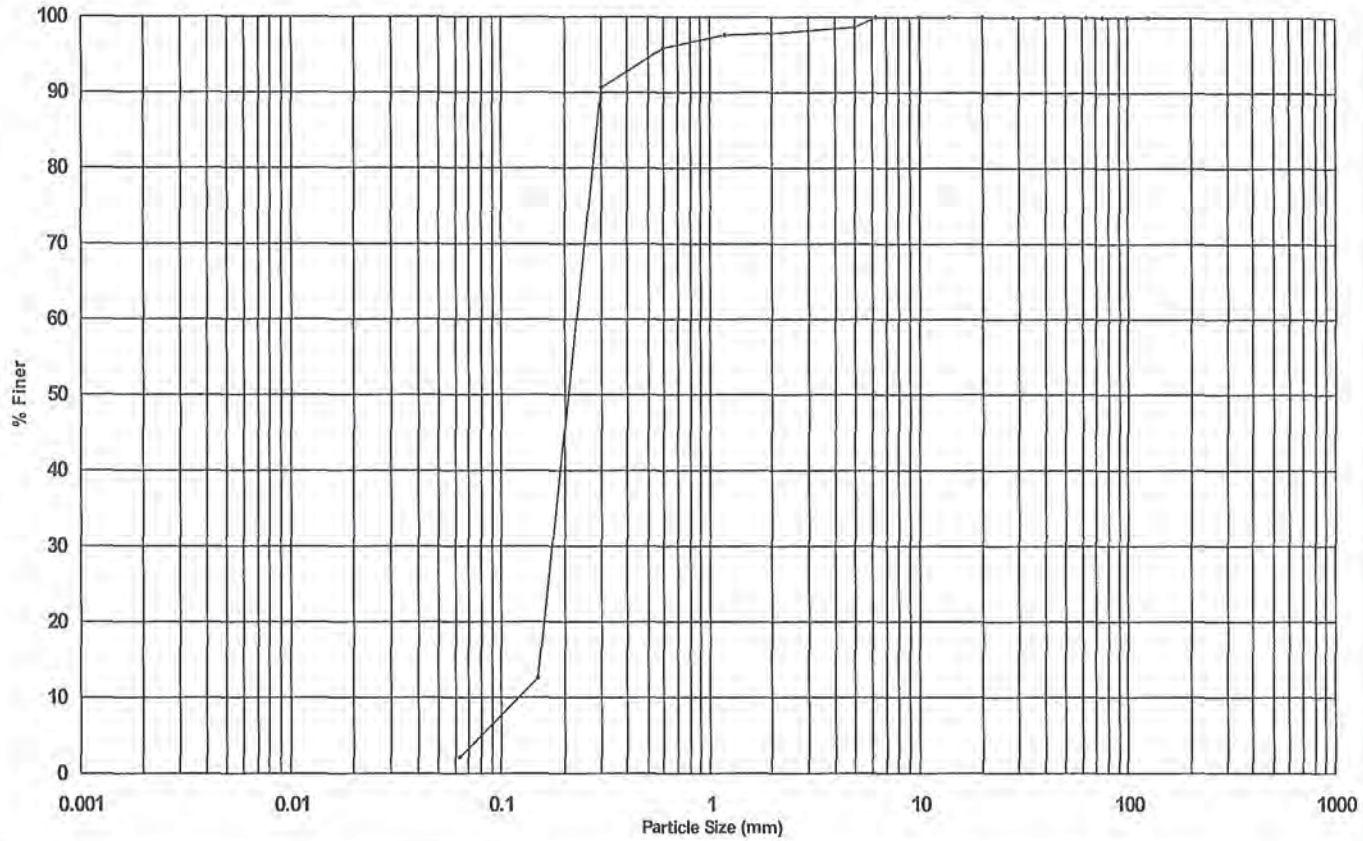
Project: LABORATORY TESTING

Project No: PC073200

Hole TP5
Sample Depth 0.80m
Sample Type B
Sample Ref C84245

Sample Description

Brown SAND. **



Classification		Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
	CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	2
SAND	96
GRAVEL	2
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
28mm	100
20mm	100
14mm	100
10mm	100
6.3mm	100
5mm	99
3.35mm	-

Size	Percentage Finer
2mm	98
1.18mm	98
600μm	96
425μm	-
300μm	91
212μm	-
150μm	13
75μm	-
63μm	2
20μm	-
6μm	-
2μm	-

Uniformity Coefficient	
2.58	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Test performed in accordance with BS 1377: Part 2: 1990

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LABORATORY RESULTS - *Particle Size Distribution*

