



**BEACONSIDE, STAFFORD FOR
MAXIMUS STRATEGIC STAFFORD LLP**

**PROPOSED MAJOR DEVELOPMENT AT
NEWBUILDINGS FARM, NORTH OF
BEACONSIDE, STAFFORD**

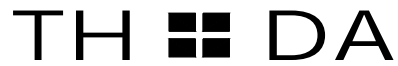
**PRELIMINARY DRAINAGE APPRAISAL
REV A**

MARCH 2010

	Prepared by	Issued for	Date	Issued by
-	SJP	Draft	Jan 2010	PAT
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PROJECT REF: 09-0473



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

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EXECUTIVE SUMMARY

Maximus Strategic Land Ltd propose a major development on an agricultural holding at Newbuildings Farm, Sandon Road, Hopton, ST18 9TH. This report considers flood risk and the drainage needs of the development on this site.

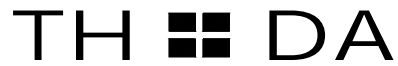
The entire site is in Flood Zone 1. Flood risk is not a significant issue for the development.

Ground conditions and land gradients appear unsuitable to support an infiltration based surface water disposal solution.

Four watercourses can be used to remove all surface water from the development. Large balancing ponds must be constructed within the site to regulate the flow passed downstream. Although four ponds is the normal solution for this site, there is an option to reduce the number of ponds to two by using interconnecting surface water pipework which could achieve better land use and lower costs.

A recommendation is made to reallocate a low lying part of the site adjacent to Beaconside from housing to surface water drainage and open space. This would avoid a need to raise land levels for flood protection and the additional expense of building on peat that underlies this land.

No foul sewers exist on site, and those local to the site are inadequate to serve the development. Therefore either a scheme of off site foul sewerage improvements to transfer sewage flow to Brancote WWTW is required, or an on site sewage treatment works could be built. The former can be requisitioned from Severn Trent Water. Initial research suggests that two new pumping stations are needed to transfer the flow to Brancote WWTW. Although on site treatment appears feasible, its environmental impact, capital cost and long term maintenance must be studied before considering if it is a better alternative to the off site solution.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

INTRODUCTION

This report, prepared by THDA Ltd following a site visit made in December 2009, makes recommendations for dealing with surface water and sewage generated by a proposed development by Maximus Strategic Land Ltd on its site at Newbuildings Farm, Sandon Road, Hopton, ST18 9TH. The development site, shown on the plan included at Figure 1, appended, principally comprises the Newbuildings Farm dairy unit and has a gross area of about 176 hectares. A master plan prepared by Pegasus Planning Group shows the development would consist of 3,000 dwellings, 9.8 hectares of commercial development, two local centres, two primary schools and associated infrastructure and open space.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

INFORMATION REVIEWED

Sources of information drawn on in the preparation of this report are listed below:

1. Pegasus Planning Group's Illustrative Framework Plan reference BIR.2908_02-1B dated October 2009;
2. A site visit undertaken by a THDA drainage engineer on 30 December 2009;
3. An enquiry to Severn Trent Water about the location of sewerage;
4. An enquiry to the Environment Agency about historic flooding and details of its Flood Map;
5. Solid and drift geology maps prepared by the Geological Survey of Great Britain;
6. Stafford Borough Council's Infrastructure Strategy Stage 1 Final Report, July 2009;
7. Stafford Borough Council's Strategic Flood Risk Assessment Level 1, January 2008;
8. Plans and a flood risk assessment prepared by White Young Green for Defence Estates' Project Bonora and published on Stafford Borough Council's planning application web site.

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FINAL

THE SITE

Figure 1 shows the proposed development at Newbuildings Farm. This plan is based on the current 1:2,500 scale Ordnance Survey topographic survey of the site and surrounding area. It shows the site boundary depicted by a red line, contours at two metre spacing, and the names of local roads and places.

Figure 2, a plan prepared by THDA to show the principles of surface water drainage serving the development, is based on a 2003 0.25 metre pixel aerial photograph supplied under licence by Blue Sky. This aerial photograph adds to the detail of the site and surrounding land shown on the Ordnance Survey plan.

