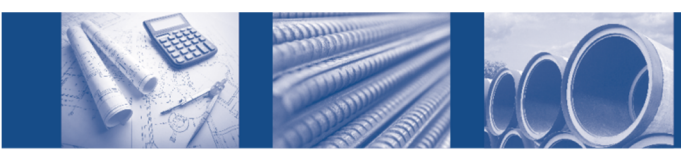
OXFORD ROAD,
BODICOTE
OXON

FLOOD RISK ASSESSMENT &
DRAINAGE ADDENDUM REPORT

CREST NICHOLSON MIDLANDS

Date:	20th July 2018
Ref:	AMc/18/0480/**5692**
Rev:	-



DOCUMENT CONTROL RECORD

Document Issue:

Rev	Date	Issue Status	Prepared by	Checked by
-	20.07.18	First Issue for comment	C.Pendle	A.McShane

CONTENTS

APPENDICES

REFERENCES

Technical Guidance to the National Planning Policy Framework - NPPF (2012)
Department for Communities and Local Government ISBN: 978-1-4098-3410-6

Contains British Geological Survey materials © NERC (2018)

The SuDS Manual CIRIA C753, London, 2015

CIRIA Report 156 Infiltration drainage – Manual of good practice

1 Introduction

1.1 Scope

Crest Nichlson Midlands are seeking to clear Reserved Matters planning consent for the residential development of 95 units with associated infrastructure and open space.

1.2 MJA Consulting has been appointed to provide an updated Flood Risk Assessment & drainage strategy for the development as part of the planning permission. This report should be read in conjunction with the Flood Risk Assessment produced by Forge Engineerng Design Solutions, Ref: FEDS-214026 approved at outline planning, the Ground Investigation report provided by Hydrock Ref: BDC-HYD-GI-RP-GE-00001, dated April 2017. This statement should also be read with the Flood Risk Assessment undertaken Banners Gate Ltd for the adjacent Cala Homes Development.

1.3 The following report confirms the potential flood risks associated with the site and to provide an updated and suitable strategy for the disposal of surface and foul water based on the current information.

1.4 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales.

1.5 This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.

1.6 The objective of this report is:

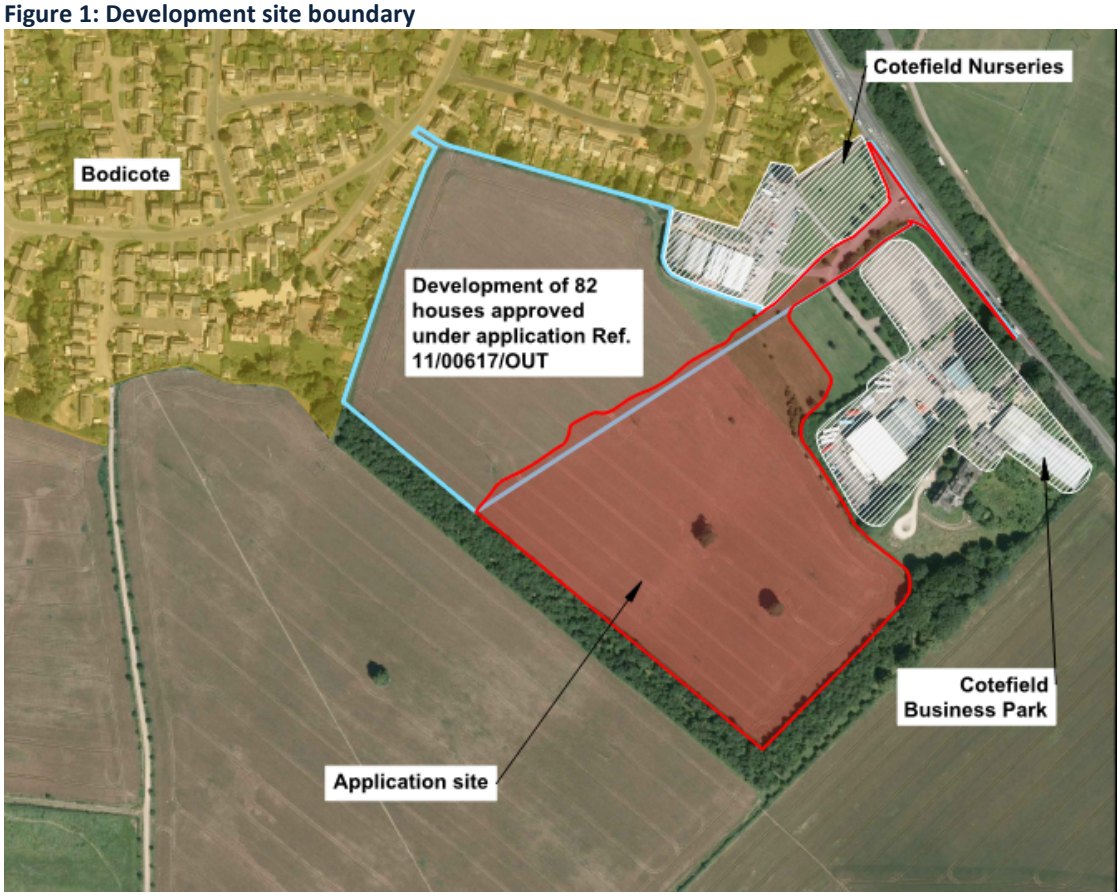
- To confirm whether the proposed development site is affected by current or anticipated future flooding from all sources for the lifetime of the site.
- To confirm that this development will not increase the risk of flooding to any offsite properties and land or increase the population within a floodplain.
- To undertake calculations to establish the foul and surface water runoff rates from the existing site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change.
- To satisfy the approving planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