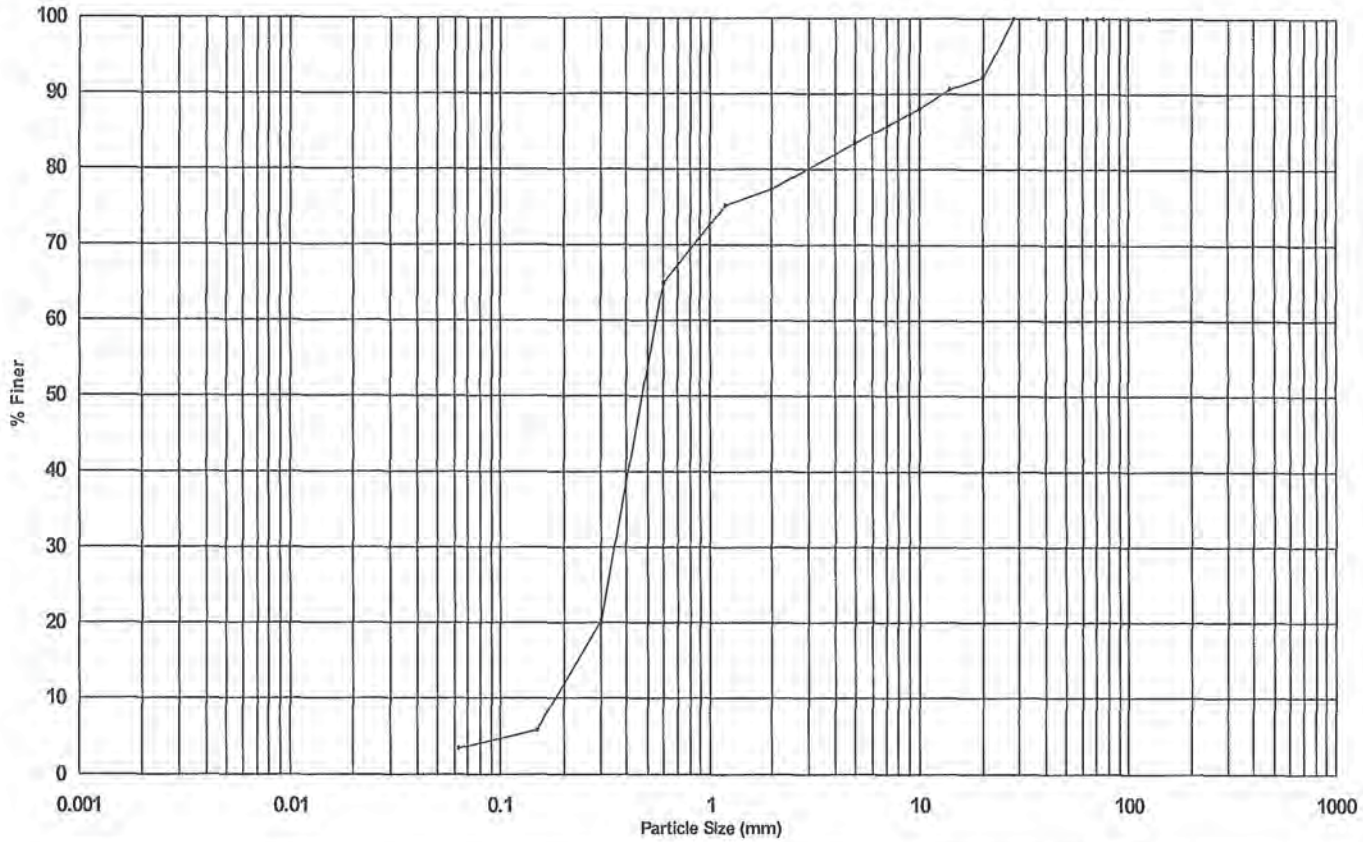
Project: LABORATORY TESTING

Project No: PC073200

Hole TP5
Sample Depth 3.00m
Sample Type B
Sample Ref C84695

Sample Description

Brown gravelly SAND. **



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	3
SAND	74
GRAVEL	23
COBBLES	0
BOULDERS	0

Size	Percentage Finer
125mm	100
100mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
28mm	100
20mm	92
14mm	91
10mm	88
6.3mm	-
5mm	83
3.35mm	-

Size	Percentage Finer
2mm	77
1.18mm	75
600μm	65
425μm	-
300μm	20
212μm	-
150μm	6
75μm	-
63μm	4
20μm	-
6μm	-
2μm	-

Uniformity Coefficient	
2.47	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Test performed in accordance with BS 1377: Part 2: 1990

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STOKE-ON-TRENT
Sir Henry Doulton House
Forge Lane
Etruria
Stoke-on-Trent
ST1 5BD
Tel: +44 (0)845 111 7777

CARDIFF
22 Windsor Place
Cardiff
CF10 3BY
Tel: +44 (0)292 072 9191

EDINBURGH
Suite 2/3
Great Michael House
14 Links Place
Edinburgh
EH6 7EZ
Tel: +44 (0)131 555 3311

GREATER MANCHESTER
2 The Avenue
Leigh
Greater Manchester
WN7 1ES
Tel: +44 (0)194 226 0101

LONDON
Third Floor
46 Chancery Lane
London
WC2A 1JE
Tel: +44 (0)207 242 3243

NEWCASTLE UPON TYNE
City Quadrant
11 Waterloo Square
Newcastle upon Tyne
NE1 4DP
Tel: +44 (0)191 232 0943

SHEFFIELD
Unit 5
Newton Business Centre
Newton Chambers Road
Thorncliffe Park
Chapeltown
Sheffield
S35 2PH
Tel: +44 (0)114 245 6244

TAUNTON
Suite E1
Victoria House
Victoria Street
Taunton
Somerset
TA1 3JA
Tel: +44 (0)182 370 3100

TRURO
Baldhu House
Wheal Jane Earth Science Park
Baldhu
Truro
TR3 6EH
Tel: +44 (0)187 256 0738

WEST BROMWICH
Thynne Court
Thynne Street
West Bromwich
West Midlands
B70 6PH
Tel: +44 (0)121 580 0909

International offices:

ALMATY
29/6 Satpaev Avenue
Hyatt Regency Hotel
Office Tower, 7th Floor
Almaty
Kazakhstan
050040
Tel : +7(727) 334 1310

MOSCOW
Suite 2, Block 10
Letnikovskaya Street
Moscow
Russia
115114
Tel: +7(495) 980 0767

Wardell Armstrong Archaeology:

CUMBRIA
Cocklakes Yard
Carlisle
Cumbria
CA4 0BQ
Tel: +44 (0)122 856 4820

SHAFTESBURY
Unit 3
Chaldicott Barns
Tokes Lane
Semley
Nr. Shaftesbury
SP7 9AW
Tel: +44 (0)174 783 0603

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