It should be noted that new development has taken place in the Tollgate Industrial Estate to the south of Beaconside which is shown neither by the Ordnance Survey plan nor the aerial photograph.

At the time of the site visit the majority of the fields were pasture. Most field boundaries were formed by substantial thorn hedges.

A disused railway embankment is present on the eastern part of the site.

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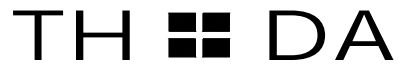
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STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

TOPOGRAPHICAL LEVELS

The developer has yet to commission a topographical survey of the site. However the two metre contours shown on both Figures and the Ordnance Survey spot levels shown on Figure 1 give a reasonable indication of the relative levels and gradients within the site and suffice to inform this initial appraisal of development drainage.

Ground levels across the site range from about 86 metres above Ordnance Datum on the southern boundary to about 117 m on the northern boundary near Kent's Barn Farm. Based on contours, land gradients within the site generally range from 1:13 to 1:60.



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STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

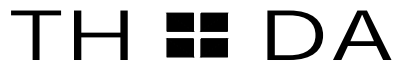
GEOLOGY

No site specific site investigation was made available for the preparation of this report.

Geological Survey of Great Britain (GSGB) solid and superficial geology maps describe the presence of several different rocks and soils near the surface of the site. A tracing of GSGB rock descriptions and boundaries is included on Figure 2.

Mudstone and Halite-Rock of the Mercia Mudstone Group Formation underlie the whole site and outcrop on the higher ground within it. Halite-Rock is named after the salt it contains. On the lower ground there are large areas of glacial diamicon till superficial deposits (typically randomly mixed moraine material) at the surface. In the south east corner of the site glacio-fluvial sheet deposits of sand and gravel are present. Peat has accumulated over a substantial area in the valley lines in the south west corner of the site. Along the line of Marston Brook which forms the south western site boundary, there are alluvial deposits of sand, silt, clay and gravel.

Two hundred metres to the east of the site there is a major fault line orientated north to south, to the east of which the near surface rocks belong to the sedimentary Kidderminster and Bromsgrove Sandstone Formations.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

EXISTING SURFACE WATER DRAINAGE

The site is drained to four non Main River watercourses present on site which are tributaries of the River Sow in the catchment of the River Trent. These watercourses are labelled on Figure 2 as Marston Brook, W/C 1A, W/C 2 and W/C 3.

Marston Brook is the principal watercourse, which rises near the village of Marston to the north west of the site. It has a catchment area of about three square kilometres. The brook crosses under Beaconside in a 1.5 metre wide by one metre deep Armco arch culvert. Marston Brook is classified as Main River downstream of the line of the old railway at the southern end of Tollgate Industrial Estate.

Watercourse 1A rises to the north west of the site. Half the site is within its catchment. The size of its culvert under Beaconside was not measured due to inaccessibility. Marston Brook and Watercourse 1A converge in Tollgate Industrial Estate 560 metres to the south of the site.

Watercourses 2 (known as Kingston Brook) and Watercourse 3 rise within the eastern part of the site and converge within the MoD Stafford to the south of the site.

Watercourse 3 commences at the entrance to a 900 mm culvert located under a hedge on the western edge of Sandon Road. This culvert changes to a brick barrel in the vicinity of the old railway, presumably built at the same time as the railway.

Watercourses 2 and 3 enter culverts as they leave the site. Neither culvert could be measured due to inaccessibility, and in the case of Watercourse 3, very high flow.

There is a farm pond located at the homestead buildings of Newbuildings Farm. This and other local ponds are shown on Figure 2.

MoD Site 4, a satellite of MOD Stafford located between Beaconside and Sandon Road drains through the site to Watercourse 1A. Any proposed development layout should maintain this connectivity.

Land at Kent's Barn Farm, located beyond the north eastern corner of the site, drains through the site to Watercourse 3, though there is no definitive watercourse along this drainage route. Any proposed development layout should maintain this connectivity.

Surface water drainage serving MoD dwellings to the east of the railway is connected to watercourse 3 by sewers under the site.

