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LAND WEST OF THE OAKS, MASHAM

DRAINAGE STRATEGY REPORT

MARCH 2017

WSP | PARSONS BRINCKERHOFF

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DRAINAGE STRATEGY REPORT

C & G Jameson

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APPENDICES

1 EXECUTIVE SUMMARY

1.1.1 WSP | Parsons Brinckerhoff has been appointed by C & G Jameson to provide a Drainage Strategy Report to support the proposed development on land west of the Oaks, Masham.

1.1.2 This report sets out the proposed strategy which will support the outline planning application of the demolition of existing derelict buildings and erection of up to 60 houses, commercial units (Use Class B1/ B2/ B8/ D2) and informal public open space. There are two distinct phases of development, the commercial element and the residential element.

1.1.3 The aim of the assessment is to demonstrate that there is a viable strategy for managing surface and foul water at the site within the requirements set out by Harrogate Borough Council and Yorkshire Water.

1.1.4 This assessment considers:-

- The destination of surface water emanating from impermeable areas of the development
- What restriction in the rate of discharge is required, and what storage and SuDS options could be used to meet any surface water storage requirements
- How the site drainage, including SuDS features will be maintained and by whom
- How foul water from the site will be managed.

1.1.5 A number of issues relating to flood risk have been assessed in a separate Flood Risk Assessment, and are therefore not included within this report.

1.1.6 It is proposed to manage surface water as closely as possible to the current drainage patterns of the site. This will see the site draining to the north and discharging runoff to the Swinney Beck which borders the northern site boundary. Surface water will be managed separately for each phase of the development (i.e. residential and commercial) and will drain independently to the other i.e. no shared storage, outfalls etc.

1.1.7 Final discharge will be to the Swinney Beck via two discharge locations, one for each phase of the development. Each will discharge at a maximum rate of 5 l/s, equating to a maximum rate of 10 l/s.

1.1.8 In order to ensure there is no increase in the rate of runoff, plot, neighbourhood and site wide SuDS will be used to control runoff across the site. This will essentially form a system of measures with appropriately located flow controls to replicate the undeveloped runoff and infiltration patterns of the site.

1.1.9 Foul water will be collected through a new foul drainage system serving both the residential and commercial phases of the development, and will connect to the public network via newly requisitioned connection.

1.1.10 It is anticipated that subject to the site drainage being designed and maintained in accordance with the strategy outlined in the strategy, both surface and foul water can be managed in a conventional and sustainable manner.

2 PROJECT BACKGROUND

2.1 APPOINTMENT AND BRIEF

2.1.1 WSP | Parsons Brinckerhoff has been appointed by C & G Jameson to undertake a drainage strategy to support a planning application for a proposed development on land west of The Oaks, Masham. The application is seeking outline planning permission with all matters reserved for the demolition of existing derelict buildings and erection of up to 60 houses, commercial units (Use B1/ B2/ B8/ D2) and informal public open space.

2.1.2 A site location plan is included in Appendix A.

2.2 STUDY AIM AND OBJECTIVES

2.2.1 The aim of this study is to develop a drainage strategy of suitable scope and detail to demonstrate that there is a viable strategy for managing surface and foul water at the site within the requirements set out by Harrogate Borough Council and Yorkshire Water.

2.2.2 The scope has been established through a review of the Harrogate Borough Council reporting requirements for a drainage strategy supporting an outline planning application. These requirements were read from the Harrogate Borough Council Supporting Drainage Information Chart for Planning Applications.

2.2.3 This study will:

- Consult with statutory consultees including Yorkshire Water and Harrogate Borough Council to understand the requirements for managing surface and foul water from the site.
- Identify a suitable point of discharge for surface water.
- Based on allowable runoff rates, establish the required volume of storage required for attenuating surface water runoff.
- Identify what storage options could be used at the site to provide the required volume of storage, and how any storage could connect with the wider site and point(s) of discharge i.e. drainage connectivity across the site.
- Identify how the drainage system for the site will be maintained and managed, and by whom.

