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LAND WEST OF TURNERS HILL ROAD AND NORTH OF HUNTSLAND, CRAWLEY DOWN

DRAINAGE STRATEGY

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Approved by	**Anthony Guay**
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Ramboll
Twenty3 Brunswick Place
Southampton
SO15 2AQ
United Kingdom

T +44 23 8081 7500
https://uk/ramboll.com

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EXECUTIVE SUMMARY

Ramboll UK Limited (Ramboll) has been appointed by Wates Developments Limited (Wates) to develop both surface water and foul water drainage strategies for the Proposed Development at Turners Hill Road, Crawley Down, Crawley. The site is located at approximate coordinates 533517E, 137794N, at postcode RH10 4HB.

The Proposed Development is for a mixed residential scheme of up to 150 dwellings and a 65 bed care home. As part of the development, the site has been divided up into Fields 1 and 2.

The proposed surface water drainage strategy consists of a series of swales and surface water attenuation areas that have been strategically located across the site.

A connecting network of swales, surface water attenuation areas, and gravity driven surface water sewers where necessary, have been located adjacent to the northern, eastern, and western boundaries of Fields 1 and 2. Runoff from Field 1 is proposed to discharge to an existing watercourse that was observed flowing away toward the west in the northwest corner of the site. Runoff from Field 2 is proposed to discharge to an existing watercourse located on the boundary between Fields 1 and 2. It was also observed to be flowing away toward the west.

Surface water features have been sized appropriately to accommodate the additional runoff expected from the Proposed Development.

Discharge rates out of the attenuation features will be limited to the 1 in 1 year greenfield runoff rate, thereby considerably reducing the peak flows presently emanating from the site area. The strategy will therefore improve upon the current situation with regard to surface water management and flood risk.

Specific mitigation and maintenance works have been recommended at the site including the regular inspection of ongoing maintenance works in Field 1.

The proposed foul strategy is for connection into an existing foul sewer approximately 150 – 200 m south of the site.

The Indicative Drainage Strategy Plan visualises the proposed drainage strategy and is presented in Figure 3.1 at the rear of the report.

1. INTRODUCTION

1.1 Background

1.1.1 Ramboll UK Limited (Ramboll) has been appointed by Wates Developments Limited (Wates) to develop both surface water and foul water drainage strategies for the Proposed Development at Turners Hill Road, Crawley Down, Crawley. The site is located at approximate coordinates 533517E, 137794N, at postcode RH10 4HB.

1.1.2 The Proposed Development is for a mixed residential scheme of up to 150 dwellings and a 65 bed care home.

1.1.3 The latest Site Illustrative Masterplan is presented in Appendix A at the rear of the report.

1.2 Scope and Objectives

1.2.1 The aim of this report is to provide a detailed overview of the surface water and foul water drainage strategies for the Proposed Development. This includes the proposed management and disposal of surface water, and how calculated surface discharge rates are to be controlled and discharged. This report includes the following:

- Review of existing drainage conditions at the site;
- Review of site topography;
- Determination of existing surface water runoff rates at the site and required storage volumes;
- High level calculation of anticipated foul water generation from the Proposed Development;
- Review of existing sewer records for the site and its surrounds;
- Options appraisal of Sustainable Urban Drainage Systems (SuDS) and their suitability for the Proposed Development; and
- Proposals for measures to mitigate the generation of surface water runoff from the Proposed Development.

1.3 Ramboll and Climate Change

1.3.1 Ramboll UK Ltd is a Partner for Sustainable Change, and as such sustainability is central to our assessments and reporting. We have made specific considerations for climate change throughout this report, to ensure that our planning and design advice is supportive of an approach to ensure robust and sustainable societies.

1.4 Consultation

1.4.1 A foul water enquiry was issued to Thames Water in March 2024. The enquiry proposed connection into an existing foul water sewer located 150 – 200 m south of the site. The enquiry was approved. West Sussex County Council, the Lead Local Flood Authority (LLFA), were engaged in November 2024 regarding pre-application discussions. The LLFA were content overall with the drainage proposals.