The owners of Newbuildings Farm maintain all the onsite watercourses to a high standard. Recently the owners improved Watercourse 3 to the boundary of MOD Stafford.

With the exception of the lowest part of the field alongside Beaconside, which is low lying on peat,

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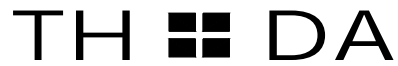
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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

and part of a field to the east of the old railway embankment where there is a spring, the fields appeared well drained. Field drains seen discharging to the watercourses were running freely.

Severn Trent Water advised that it has no surface water sewers on the site.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

FLOOD HISTORY

In response to the THDA enquiry, the Environment Agency advised that that the entire site is fluvial Flood Zone 1, ie it does not include any fluvial Flood Zone 3 (1:100 year) or fluvial Flood Zone 2 (1:1,000 year). The Agency does not have any formal record of flooding on the site, and did not provide copies of the formal Flood Map.

There are areas of fluvial Flood Zones 3 and 2 downstream on the Marston Brook. These areas are indicated on Figure 2.

The lack of Flood Zones 3 and 2 within the site could be attributed to the fact that the generalised flood mapping method used by the Environment Agency to compile the Flood Map does not show any such Zone where the catchment area is less than three square kilometres. The catchments of the on site watercourses are smaller than this area. Local watercourse flood modelling must be done as part of the Flood Risk Assessment for the site, required because the site area exceeds one hectare. This modelling is quite likely to find that local flooding occurs near the watercourses, particularly at the entrances to culverts, in the 100 year plus 20% flow condition proscribed by PPS 25. Based on current information, it is thought that flooding will not have a major impact on the current development layout.

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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

EXISTING FOUL SEWERAGE

Severn Trent Water advised that it has no foul sewers on the site.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

EFFECT OF FLOODING ON PLANNING

A flood risk assessment must be prepared due to the size of the development and the area of the site. In practice the emphasis of the flood risk assessment will be to demonstrate a standard of design and implementation of surface water drainage infrastructure that does not worsen downstream flooding. Current information suggests these things can be readily achieved for the development layout currently proposed.

As part of the flood risk assessment, the impact of blockages of culverts must be undertaken, in particular blockage of the culverts under Beaconside and MOD Stafford through which Marston Brook and watercourses 1A, 2 and 3 pass at the site boundary. It is important that the development is designed so that the development if blockage were to occur there would be no flooding of sensitive parts of the development. The standards for design for blockage are not set out in a national standard and must be negotiated with the Environment Agency on a case by case basis. Discussions with the Environment Agency about standards appropriate to the site have yet to take place.

Because the entire site is in Flood Zone 1, PPS 25 style Sequential and Exception Tests are not required.

The Strategic Flood Risk Assessment does not offer any specific advice about the development.

Based on current knowledge, it is unlikely that flood risk will constrain the issue of planning permission, but alterations to the Master Plan might be required to contain flood risk local to watercourses.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

DRAFT PROPOSALS FOR DEVELOPMENT SURFACE WATER SEWERAGE

In order to meet the standards for attenuation of surface water flows from new development at Newbuildings Farm, development surface water either must be disposed within the site or released at a controlled rate to the four watercourses. Flow distribution between the watercourses should be similar to existing.

With the exception of an essential off site sewer needed to transfer the outflow from Pond 3 to a watercourse elsewhere on site, described below, there seem to be no advantages to using off site sewerage for the disposal of surface water from the development.

Other options for surface water disposal within the site are limited to rainwater harvesting and infiltration.

Soakage testing and water table measurement have yet to be undertaken to establish the viability of infiltration drainage. Based on the site geology, it is predicted that either the soakage rate will be too poor or the water table too high to permit economical disposal of large quantities of surface water by infiltration. The site gradient generally is too steep for porous paving, the infiltration solution which can be made to work when permeability is low and the water table high. Thus rainwater harvesting is the only method that could reasonably be applied to any future buildings proposals.