2.2.4 An accompanying Flood Risk Assessment (doc ref. 70028809-FRA-001) should be read in conjunction with this report.

2.3 PROPOSED DEVELOPMENT

2.3.1 An indicative plan of the development proposals provided by the architect is included in Appendix B.

2.3.2 It is understood that the development will be formed of two separate phases, one being commercial and the other being residential. The commercial element covers 0.33 ha of the site in the north west corner, whilst the rest of the site is covered by the residential development including an area of proposed open space in the north east corner.

2.4 LIMITATIONS

2.4.1 This report is based on the interpretation and assessment of data provided by third parties.

2.4.2 Whilst every care has been taken to ensure this information is accurate and up-to-date, WSP | Parsons Brinckerhoff cannot guarantee the accuracy of third party data.

2.4.3 The findings of this report may change if the data is amended or updated after consultation.

2.4.4 The recommendations made within this report may also be subject to change upon receipt of further consultation responses.

3 EXISTING SITE

3.1 SITE LOCATION

3.1.1 The site is located to the west of the Oaks, Masham, North Yorkshire approximately 0.4 km west of Masham's market place.

3.1.2 An approximate post code is HG4 4EL (adjacent property to the west), and British National Grid coordinates are 422027, 480743.

3.2 SITE DESCRIPTION

3.2.1 Table 3-1 describes the general site characteristics.

Table 3-1 - Characteristics of the Site

Area		2.66 ha
Existing Usage		The majority of the site is permeable, consisting of agricultural grazing land, together with a number of disused farm buildings and hardstanding areas in the far north eastern corner.
General Topography		A topographical survey (Dwg No. 8389/10) was undertaken by CSL Surveys in April 2008, and is included in Appendix C. The site slopes from south to north giving the site a northerly aspect. The maximum fall across the site is from 96.75 m AOD in the far south western corner to 87.89 m AOD in the far north eastern corner.
Boundaries	North	Swinney Beck beyond which is Westholme Road.
	South	Agricultural land and a small play area located directly south of the site.
	East	The Oaks, an existing housing development.
	West	Agricultural land
Access		There is vehicular access via Foxholme Lane to the disused farm buildings and hardstanding areas.

3.3 EXISTING WATERCOURSES

3.3.1 Swinney Beck flows in a north west to south east direction past the northern boundary of the site. It is classed as a 'Main River' meaning it is the maintenance responsibility of the Environment Agency.

3.3.2 An inspection of the watercourse during a site visit identified the watercourse to be in acceptable condition, with no excessive build-up of silt within the channel and as such was freely flowing. The road bridge downstream of the reach past the site was free from blockage and of clear span design.

3.4 GROUND CONDITIONS

3.4.1 The information regarding the underlying ground conditions at the site was provided by CGL, the project engineers who undertook the Phase 1 Ground Investigation.

3.4.2 The general sequence of deposits underlying the site is summarised in Table 3-2 below.

Table 3-2 – Ground Conditions underlying the Site

GEOLOGICAL UNIT		DESCRIPTION
Superficial deposits	Diamicton Till	Clay/sand and gravel for the most part. This appears to be present to at least 5m depth.
Bedrock	Stainmore Formation	Millstone Grit Group in the western half of the site and the Cayton Gill Shell Bed in the eastern half of the site present to at least 5m depth.

3.4.3 Given proximity to the watercourse, groundwater across the site is anticipated to be present at depths of between 0.5m and 1.0m below existing ground level.

3.5 EXISTING SURFACE WATER DRAINAGE

3.5.1 The existing drainage arrangements for the site were established during the site visit and inspection of the above ground drainage infrastructure. No existing drainage records were made available for the study.

3.5.2 The majority of the site is open fields and as such is not served by any formal drainage. The topography indicates these undeveloped parts of the site drain downslope to the north eventually discharging to the Swinney Beck.

3.5.3 Parts of the existing impermeable areas were observed to be served by a number of gulleys. Surface water from these areas is believed to discharge to Swinney Beck via an observed outfall in the north eastern corner of the site.

3.6 EXISTING SURFACE WATER FLOOD RISK

3.6.1 The extent of existing surface water flood risk has been assessed based on the Environment Agency flood map for surface water, which indicates two areas susceptible to flooding.