1.5 General Limitations and Reliance

1.5.1 This report has been prepared by Ramboll exclusively for the intended use by the client in accordance with the agreement between Ramboll and the client defining, among others, the purpose, the scope and the terms and conditions for the services. No other warranty, expressed or implied, is made as to the professional advice included in this report or in respect of any matters outside the agreed scope of the services or the purpose for which the report and the associated agreed scope were intended, or any other services provided by Ramboll.

1.5.2 In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to Ramboll was accurate, complete, and available to Ramboll within the reporting schedule.

1.5.3 Ramboll's services are not intended as legal advice, nor an exhaustive review of site conditions and/or compliance. This report and accompanying documents are intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

1.5.4 Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the site will continue to be used for its proposed end-use without further significant changes onsite. Unless stated otherwise, the geological information provided is for general environmental interpretation and should not be used for geotechnical and/or design purposes.

2. SITE DETAILS

2.1 Site Location and Description

2.1.1 The site is located on land to the west of Crawley Down, a village in the Mid Sussex district of West Sussex, England. The site is located at approximate coordinates 533517E, 137794N, at postcode RH10 4HB. The Proposed Development is for up to dwellings and a 65 bed care home.

2.1.2 The site currently consists of undeveloped greenfield land, with adjacent and surrounding land uses as follows:

- North: Mature woodland, including Pescotts Wood and Wins Wood. Approximately 250 m further north is Westlands Wood. Woodland is denser to the northwest, with areas of greenspace more common to the north and northeast, on either side of Turners Hill Road (B2028) Hurst Farm, an allocated site within the emerging local plan, is located immediately northeast of the site;
- East: The existing estate on Wychwood Place, Turners Hill Road and immediately beyond the wider residential area of Crawley Down;
- South: Intermittent woodland and greenspace, and Huntsland (private road); and
- West: Intermittent woodland and a series of farms/smallholdings and cottages.

2.1.3 The wider residential area of Crawley is located approximately 3.1 km west of the site.

2.1.4 The Site Location Plan is presented in Figure 2.1 at the rear of the report. The Plan includes labels of Fields 1 and 2.

2.2 Site Topography

2.2.1 A site topographical survey[1] was previously undertaken at the site. A description of the topography is summarised as follows:

[1] CD Surveys Ltd, Topographical Survey Overall, W/2401010, February 2024.

Field 1

2.2.2 Field 1 in the far north of the site is shown to fall from approximately 118.4 m Above Ordnance Datum (AOD) in the southeast to approximately 111.5 m AOD in the northwest. The survey indicates steadily falling levels from east to west along both the northern and southern boundaries of the field, and from south to north along both the western and eastern boundaries of the field. Levels in the central part of the field are typically between 115 and 116 m AOD.

Field 2

2.2.3 Field 2 is located to the immediate south of Field 1 and is separated from Field 1 by an existing ditch/hedgerow/wire fence. The levels within Field 2 are shown to fall in all directions from an approximately central point within the southern half of the field, shown to be at approximately 126.1 m AOD. The steepest falls are indicated to be toward the north and south, with minimum levels of approximately 115.4 m AOD and 118 m AOD indicated by the survey in the northwest and southwest corners of the field. Levels are also indicated to fall from east to west across the northern part of the field.

Summary and Surrounding Area

2.2.4 The site topographical survey is presented in Appendix B at the rear of the report.

2.2.5 A site visit was undertaken in March 2024 by representatives from both Ramboll and Wates. The topography was observed to be in line with that shown by the topographical survey. A series of photographs taken while onsite are presented in Appendix C at the rear of the report.

2.2.6 Light Detection and Ranging (LiDAR) data[2], is shown to broadly agree with the findings of both the topographical survey and the site visit. Outside the site boundary, the topography is as follows:

- North: Land is shown to fall steadily toward the north and northwest, with levels falling approximately 4 to 5 m AOD over approximately 200 m;
- East: Land is shown to rise steadily within residential areas of Crawley Down to the east of the site. Levels are indicated to rise approximately 3 m AOD over approximately 200 m;
- South: Land is shown to fall approximately 20 m AOD toward an existing watercourse over approximately 200 m; and
- West: Land is typically shown to fall toward the west, with falls of approximately 10 to 15 m AOD over approximately 200 m.