2 The Development Site

2.1 Site Location and Description

The application site covers an area of approximately 4.5ha, and is located to the west of the A4260 Oxford Road. north west of the A4094 & River Wye. The site is bounded by other new and existing residential dwellings to the north, commercial properties to the north east and east, and agricultural land to the south east, south and south west.

Figure 1: Development site boundary



2.2 Topography

The site is located in a natural valley, with levels ranging from 114.130m to 102.27m AOD with the valley floor sloping down towards the south western boundary. The steepest gradients are in the southwestern part of the site, either side of the valley feature,
up to approximately 1 in 10.

2.3 Geology

The site is indicated by the BGS mapping (Sheet 218 and the mapping portal) to be underlain by Marlstone Rock Formation, comprising sandy, shelly and ooidal ferruginous limestone interbedded with ferruginous calcareous sandstone, and generally subordinate ferruginous mudstone.

The ground conditions found during the original and current investigation are in general accordance with the published geological literature.

Sub strata summary:

	Summary Description	Depth to Top (m bgl)	Thickness (m)
Topsoil	Soft dark brown sandy gravelly clay and clayey gravelly sand with rootlets	0	0.20 – 0.35
Head Deposits (southwest area of site on lower slopes)	Stiff greenish grey mottled orange silty sandy gravelly clay	0.30	>1.50 - >2.40
	Orange brown clayey gravelly sand		
	Soft blue grey / purple gravelly clay / silt		
Marlstone Rock Formation	Firm to stiff orange brown to greenish grey silty sandy gravelly CLAY, with fine to coarse angular to rounded gravel of limestone and ironstone.	0.20 - 0.30	0.50 - >2.80
	Orange brown clayey silty gravelly sand with limestone and ironstone gravel.		
	Moderately strong fractured grey brown limestone		
Dyrham Formation	Stiff blue grey silty CLAY, weathered to firm orange brown clay near the upper surface.	0.60 – 2.60	>0.20 - >1.60

Extract from Hydrock Report

2.5 Hydrogeology

The Marlstone Rock Formation is classified as a 'Secondary A aquifer' by the Environment Agency meaning it comprises 'permeable layers capable of supporting water supplies at a local rather than strategic scale.

The Dyrham Formation is classified as Unproductive Strata and is likely to be lower in permeability than the Marlstone Rock. It is therefore expected that there may be a spring line along the boundary between them and any associated solifluction deposits.

The site is not within a Source Protection Zone for drinking water supply, but groundwater in the Marlstone Rock aquifer is considered to be vulnerable to pollution.

2.6 Groundwater

Groundwater strikes were encountered during the investigation 1.6 – 3.0m below ground. Where groundwater was not encountered, the groundwater level can be assumed to be deeper than the base of the trial pits. On this basis, the depth to groundwater where not encountered in the trial pits varies between >0.70m and >3.20m below existing ground level.

2.7 Soil Permeability

Infiltration testing was carried out as part of the site investigations in accordance with BRE 365.