3.6.2 The first is to the north east of the site adjacent to the watercourse. The area represents the lowest topographic area of the site, and is likely to be the recipient of a large percentage of the surface water runoff from the site.

3.6.3 The second is to the east of the site adjacent to the proposed new access, which again is located in the area of lower topography.

3.6.4 No evidence of surface water flooding was observed at either location during the site visit.

4 SURFACE WATER MANAGEMENT

4.1 OVERVIEW

4.1.1 The surface water strategy has been developed based on conversations with Harrogate Borough Council (HBC) during which the requirements for the strategy were agreed. In summary, the strategy is as follows:

- The site drainage has been divided into separate phases for the commercial (Area A) and residential (Area B) elements. Each development phase drains independently to the other i.e. no shared storage, outfalls etc.
- Discharge of surface water is to Swinney Beck via two separate outfalls (one for each development phase) each discharging at a restricted rate of 5 l/s (i.e. 10 l/s maximum combined total for each outfall).
- The drainage for the residential development phase is divided into a number of separate smaller catchments (4 in total plus an area designated for public open space/SuDS storage). Each catchment provides storage at a street and neighbourhood level before discharging at a restricted rate to a main storage pond, which in turn discharges to Swinney Beck at 5 l/s.
- A climate change allowance of 40% for rainfall has been considered in the calculation of surface water runoff and required storage volumes.

4.1.2 A Surface Water Drainage Strategy Plan (Drawing No. 70028809-D-001 included in Appendix D) has been prepared and should be read in conjunction with this section of the report.

4.2 DISPOSAL OF SURFACE WATER

4.2.1 The method for removal of surface water from the site has been selected in the order of preference outlined in Building Regulations Part H. The hierarchy is as follows:

- Infiltration to the ground.
- Discharge to a watercourse.
- Connection to a sewer.

4.2.2 Each of the above will be considered in order of preference to establish the most suitable method(s) of disposal.

INFILTRATION TO THE GROUND

4.2.3 No intrusive ground investigation/infiltration testing was available to inform the drainage strategy at this outline planning stage. In the absence of detailed test results/investigation, the Phase 1 Ground Investigation has been used by CGL to establish the underlying ground conditions and suitability for infiltration.

4.2.4 The records indicate Diamicton Till to be present at ground level with available borehole records just to the north of the site indicating these comprise of clayey sand and gravel for the most part. This appears to be present to at least 5 m depth.

4.2.5 Due to the uncertainty regarding the capacity of the underlying ground to infiltrate runoff and in order to allow a workable strategy to be demonstrated for the purpose of outline planning, infiltration measures have not been included within the strategy as a source of surface water removal.

CONNECTION TO A WATERCOURSE

4.2.6 Swinney Beck flows past the northern site boundary, and as runoff currently will preferentially drain towards the Beck as a result of the site topography it is proposed to discharge surface water to this location in a continuation of the existing arrangements.

4.2.7 A separate point of discharge is proposed for commercial and residential aspects of the development to enable each phase of the development to be drained independently. The proposed location of each point of discharge is indicated on the drainage strategy plan, and each phase of the development is hereafter referred to as Area A (Commercial) served by Outfall Location 1 and Area B (Residential) served by Outfall Location 2.

4.2.8 The Beck was observed to be a shallow depth throughout the reach past the site. To ensure there is adequate depth to allow discharge of surface water, a survey of the river channel was reviewed and compared to adjacent ground levels. A summary of the comparison is provided below:

- → Outfall Location 1 = Local ground level 89.30 mAOD; Bed level 88.15 mAOD.
- → Outfall Location 2 = Local ground level 88.38 mAOD; Bed level 87.16 mAOD.

4.2.9 A fall of 1.15 m and 1.22 m for Outfalls 1 and 2 respectively suggest there is adequate depth for discharge to the watercourse. However, the invert level of any flood storage/attenuation feature should be raised at least 300 mm above bed level, which will most likely prohibit the use of any storage pond greater than 0.75 m depth.