[2] Department for Environment Food & Rural Affairs, Data Services Platform, LIDAR Composite Digital Terrain Model (DTM) – 1m [online]. Available at: https://environment.data.gov.uk/dataset/13787b9a-26a4-4775-8523-806d13af58fc. Accessed September 2024.

2.2.7 LiDAR Topography is presented in Figure 2.2 at the rear of the report.

2.3 Hydrological Setting

2.3.1 A review of the EA Statutory Main River Map[3] indicates there are no EA Main Rivers located within the boundary of the site. The nearest is located approximately 1.9 km northwest of the site.

2.3.2 The site drains toward existing watercourses located approximately 200 to 250 m west of the site. All of these watercourses ultimately drain northwards and become tributaries of the River Mole. The Mole then flows northwest through Surrey for 80 km (approximately 50 miles) to the River Thames at Hampton Court Palace.

2.3.3 The Hydrological Setting is presented in Figure 2.3 at the rear of the report.

March 2024 Site Visit - Observations

2.3.4 Within the site the headwaters of two watercourses that discharge from the site toward the west were observed to be present. These watercourses are identified in Appendix C and in Figure 3.1 at the rear of the report. One is located in the northwest of Field 1, whereas the other is located along the boundary of Fields 1 and 2. It is considered that these two watercourses join one of the existing watercourses located within Wins Wood, as identified in Figure 2.3.

2.3.5 Along the northern boundary of the site and to the immediate northeast, large areas of surface water flooding were observed to be present, with water flowing approximately east to west. This extended into the wooded areas to the north of the site.

2.3.6 Saturated ground and standing water were observed in lower lying areas in the east of Field 2, adjacent to the site boundary.

2.4 Geological and Hydrogeological Setting

2.4.1 Geology and ground conditions at the site were investigated by Geo-Environmental[4] in November 2023. The ground conditions typically encountered across the boreholes comprised a mantle of Topsoil overlying the Upper Tunbridge Wells Sand Formation.

[3] Department for Environment Food & Rural Affiars, Data Services Platform, Statutory Main River Map [online]. Available at: https://environment.data.gov.uk/dataset/25dde009-ba7d-40de-8380-c5c3bb32ccdc. Accessed September 2024.

[4] Geo-Environmental, Ground Appraisal Report, Land Off Turners Hill Road, Crawley Down, West Sussex, RH10 4HB, January 2024, GE21953-GAR-JAN24.

2.4.2 Groundwater monitoring investigations were previously undertaken by Geo-Environmental[5] between November 2023 and April 2024. They indicate a site-wide groundwater level typically shallower than 2 m Below Ground Level (BGL). In many areas of the site the level is shallower than 1 m BGL.

2.4.3 According to the Cranfield University LandIS soils map[6], the soil at the site is described as 'slightly acid loamy and clayey soils with impeded drainage'.

2.4.4 According to British Geological Survey (BGS) GeoIndex Onshore data[7], the underlying rock unit beneath the site is defined as a moderately productive aquifer and is summarised as sandstones of the Ashdown Formation yielding up to 60 L/s and Tunbridge Wells Sand yielding up to 10 L/s; separated by Wadhurst Clay.

2.4.5 According to the BGS Geology Viewer[8], the underlying geology beneath the site is defined as the Upper Tunbridge Wells Sand. This is typically described as interbedded sandstone and siltstone. No superficial geology layers are recorded.

2.5 Existing Drainage

2.5.1 At present, the site is comprised of undeveloped, greenfield land with no impermeable surfaces.

Surface Water

2.5.2 According to the LandIS soils map[6], the site is stated to drain to the 'stream network'. This statement is backed up by observations made during the site visit undertaken in March 2024, where saturated ground and pooling of water were observed in many places across the site, as well as the drainage of surface water to existing watercourses both on and offsite.

2.5.3 During the March 2024 site visit, surface water at the site was observed to be draining toward the west. In Field 1, surface water was observed to flow toward the northwest of the field where it pooled significantly and then flowed away in a ditch into the woods to the west. A similar watercourse was observed to be flowing west into the woods in the northwest corner of Field 2 along the hedgerow that marked the boundary between Fields 1 and 2.