Discharge of surface water to the watercourses is a certain method of surface water disposal, but a high cost is anticipated to build and maintain the large amount of storage needed to achieve low rates of discharge specified by current national sustainable drainage standards. The traditional standard for discharge to a watercourse is not to exceed the current green field run off rate in any storm up to the worst 100 year storm. Recently the volume of storage was increased to ensure no overflow with 20% extra inflow volume added to allow for future climate change. The 2007 joint Defra/Environment Agency publication "Preliminary Rainfall Runoff Management for Developments, Revision D", specifies that the rate of discharge should reduce to only two litres per second per hectare after six hours of rainfall. This latest standard increases the size of balancing facilities substantially, and this standard has been utilised as part of this assessment.

THDA estimated the average green field run off rate for the site using two methods. These methods were loH 124 and the Flood Estimation Handbook Revitalised Rainfall Run Off (ReFH) spreadsheet. Both methods indicate that the 100 year green field run off rate is about 10 litres per second per hectare. The rate derived from a non rigorous application of the ReFH spreadsheet, 10.2 litres per second per hectare, has been used for estimating allowable rates of discharge and associated storage volumes.

THDA undertook two estimations of the storage required per hectare of drained impermeable area within the development, one using Flood Studies Report (FSR) rainfall, the other FEH rainfall. The latter method gave the lower figure of 450 cubic metres per hectare. As FEH rainfall is accepted to be a better estimate than FSR, this figure has been used for storage calculations.

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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

Figure 1 shows four flood storage (balancing pond) locations within the site as proposed by Pegasus and shown on its current master plan. Each pond has been numbered on Figure 2 (ie ponds 1-4 inclusive) for ease of reference.

Figure 2 includes dashed magenta coloured lines which indicate the outlines of the developed area in each natural catchment of the four balancing ponds. Using these areas, an impermeable area/gross area ratio of 50% and a volume of 450 cubic metres per impermeable hectare, THDA calculated pond storage volumes for each pond and estimated how large at ground level the pond would be if it were to be circular in plan. These figures are summarised in the following table.

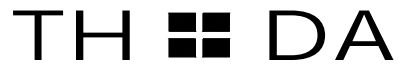
BALANCING PONDS INITIAL SIZE ESTIMATE							
						Max rate of discharge	10.2 l/s/ha
						Reduced rate of discharge after 6 hrs	2 l/s/ha
						Storage per hectare impermeable	450 cubic metre
<u>Pond</u>	<u>Gross developed area /ha</u>	<u>Impermeable area /ha (50% gross)</u>	<u>Maximum rate of discharge litres/sec</u>	<u>Reduced rate of discharge litres/sec</u>	<u>Max water depth /m</u>	<u>Rise and fall volume /m3</u>	<u>Top of bank radius /m (from other calc)</u>
1	4.9	2.45	25	4.9	1	1103	25
2	66.4	33.2	339	66	2	14,940	58
3	18.3	9.15	93	18	1.5	4118	37
4	34.4	17.2	175	34	1.5	7740	48
1, 2 & 3 combined	89.6	44.8	457	90	1.2	20160	72

The required pond sizes are shown to scale on Figure 2. It should be noted that although no pond is classified as a reservoir under the current Reservoirs Act, the government proposes to reduce the reservoir classification threshold from 25,000 cubic metres contained by a dam to 10,000 cubic metres contained by a dam. The implication is that the design of three of the ponds might have to be signed off by a Panel Engineer and be inspected regularly by a Panel Engineer.

In all cases the pond sizes are estimated using a side slope of 1:6 and a free board of 300 mm. This slope is similar to the recommended maximum angle for safe tractor mowing.

Pond 3 does not have a local outfall. Surface water sewers must be laid beyond the site boundary to connect Pond 3 to Watercourse 1A or 2. It is understood that land between Pond 3 and Watercourse 1A is owned by a party with an existing interest in the development, so probably such a link can be arranged without recourse to a requisition on Severn Trent Water.

There is an option to combine ponds 1, 2 and 3 into one large pond, the location and size of which also are shown on Figure 2. A combined pond could be the best use of the land underlain by peat



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

located next to Beaconside, and could reduce substantially the cost of drainage. This option would necessitate construction of an off site sewer along a line similar to that shown by a dashed blue line on Figure 2, linking development on the east side of the MoD Site 4 to the combined pond.