4.3 PROPOSED DISCHARGE RATES AND STORAGE

4.3.1 Runoff from the site is required to be restricted to 1.4 l/s/ha, although where required this should be increased to 5 l/s to account for the minimum practical diameter for a flow control device to avoid risk of blockage.

4.3.2 Using the Source Control function within Micro Drainage, the following were calculated for each of the surface water catchments:

1. Post development runoff.
2. Volume of storage required across each catchment to attenuate to 5 l/s.

4.3.3 The volume was calculated based on providing attenuation for events up to and including the 1 in 100 year event plus an allowance for climate change for the critical storm season and duration. As each catchment has a different area of coverage, the critical storm for each respective catchment was used. An uplift of 40% has been used in considering climate change. A summary of the results is provided in Table 5-1.

Table 4-1 – Runoff Rates and Storage Volumes

CATCHMENT	N/A	1	2	3	4	PUBLIC SPACE/SUDS AREA
Development Area	A	B	B	B	B	B
Catchment Area (ha)	0.33	0.40	0.63	0.57	0.57	N/A
Allowable maximum discharge (l/s)	5*	5**	5**	5**	5**	5*
Required Storage Volume (m^3) for the 1 in 100 year	175	225	400	350	350	225

CATCHMENT	N/A	1	2	3	4	PUBLIC SPACE/SUDS AREA
plus 40% Climate Change event						
Catchment Discharges to	Swinney Brook Via Outfall 1	Public Space/Pond Area	Public Space/Pond Area	Public Space/Pond Area	Public Space/Pond Area	Swinney Brook Via Outfall 2
Critical Storm Season/Duration	180 min Winter	240 min Winter	360 min Winter	360 min Winter	360 min Winter	N/A
*Discharge to Swinney Beck (maximum total of 10 l/s) **Discharge from catchment into wider SuDS network i.e. not to an offsite location						

4.3.4 A copy of the Micro Drainage calculations is included in Appendix E.

4.4 PROPOSED SUDS APPROACH

4.4.1 In order to provide the required volume of storage, a sequence of SuDS measures will be required at street, neighbourhood and site level. The use of a sequential system of SuDS will reduce the required land take for storage, increase the resilience of the system and increase the scope for providing wider aesthetic benefits.

4.4.2 Table 5-2 below outlines how the range of SuDS measures could be used to form the overall strategy, specific reference is made to the suitability of each catchment and the SuDS measures suggested are based on the site layout.

Table 4-2 - Overview of SuDS Features

HIERARCHY	TYPICAL MEASURES	FLOW CONTROL DETAIL	DESIGN CONSIDERATIONS
Street Level	Permeable paving, filter strips, rainwater harvesting, green roofs, rain garden and filter drains	Check dams, small diameter pipes and low gradients. Hydrobrakes should be avoided for street level flow control.	■ Parking areas and cul-de-sacs would be particularly suitable for permeable paving. The gradients of some streets would be a consideration. ■ Small scale rain gardens could be particularly suitable and could occupy some areas of proposed green areas. ■ The use of water butts to store water from individual properties should be actively encouraged by the developer.
Neighbourhood Level	Management of runoff across a number of development plots/street level including swales, small basins, rain gardens, ditches, filter drains and other public realm SuDS components.	Flow to be controlled through a system of check dams designed to reduce the rate of flow through each storage structure. Small diameter throttle pipes could also be used to attenuate flow. Along with low gradients all of the above should be used in preference to hydrobrake at this stage, which should be avoided at neighbourhood level.	■ It is proposed that measures should follow the route of the highway layout, and be provided as roadside/kerbside attenuation features. ■ Swales and filter drains would be particularly suitable, although the design of swales will need to consider the steep gradients and use small dams to control the flow of water and maximise storage. ■ Larger rain gardens could also be provided at road intersections to enhance the proposed areas of green space. ■ Drop kerbs should be used to facilitate the movement of surface water off highway areas and towards the

HIERARCHY	TYPICAL MEASURES	FLOW CONTROL DETAIL	DESIGN CONSIDERATIONS
			green/SuDS infrastructure.
Site Level	Management of residual runoff from across the whole development catchment as indicated through measures such as retention ponds, wetlands etc.	Flow to the Swinney Beck should be controlled via hydrobrake/overflow weir. A hydrobrake should be used in preference as more certainty is provided regarding rate of discharge.	■ It is proposed that the amenity area to the north east of the site could be a suitable location for an attenuation pond. ■ Surface water will naturally flow to this area of the site under gravity having been slowed down by the upstream drainage features, which will also reduce the rate/volume at which runoff enters the pond, reducing the spatial requirements.