The tests were undertaken in both within the Limestone & Clay layers. These results indicate fast infiltration into the limestone beds, where these occur as the outflow from the pit was greater than the inflow that could be gained from a water bowser. The clay horizons in the Marlstone Rock Formation are effectively impermeable for soakaway purposes.

Hydrock concluded that limestone beds within the Marlstone Rock are likely to be of limited thickness and may not be continuous, in which case they would not be reliable and may result in water being channelled through the limestone beds to their outcrop, rather than infiltrating generally into the ground. For these reasons, soakaways are not considered suitable.

If infiltration features were to be used within the higher areas of the site there are potential implications with regard to slope stability, this may manifest as spring lines at the interface between the Marlstone rock and Dryham Formation but could in certain circumstances result in slope instability.

2.8 Local Watercourses

The nearest open watercourse is the Sor Brook which is located approximately 500m to the southwest of the Site.

2.9 Existing Utility Appuratus

Following further site investigations it has been found that two existing surface water systems run through the site, one of which takes highway runoff from the A4260 Oxford Road while the other receives runoff from the existing agricultural buildings and yards located to the north east of the site. Both of which discharge to the Sor Brook.
The site is also bisected by a Thames Water raw water main which feeds to the treatment works with Banbury.
All three of these piped systems will be diverted within the development layout.

2.10 Cala Homes Development:

The land associated with the Cala Homes development lies above and to the north of the Crest Nichlson development with falls from north to south from approximately 116.0m to 112.0m AOD. The sub strata found is similar to that on the Crest Nichlson development area.

As part of the approved drainage design the development runoff is attenuated and discharged through a new storm outfall which runs from the Cala Homes site through the Crest Nichlson site. The storm outfall then discharges in a south west direction to the Sor Brook.

The outfall has been designed to also take the attenuated flows from the Crest Nicholson site.

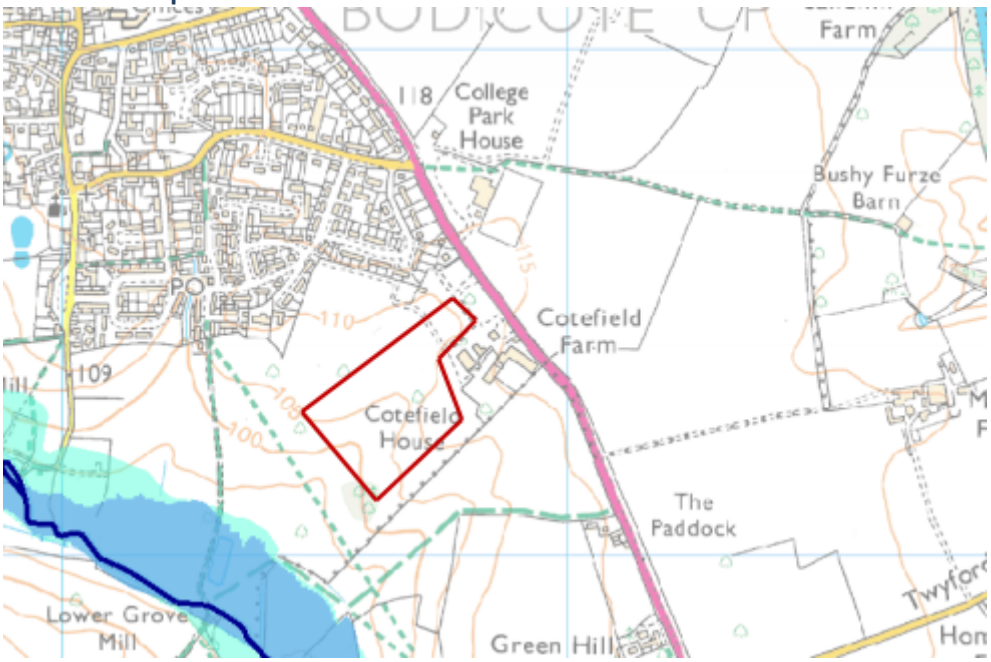
3 Flood Risk Assessment

3.1 A Flood Risk Assessment requires that an evaluation of all potential forms of flood risk to the site are considered.

In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

3.2 The Flood Risk Assessment produced by Forge Engineerng Design Solutions, Ref: FEDS-214026 approved at outline planning stage has confirmed that in accordance with the Environment Agency Flood Zone Mapping service indicates that the site is located in Flood Zone 1, which has a Low risk of fluvial flooding from Main Rivers. That is land having a less than 1 in 1,000 annual probability of river or sea flooding.