An important planning consideration relating to existing watercourses is that they are considered to be ecologically important, so must be maintained and kept flowing. The Environment Agency normally requires buffer strips alongside all watercourses, normally eight metres wide both sides, measured from the top of bank. In practice this means siting the watercourses in public open space and maintaining all land drainage connections to them. The Environment Agency would welcome replacement of existing culverts with open watercourses wherever possible. The only culvert within the site boundary that THDA have seen which could be opened up is the brick culvert on Watercourse 3 where it crosses the line of the former railway.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

DRAFT PROPOSALS FOR SEWAGE DISPOSAL

Stafford Borough Infrastructure Strategy Stage 1 Final Report July 2009 includes details that Severn Trent Water provided about sewage and surface water disposal from hypothetical developments in the vicinity of the site. That report suggests that sewage should be transferred to a pumping station nearer Stafford town centre and pumped from there to the local sewage treatment works, Brancote WWTW, which is located to the east of Stafford. It looked at developments of 3,000 dwellings and 70 hectares of commercial buildings in the vicinity of the site, and suggested off site foul sewerage costs of £307,000. As the Beaconside development has only 10 hectares of commercial buildings, the off site foul sewerage costs might be slightly lower based on the Severn Trent Water estimate.

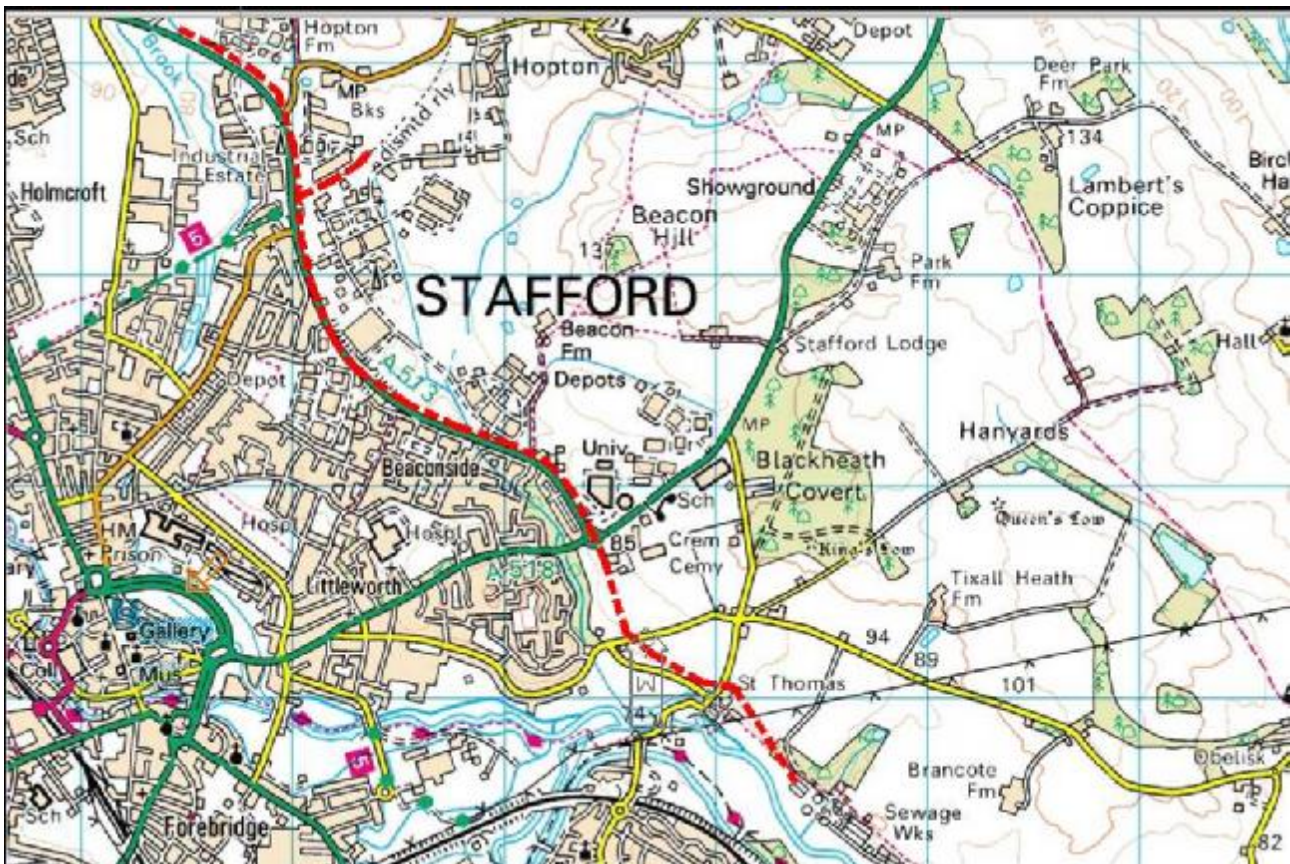
THDA has made an alternative, worst case, estimate of off site foul sewerage costs based on two pumping stations on site (necessary as there are two low points to serve), single rising mains from each of the pumping stations converging at the A513 near the old railway bridge, and a single rising main from that place to Brancote WWTW. This arrangement is shown on the figure below, on which the rising mains are depicted by dashed red lines. The total length of rising main is about 5.2 kilometres. The cost of this provision is not known at this time, but in any event the cost to the developer will be discounted by the amount of sewerage rates levied by Severn Trent Water from the development in the first 12 years. On this basis the cost of off site works to the developer could be lower than suggested by the Stafford Borough Council Infrastructure strategy report.