4.4.3 At this outline planning stage and prior to the agreement of the final site masterplan it is not possible to provide comprehensive detail on what SuDS measures may be the most suitable. In achieving the overall strategy at least one measure from each 'level' of the SuDS management train should be used.

4.5 DRAINAGE SYSTEM ADOPTION

4.5.1 Harrogate Borough Council was able to confirm that they do not currently adopt drainage systems, but do however require that suitable management & maintenance arrangements are in place for the lifetime of the development. This would typically involve a detailed SuDS management & maintenance plan being conditioned as part of any planning approval.

4.5.2 The adoption and maintenance was discussed with the planner acting on behalf of the developer, who confirmed that the intention is to maintain all SuDS, public open spaces and highways infrastructure through a management company/service partner who would undertake all maintenance tasks.

4.5.3 However, at this outline stage of planning no specific company has been appointed or an agreement entered into, it is expected this will be established once the detailed design of the site drainage and SuDS infrastructure has taken place, and a detailed plan for maintenance can be devised.

4.6 DRAINAGE SYSTEM MAINTENANCE

Irrespective of eventual ownership, in order to ensure the long-term performance of the site drainage all aspects of the system should be periodically inspected and maintained with the indicative schedule outlined below. The following provides a summary of the typical maintenance activities associated with the drainage features:

- Permeable paving - Brushing and vacuuming three times per year; removal of weeds, repair any broken blocks / damaged areas; maintain vegetation; 3 monthly inspection of poor operation and/or weed growth; annual inspection of silt accumulation and inspection chambers.
- Swales/rain planters - Monthly removal of litter, grass cutting and vegetation management; annual re-seeding and pruning; repair erosion, reinstate design levels, scarify and spike topsoil, remove sediment and remove oils or petrol residues as required; monthly inspection for blockages, ponding, compaction and silt accumulation; years; monthly inspection for

blockages and physical damage; 6 monthly inspection for silt accumulation and functioning of mechanical devices (where necessary).

- Flow control devices – To be inspected every 3 - 6 months, after a large storm event or after an observed deterioration in system performance.
- Attenuation ponds – Main requirements include mowing along maintenance access routes, amenity areas and across any formed embankment. The remaining areas can be managed as 'meadow'. Glass clippings should be disposed of offsite to remove nutrients and pollutants. Occasionally sediment will require removal when reaching 25 mm depth.

4.6.1 The above represents a typical maintenance schedule; a site specific schedule should be developed following the detailed design of the drainage system.

4.7 DRAINAGE SYSTEM PERFORMANCE AND MANAGEMENT OF SURFACE WATER FLOOD RISK

4.7.1 The storage values calculated at this stage are indicative and are intended to provide enough detail to inform the next stage of design. When the detailed layout of each site is being undertaken, the performance of the SuDS system should be modelled, with adequate storage within the system being provided to ensure flooding does not occur:

- On any part of the site for a 1 in 30 year rainfall event
- During a 1 in 100 year rainfall event in any part of:

  a) A building (including a basement).

  b) Utility plant susceptible to water (e.g. pumping station or electricity sub-station).

- On neighbouring sites during a 1 in 100 year rainfall event. The eventual site layout (including SuDS locations and overland flow routes.

4.7.2 The performance of the system should also consider the occurrence of an extreme storm event over and above for which the system was designed (i.e. the 1 in 100 year plus climate change storm event).

4.7.3 In keeping with the current guidance outlined in CIRIA C635 Designing for Exceedance in Urban Drainage, each development plot design and layout will ensure site levels are engineered to ensure flow is directed away from buildings and towards less vulnerable receptors i.e. amenity, car parking and road areas should be designed to occupy lower areas of a site where water may collect, as this reduces the likelihood of water ingress into buildings.