Flood Zone Map



Key:

Main Rivers

Dark Blue : (Flood Zone 3)
Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)
Shows the additional extent of an extreme flood from rivers or the sea.
These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

Clear : (Flood Zone 1)
Shows the area where flooding from rivers and the sea is very unlikely.
There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

3.3 As confirmed by the latest Environment Agency 'Flood Zone Map', the site is located within the lowest risk category - Flood Zone 1.

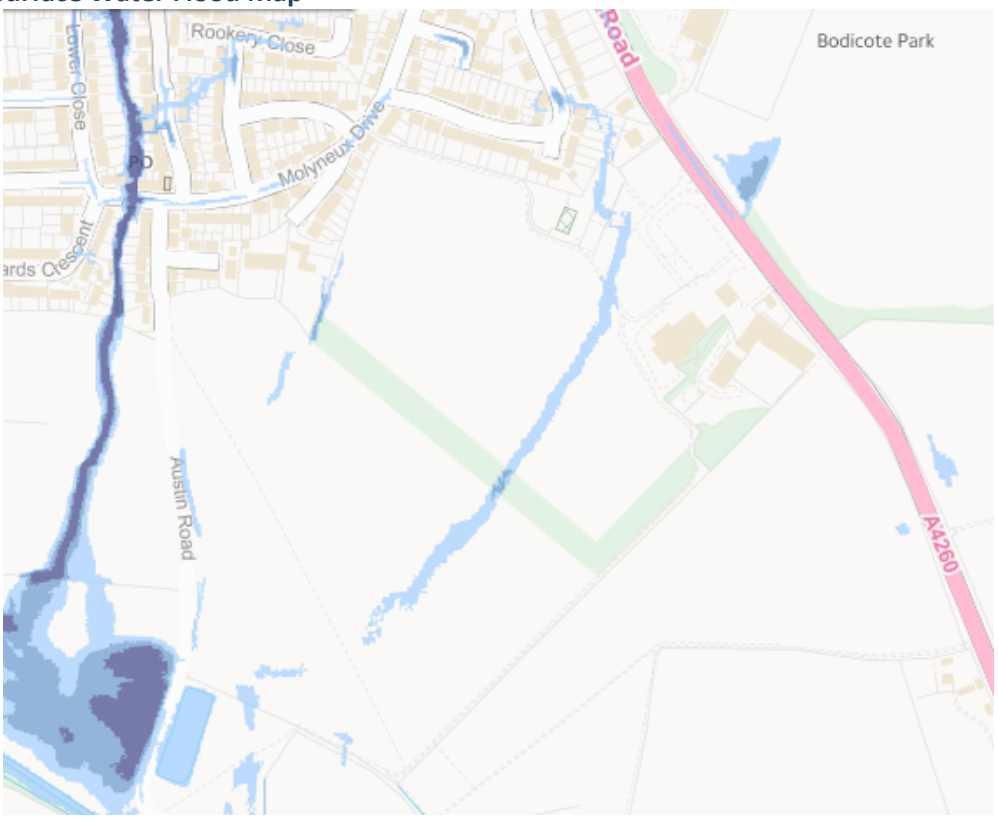
3.4 West Oxfordshire District Council (WODC) and Cherwell District Council (CDC) carried out a joint Level 1 Strategic Flood Risk Assessment (SFRA) for their districts, and published the final report in April 2009.
The aim of WODC and CDC's SFRA is to assess and map the different levels and types of flood risk in the study area for the land use planning process.

3.5 Within the context of the proposed development, there have been no recorded issues of flooding from potential sources including:

- Tidal.
- Fluvial (Main rivers and Ordinary watercourses).
- Groundwater.
- Existing foul and storm sewers and potable water main infrastructure.
- Artificial infrastructure (ponds, sewerage treatment plants etc.).

3.6 Since approval of the FRA the Environment Agency surface water flood mapping service has been updated. This indicates that the site has a strip of potential surface water flooding located on site, as highlighted on the extract plan. This is consistent with the topographical survey which incicates the valley feature running through the centre of the site.

Surface Water Flood Map



Contains Environment Agency information © Environment Agency 2015

3.7 While this is shown as flooding no recorded flooding data has been found within the site boundary and no evidence of additional surface water flooding at the site has been identified.
The route of the indicated flooding does follow the line of an existing surface water and highway drainage system which takes runoff from the A4260 Oxford Road to the Sor Brook.