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PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE, STAFFORD PRELIMINARY DRAINAGE APPRAISAL

FINAL



Although the cost of a requisition always is based on the least expensive off site sewerage solution that provides a development with sewerage capacity, in practice the sewerage undertaker has the option of implementing a different scheme, for instance to yield wider benefit. However the time for provision of the sewerage must not be extended. Therefore at Beaconside is not yet possible to predict the nature of the off site sewerage works that will be built.

Because the development is large, constructing a permanent on site sewage treatment works should be considered as an alternative to requisitioning off sewers connecting to Brancote WWTW. Possible advantages of on site treatment are that sewage disposal could be provided more quickly, there would be a lower impact on people and the environment during construction and operation, and there would be a beneficial improvement in summer flow in local watercourses. An on site treatment works could be located in the open space in the northern part of the site.



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

RECOMMENDATIONS

Several recommendations are made as listed below:

1. Some limited topographical survey work should be undertaken to inform the flood risk assessment;
2. A check should be made for any on site watercourses not seen during the site visit;
3. Selected infiltration testing should be undertaken to confirm the likely performance of soakaways on the site;
4. Work on the flood risk assessment should be commenced. This will include a check for any areas within the site liable to flooding from watercourses in 100 year plus 20% flow conditions. If any part of the site is found liable to flooding, either the development should be moved further from the watercourses, or ground levels should be raised to provide protection against flooding;
5. The viability of an offsite link for the surface water and foul sewers to the south of MOD Site 4 should be confirmed;
6. The master plan should be adapted to accommodate combined balancing ponds 1,2 &3 and pond 4, and to maintain and buffer all existing watercourses;
7. Discussions should be opened with the Environment Agency aimed at confirming the surface water drainage strategy, standards culvert blockage, and watercourse protection measures;
8. Discussions should be opened with Severn Trent Water about the scope and cost of an off site foul sewerage requisition;