4.7.4 Furthermore, the drainage strategy is based on observing existing overland flow paths and maintaining areas of lower topography as areas of surface water storage or conveyance. Therefore the site layout has preferentially avoided locating any development in areas which are high susceptible to surface water flooding.

4.8 TREATMENT OF RUNOFF

4.8.1 The SuDS approaches outlined in Table 4-2 would provide a total of 3no. stages of treatment, which would be adequate given the expected level of contamination of runoff from the development i.e. 'Medium Hazard' residential, amenity, commercial, industrial uses including car parking.

5 FOUL WATER STRATEGY

5.1 YORKSHIRE WATER CONSULTATION

5.1.1 The consultation response from Yorkshire Water relating to foul sewerage stated the following:

"The local Waste Water Treatment Works (WWTW) is Masham. It is understood that this WWTW may only have limited spare capacity, if any, available. We have contacted the respective treatment team for more information regarding the impact of proposed development and will contact you when an assessment has been made.

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

Foul water waste should discharge to the 225 mm diameter public foul sewer recorded in The Oaks, at a point approximately 35 metres from the east of the site"

5.1.2 The following foul drainage strategy has been developed in accordance with the requirements outlined above. A copy of the public sewer records is included in Appendix F.

5.2 PROPOSED DISCHARGE RATE

5.2.1 The expected loadings for each aspect of the development have been calculated from Sewers for Adoption Vol. 6 for the domestic loadings.

5.2.2 The anticipated flows from each aspect of the development are outlined in Table 5-1 below.

Table 5-1 - Expected Daily Peak Flow

DEVELOPMENT ASPECT	AREA/ NO. UNITS	EXPECTED FLOW (DAILY PEAK) L/S
Area A (Commercial)	750 m^2	0.05*
Area B (Residential)	60 Units	2.78**
Total	-	2.83
*Based on 0.6 l/s/ha of developable land **Based on 4000 l/dwelling /day		

5.2.3 It is therefore proposed to discharge to the public sewer at a peak rate of 2.83 l/s.

5.3 CONNECTION TO PUBLIC NETWORK

5.3.1 Subject to a positive response Yorkshire Water's Asset management team, who will be able to confirm capacity within the local treatment works, it is proposed to make a connection to the public sewer network at MH1704 to the 225 mm foul sewer which drains south to Masham WWTW, in accordance with the Yorkshire Water's consultation response.

5.3.2 Should it be determined that there is not sufficient capacity in the Masham WWTW, a programme for phasing the proposed development would need to be agreed with Yorkshire Water to coincide with an upgrade to the treatment works.

5.3.3 The details for the proposed connection have been read from the public sewer records (to establish sewer depth to invert 1.38 mAOD) and the topographic survey (to establish the cover level of 88.36 mAOD). It is expected that whilst this is at a relatively shallow depth, in considering the slope of the land from the site towards the proposed connection a gravity connection could be made.

5.4 FOUL WATER DRAINAGE

5.4.1 It is proposed the foul water drainage will take the form of a conventional piped consisting of a branched dendritic network with main runs extending through the highway areas of the development. It is proposed to drain foul water via a gravity fed system in a predominant south-direction.

5.4.2 Once routed towards the northern end of the site foul sewerage will connect to the public network via MH1704. This will require a new requisitioned connection to be made. The final route of the sewer requisition will be designed and constructed by Yorkshire Water at the detailed design stage prior to the phased construction of the proposed development.

6 SUMMARY

6.1.1 Surface water will be managed separately across the two discrete development phases; this will include separate networks, storage points of discharge etc.

6.1.2 Surface water will be managed as close as is practicably possible to the greenfield rate, with the total maximum rate of discharge being restricted to 10 l/s (5 l/s for each aspect of the development). Restricting this rate any lower would have required an outfall control of < 150 mm, which would generate an unacceptable risk of blockage.