3.8 Sequential Test

The flood risk technical guidance to the National Planning Policy Framework (NNPF) categorises residential developments as 'More Vulnerable' within the risk classification. 'More vulnerable' developments located within Flood Zone 1 are considered appropriate under the NPPF.

3.9 The NPPF guidance states that planning authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding.
Under the requirements of the 'Sequential Test' and as the proposed development is already located within Flood Zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective which could accommodate the proposed development.

4 Surface Water Drainage Strategy

4.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks on the development site or to offsite parties and land. There is, therefore, a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.

4.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of 'sustainable development' via the provision of Sustainable Drainage Systems (SuDS).

4.3 The SUDs Manual and Building Regulations Document H (2015) details the appropriate hierarchy of potential methods for disposing of surface water from a development:

1. A soakaway or some other adequate infiltration system, or where that is not practicable;
2. A watercourse, or where that is not practicable;
3. A sewer.

4.4 Following the further ground investigatons which has highlighted that while the areas of limestone have a high potential for infiltration the discharge appears to be running between the layers of clay and limestone creating a high risk for groundwater springs within the site or as a worstcase senereo creation of a slipplane.

4.5 Based on the findings of the ground investigation as highlighted within Hydrock report the most suitable method of surface water disposal for the proposed development will be a fully attenuated surface water system with a controlled discharge to the new storm outfall sewer.

4.6 Existing Surface Water Runoff Peak Runoff Rate & Volume (Greenfield)

As part of the original Forge Engineerng Design FRA an assessment was made of the Greenfield runoff rate. These are calculated to determine the theoretical rate of discharge from the Greenfield site to surrounding areas and receiving watercourses in the vicinity.

4.7 The estimated Greenfield run-off for the site was calculated using the Institute of Hydrology's Report No. 124 methodology for sites with an area between 0 ha and 50 ha:

QBARrural = 0.00108 AREA0.89 SAAR1.17 SOIL2.17

Where,
0.00108 is a conversion factor for the units used
AREA is the site catchment area in km2
SAAR is the Standard Average Annual Rainfall
SOIL is the soil index classification.

4.8 The run-off rate is calculated for a 50 ha (0.5km2) catchment using the site's catchment details, and then interpolated using the site's total area to calculate the site's Greenfield run-off rate.

4.9 Using a SAAR of 654mm and SOIL of 0.400, the estimated existing site's Greenfield surface water run-off rate peak flow is:

QBARrural = 0.00108 x 0.500.89 x 6541.17 x 0.4002.17 = 0.1571 cumecs / 50 ha
which equates to QBarRrural = 157.1 l/s/ 50 ha
which equates to QBarGreenfield = 3.142 l/s/ha,
and for a site area of 4.50 ha = 14.1 l/s

4.10 For the site's catchment area of 4.50ha and specified storm events, the site's estimated Greenfield run-off rates and volumes were calculated to be:

Storm Event 1 in n year	Growth Curve Factor	Estimated Site's Run-off Rate Peak Flows (l/s)	Estimated Site's Run-off Peak Volume (m3)
QBAR Greenfield	-	14.1	304.6
1 in 1 year	0.85	12.0	259.2
1 in 30 year	2.27	32.0	691.2
1 in 100 year	3.19	45.0	972.0
1 in 100 year + 30% CC	4.15	58.5	1263.6

Extract from Flood Risk Assessment produced by Forge Engineerng Design Solutions

4.11 Surface Water design:

The surface water design will follow the principles previously set out in both the approved flood risk assessments undertaken by Forge Engineering Design and Banners Gate Ltd which confirm that a final discharge to the Sor Brook is required. This as previously described has already been provided for the adjacent Cala Homes development.

The surface water drainage strategy for the development is described below:

Roof Runoff:-

- Roof runoff will be collected by a conventional system of guttering and downpipes where it will be discharged to a main storm sewer.
- Water Butts are to be provided per plot where feasible on a rainwater downpipe to collect roof runoff for re-use.

Private Drives & Parking Courts:-

All private drives and parking courts will either drain via a traditional gully & piped system prior to outfalling to a the main storm drain.

Development Roads:-

Runoff from the highway areas will drain via deep trapped road gullies connecting directly to either the main piped storm drain.