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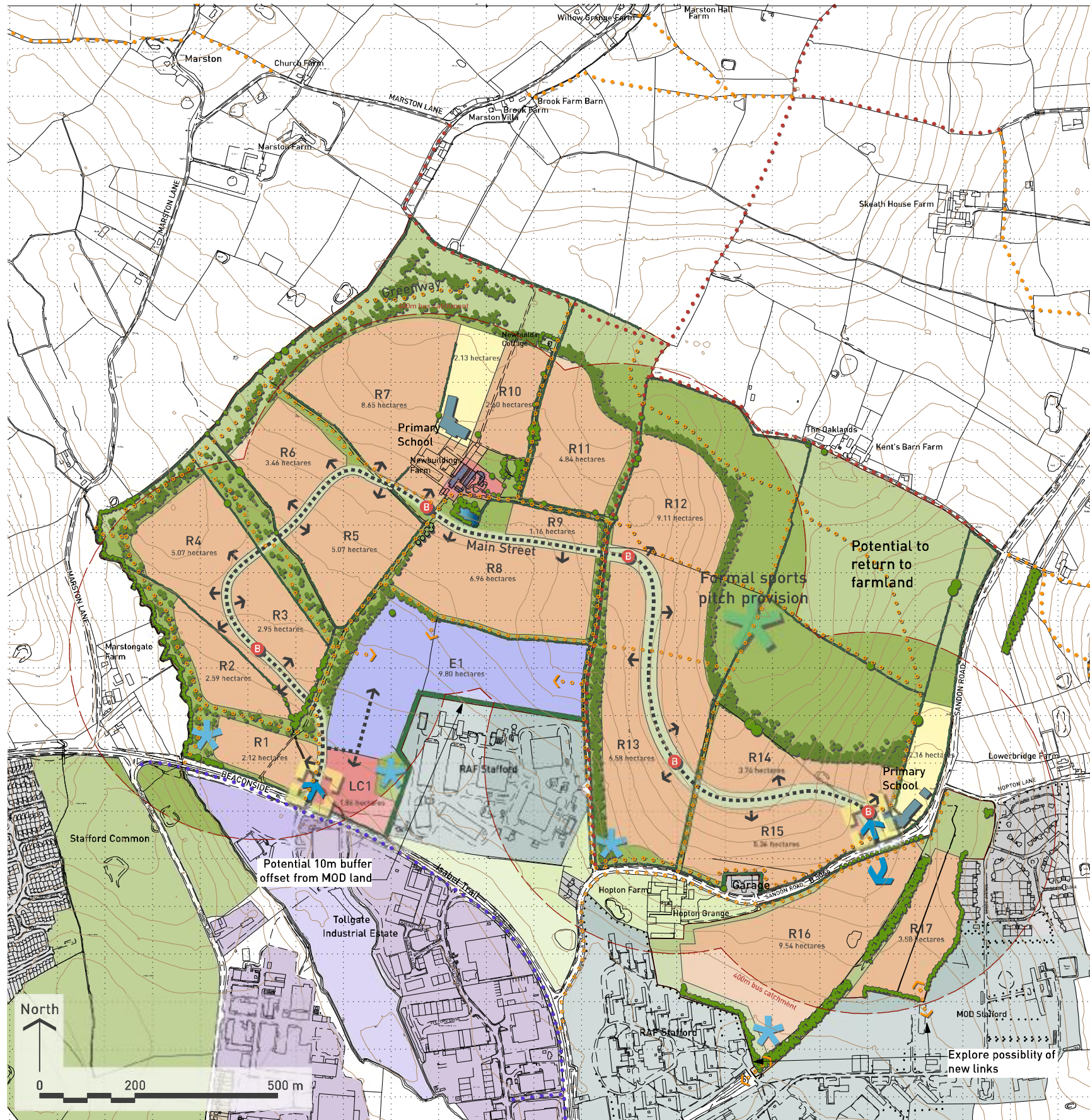
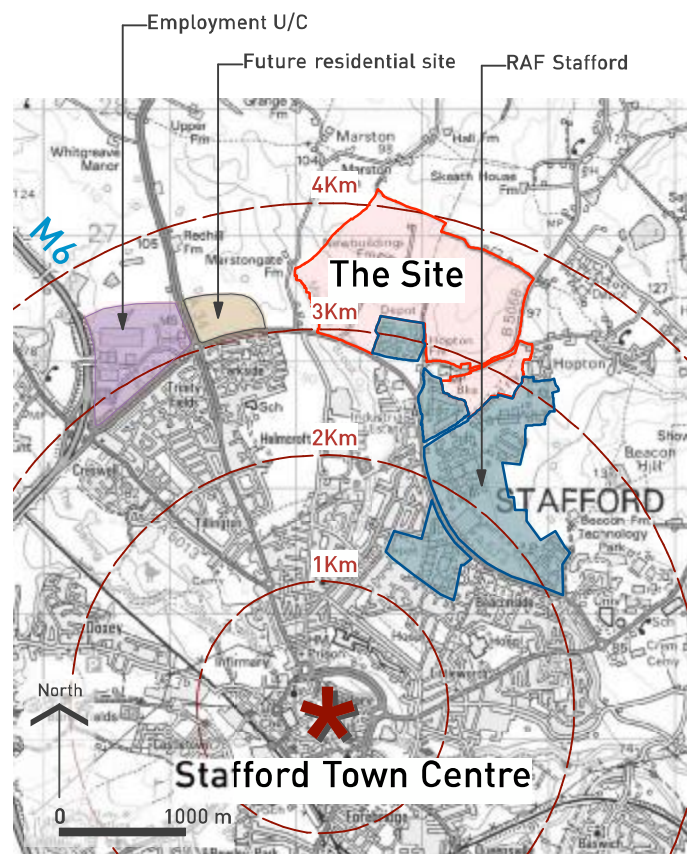
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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