6.1.3 The surface water storage required to meet the discharge requirements will be provided across a hierarchal system of SuDS, drainage and flow control features which will manage the flow of surface water across the site. A total of **1,750 m^3** will be required across the development (pro-rated to each development phase).

6.1.4 The SuDS proposals will provide three stages of treatment, which is adequate for the level of contamination expected.

6.1.5 The final site design will and drainage system layout will be developed in consideration of the occurrence of extreme rainfall events, through which exceedance routes and overland flow paths will be directed away from buildings and towards less vulnerable receptors.

6.1.6 Foul water will be managed through a single, conventional below ground system serving both components of the development. A newly requisitioned connection to the existing public network will be made to the east of the site.

Appendix A

SITE LOCATION PLAN

File: Created using iGIS, WSP's Online Mapping System Drawn By: UKLXG002 Date Modified: 14/02/2017 13:28

Appendix B

P+HS ARCHITECT'S DEVELOPMENT LAYOUT

Indicative Layout

P+HS architects

Appendix C

TOPOGRAPHIC SURVEY (DWG NO. 8985 – 01D)

KEY:

B	BOLLARD
BT	BRITISH TELECOM COVER
CB	CONTROL BOX
CONC	CONCRETE
DC	DRAINAGE CHANNEL
DK	DROP KERB
DP	DOWN PIPE
EP	ELECTRICITY PYLON
FL	FLOOR LEVEL
FH	FIRE H YDRANT
G	GULLY
GP	GATE POST
GV	GAS VALVE
H	HEIGHT
IC	INSPECTION COVER
IL	INVERT LEVEL
LP	LAMP POST
MH	MANHOLE
NB	NAMING BOARD
RE	RODDING EYE
RS	ROAD SIGN
RW	RETAINING WALL
TB	TRAFFIC BOLLARD
TL	TRAFFIC LIGHT
TP	TELEGRAPH POLE
UTL	UNABLE TO LIFT
WM	WATER METER
WC	WATER COURSE
SV	WATER STOP VALVE
▲	SURVEY STATION
●	BOREHOLE
●	SOIL SAMPLE
⊗	DIAMETER
TH	TRIAL HOLE/PIT

NOTES

Levels have been related to the previous survey carried out in April 2008 ref: 8389

This survey contains information taken from drawing no. 8389 - 10

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

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

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

The proposed building has been positioned as instructed by Mr Graham Jameson.

Station	Easting	Northing	Level
CSL3	422004.746	480877.946	89.758
CSL4	421984.432	480855.589	89.393
CSL5	421924.876	480879.828	90.301
CSL6	421889.378	480904.411	90.604
CSL7	421847.758	480926.550	90.956
CSL8	421817.488	480899.907	90.836
CSL9	421809.420	480924.094	91.840
CSL10	421785.203	480919.091	91.636
CSL11	421786.581	480885.979	90.995
CSL12	421760.510	480863.245	91.194
CSL13	421779.744	480852.583	91.208
CSL14	421780.249	480833.898	91.222
CSL15	421796.244	480792.685	91.636
CSL16	421841.970	480796.789	91.309
CSL17	421822.606	480830.908	90.186
CSL161	421871.248	480867.591	90.611
CSL162	421851.465	480838.844	90.939
CSL163	421812.747	480838.569	91.213
CSL164	421804.616	480844.224	91.029

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TITLE
Topographical Survey
Foxholme Lane Mill
Masham

CLIENT
W E Jameson & Son Limited

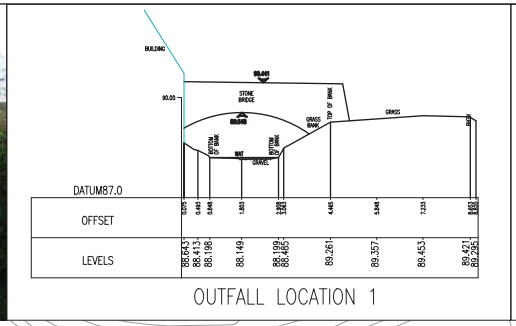
DATE	DRAWN BY	CHKD. BY
June 2016	SA	ACA

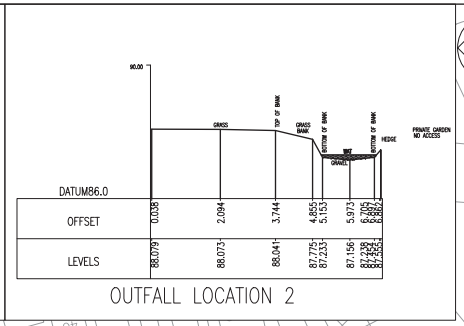
DRG NO.	PLOT SCALE
8985 - 01D	1 : 500 @ A0