Attenuation Tanks:-

Due to the layout and levels of the development the flows from the piped storm drainage system will discharge into an main attenuation tank or storage culvert. The main attenuation will be an offline cellular attenuation tank located within the open space area.
Flows will be controlled downstream via a flow control.

4.12 The final flow from the development will be controlled to a maximum discharge of 14.0 l/sec for all storm events which equates to the agreed QBar Greenfield runoff rate. The attenuation tanks will be designed to accommodate the necessary storage volumes to manage the 1:100 year storm event, plus an extra allowance of 40% for the predicted potential increase in peak rainfall up to 2115.

4.13 This ensures that all surface water drainage features are designed to accommodate the extreme storm event and will minimise the occurrence or potential for surface flooding within the development.

5 Foul water drainage strategy

5.1 The foul water generated from each property will drain via gravity through the private house drainage before out-falling to a new sewer located typically within the development road network.

5.2 All plots will drain via a main gravity sewer system which will convey flows to the existing off site foul sewer constructed as part of the adjacent Cala Homes development.

5.3 The predicted peak foul sewer discharge from the site based on the Sewers for Adoption figure (4000 l/dwelling/day) for up to 95 units will be 4.4 l/sec.

5.5 The development foul drainage network will be offered to Thames Water for adoption under a Section 104 agreement of the Water Industry Act 1991.

APPENDIX A
SITE LAYOUT

KEY: SITE LAYOUT

APPLICATION BOUNDARY

SURFACE MATERIALS:

GARDEN/POS/HIGHWAY VERGE
(SEE DETAILED LANDSCAPE PROPOSALS)

TARMACADUM

BLOCK PAVING

CONCRETE SLAB

ENCLOSURE DETAILS:

1.8M HIGH BRICK WALL [BW]

1.8M HIGH TIMBER PANEL FENCING [PF]

1.8M HIGH CLOSE BOARDED FENCING [CBF]

0.6M KNEE HIGH RAIL FENCE

LANDSCAPING:

RETAINED VEGETATION

INDICATIVE TREE PLANTING
(SEE DETAILED LANDSCAPE PROPOSALS)

OTHER:

AS — DWELLING PLOTTED AS SHOWN IN HOUSE PACK

OPP — DWELLING HANDED FROM HOUSE PACK

AFFORDABLE HOUSING
(SHARED OWNERSHIP)

AFFORDABLE HOUSING
(RENTED)

B — BIN COLLECTION POINT

Open Market					
Unit Type	No. Beds	Storeys	Sqft./unit	Sqm./unit	No. of
SANDOWN	2	2	771	71.6	6
HARTLEY	3	2	997	92.6	4
HUNTINGDON	3	2	1,027	95.4	4
LANGFORD	3	2	1,105	102.7	4
HALSTEAD	3	2.5	1,173	109.0	8
AVON	4	2	1,399	130.0	4
SOMERTON	4	2	1,514	140.7	3
CALDER	4	2	1,517	140.9	3
RADLEIGH	4	2	1,579	146.7	10
CALDWICK	4	2	1,800	167.2	8
TINDALL	5	2	2,118	196.8	4
ADDERBURY	5	2	2,162	200.9	4
		OM TOTAL			62
Affordable					
RENTED					
DOVEDALE TYPE A	1	2	506	47.0	2
DOVEDALE TYPE B	1	2	472	43.9	2
AH2B	2	2	769	71.4	6
AH2B LTH	2	2	874	81.2	6
AH2B WC	2	2	1,130	105.0	1
AH3B	3	2	911	84.6	4
AH3B LTH	3	2	1,028	95.5	2
		sub total	70%		23
INTERMEDIATE					
AH2B	2	2	769	71.4	8
AH3B	3	2	911	84.6	2
		sub total	30%		10
		AFF TOTAL	35%		33
					35%
		TOTAL UNITS			95

OXFORD ROAD, BODICOTE - **COMPOSITE SITE LAYOUT 'WIP'**

Pegasus Design

PLANNING | DESIGN | ENVIRONMENT | ECONOMICS

| www.pegasusgroup.co.uk | TEAM/DRAWN BY: STH/JBS/THA | APPROVED BY: STH |
DATE: 07/07/18 | SCALE: 1:500 @ A1 | DRWG: **P16-1364**_20 SHEET NO: __ REV: G