Figure 1

**Pegasus Planning Group's Illustrative
Framework Plan reference BIR.2908_02-
1C dated January 2010**



- Key**
- Site boundary (155.6ha)
 - Residential (83.4ha, 2920 dwellings @ 35dph)
 - Employment (9.8ha)
 - Local centre facilities (2.56ha)
 - Primary schools (4.26ha)
 - Gateway Features
 - Formal sports pitch provision
 - Main site access
 - Main Street to incorporate bus route
 - Access points to secondary streets
 - Bus stops and 400m catchment
 - Bridleways (existing)
 - Proposed primary foot/cycleways
 - Foot/cycleways 'Isabel Trail' (existing)
 - Public footpaths (existing)
 - Attenuation areas
 - Public open space
 - Tree belts (existing)
 - Hedges (existing)
 - Pond (existing)
 - Proposed planting (TBC)
- NB: NEAP: Neighbourhood equipped area of play
LEAP: Local equipped area of play
- Existing land uses**
- Residential
 - MOD
 - Employment
 - Employment under construction
- N.B. Contours at 2m intervals

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Land north of Beaconside, Stafford -Illustrative Framework Plan



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**PROPOSED MAJOR DEVELOPMENT AT NEWBUILDINGS FARM, NORTH OF BEACONSIDE,
STAFFORD
PRELIMINARY DRAINAGE APPRAISAL**

FINAL

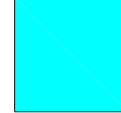



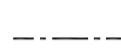


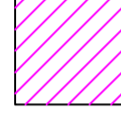

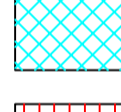



Figure 2

THDA Drainage Plan

NOTES

- 1 The aerial photograph upon which this drawing is based is reproduced under licence from Blue Sky. Unauthorised reproduction of this drawing would infringe the Blue Sky copyright.
- 2 This drawing is centred on OS National Grid co-ordinates 392920,326420, and covers an area 2,000 metres wide by 2,000 metres high.
- 3 Contours at two metre intervals, to OS Datum.
4. Development proposals shown on this drawing are based on the Illustrative Framework Plan BIR.2098_02.1B date October 2009.

KEY

-  Fluvial Flood Zone 2
-  Fluvial Flood Zone 3
-  Existing pond
-  Watercourse with formal name or report reference and EA buffer strip edges
-  Approximate geological boundary
-  Development site boundary
-  Pond shown on Master Plan
-  Proposed dwellings
-  Proposed employment
-  Proposed local centre
-  Proposed school
-  Indicative size of required balancing pond based on 10 litres per second per hectare maximum rate of discharge and 100 year plus 20% rainfall
-  Indicative balancing pond catchment

rev.	date	description	chk.

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client:

MAXIMUS

job title:

NEWBUILDINGS FARM
STAFFORD

drawing title:

EXISTING SURFACE WATER
DRAINAGE AND GEOLOGY

scale: date: drawn by: checked by:

1:4000 12.03.10 SJP PAT

job number: drawing number: revision:

09-0473 100