REV	AMENDMENT	DATE	BY	CHKD.
A	Proposed building position added.	13/12/12	SA	ACA
B	Dimensions added.	13/12/12	SA	ACA
C	Building areas added.	05/03/15	SA	ACA
D	Neighbouring land & access road added.	20/06/16	SA	ACA

Appendix D

DRAINAGE STRATEGY PLAN (DRAWING NO. 70028809-D-001)





DO NOT SCALE

KEY:

SITE BOUNDARY (2.69Ha)

EXTENT OF PROPOSED IMPERMEABLE AREA FOR THE RESIDENTIAL DEVELOPMENT (1.06Ha)

EXTENT OF PROPOSED IMPERMEABLE AREA FOR THE COMMERCIAL DEVELOPMENT (0.23Ha)

8.0m STAND-OFF FROM THE SWINNEY BECK (AN ENVIRONMENT AGENCY MAIN RIVER)

PREDOMINANT DIRECTIONS OF DRAINAGE

NORTH

SCALE 1:2

OUTFALL LOCATION 1
(SECTION 32 FROM CHANNEL SURVEY)

OUTFALL LOCATION 2
(SECTION 34 FROM CHANNEL SURVEY)

OUTFALL LOCATION 2
150mm (MIN) HYDROBRAKE OR SIMILAR APPROVED FLOW CONTROL DEVICE TO RESTRICT ONWARD DISCHARGE TO A MAXIMUM RATE OF 5l/s

SWINNEY BECK

PUBLIC OPEN SPACE

CATCHMENT 1

CATCHMENT 2

CATCHMENT 3

CATCHMENT 4

AREA A

AREA B

OUTFALL LOCATION 1
150mm (MIN) HYDROBRAKE OR SIMILAR APPROVED FLOW CONTROL DEVICE TO RESTRICT ONWARD DISCHARGE TO A MAXIMUM RATE OF 5l/s

Play Area

El Sub Sta

Silos

0 25 metres

AREA	CATCHMENT	AREA (HA)	RATE OF DISCHARGE (L/S)	REQUIRED STORAGE (M³)	DESTINATION OF DISCHARGE
A	N/A	0.33	5 l/s	175	**Outfall Location 1 to River Swinney**
B	1	0.4	5 l/s	225	SuDS/Drainage System, eventually discharging to Storage Pond/Amenity Area
B	2	0.64	5 l/s	400	SuDS/Drainage System, eventually discharging to Storage Pond/Amenity Area
B	3	0.55	5 l/s	350	SuDS/Drainage System, eventually discharging to Storage Pond/Amenity Area
B	4	0.58	5 l/s	350	SuDS/Drainage System, eventually discharging to Storage Pond/Amenity Area
Storage Pond Area	**N/A**	**N/A**	**5 l/s**	**225**	**Outfall Location 2 to River Swinney**

REV	DATE	BY	DESCRIPTION	CHK	APD
A	03.03.17	KD	FIRST ISSUE	TH	

DRAWING STATUS: FOR INFORMATION ONLY

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CLIENT: W E JAMESON & SON Ltd

ARCHITECT: P+HS ARCHITECTS

PROJECT: LAND TO THE END OF THE OAKS, MASHAM

TITLE: OUTLINE SURFACE WATER DRAINAGE STRATEGY PLAN

SCALE @ A1:	CHECKED:	APPROVED:
1:500	TH	
CAD FILE: 70028809-D-001	DESIGNED/DRAWN: KD	DATE: March 2017
PROJECT No: 70028809	DRAWING No: 70028809-D-001	REV: A