[5] Geo-Environmental, Land off Turners Hill Road, Crawley Down, West Sussex, RH10 4HB – Ground Gas Assessment & Winter Groundwater Monitoring, May 2024, GE21953 – LRv1AP240203.

[6] LandIS, Soilscapes Viewer [online]. Available at: https://www.landis.org.uk/soilscapes/. Accessed September 2024.

[7] BGS British Geological Survey, GeoIndex Onshore [online]. Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html. Accessed September 2024.

[8] BGS Geology Viewer [online]. Available at: https://geologyviewer.bgs.ac.uk. Accessed September 2024.

2.5.4 Thames Water sewer records are presented in Appendix D at the rear of the report.

Foul Water

2.5.5 The Thames Water sewer records indicate the presence of a 225 mm diameter foul (wastewater) sewer approximately 150 – 200 m south of the site. The sewer is gravity driven and is joined by a smaller 100 mm diameter connection flowing north to south from Huntsland House.

2.6 Surface Water and Sewer Flood Risk

2.6.1 The topography of the site and surrounding area is detailed in Section 2.2. Levels across the site and in the surrounding area are suggestive of a typical east to west sloping pattern. The topography of the site and surrounds is therefore suggestive of the potential for overland flow paths leading onto the site from the east.

2.6.2 The EA publishes geo-spatial data[9] describing the suitability of the modelling for a range of types of assessment for given locations. At the site location it is confirmed that the mapping was produced by the JFlow National Surface Water model, which was run in March 2013 at a 2 m resolution. It is stated that the assumption at this location was that any drainage systems are at capacity. Therefore, the model does not allow for losses (departure) of surface water runoff during the modelled storm event via the natural drainage at the site and in the vicinity of the site.

2.6.3 The Suitability[10] of the results at this location are stated to be 'National to County'. This suggests that whilst suitable for identifying which parts of countries or counties are at risk, or which countries or counties have the most risk, the results at this location are *"Very unlikely to be reliable for a local area"* and *"Extremely unlikely to be reliable for identifying individual properties at risk"*.

2.6.4 According to the EA long term flood risk mapping[11], approximately 80% of the site is located in an area considered to be at a Very Low risk from surface water flooding. Areas at High risk are present in the northwest and west of the site and are surrounded by areas at Medium and Low risk. The different surface water risk categories are defined below:

- High – Greater than a 1 in 30 (3.3%) annual probability;
- Medium – Between a 1 in 30 and 1 in 100 (3.3% to 1%) annual probability;
- Low – Between a 1 in 100 and a 1 in 1,000 (1% to 0.1%) annual probability; and
- Very Low – Less than a 1 in 1,000 (0.1%) annual probability.

[9] Department for Environment Food & Rural Affairs, Data Services Platform, Risk of Flooding from Surface Water Input Model Details [online]. Available at: https://environment.data.gov.uk/dataset/926e600f-d465-11e4-95fe-f0def148f590. Accessed September 2024.

[10] Department for Environment Food & Rural Affairs, Data Services Platform, Risk of Flooding from Surface Water Suitability [online]. Available at: https://environment.data.gov.uk/dataset/92912a4f-d465-11e4-8687-f0def148f590. Accessed September 2024.

[11] GOV.UK, Check the long term flood risk for an area in England [online]. Available at: https://check-long-term-flood-risk.service.gov.uk. Accessed September 2024.

2.6.5 It is noted that the EA mapping indicates areas at risk of flooding from surface water in addition to flood risk from rivers or the sea. It does not however account for building removal, ground raising, or site levelling. In addition, it does not consider specific drainage assets such as sewers, drains or ditches when calculating extents.

2.6.6 Whilst the surface water mapping indicates where there could be heightened surface water flood risks in some surrounding areas, this does not account for public surface water drainage measures which would be expected to significantly reduce surface water flood risks from that assumed and presented by the mapping. The EA's data confirms that the mapping at this location should not be used for site-specific assessment of risk.

2.6.7 EA Surface Water Flood Risk is presented in Figure 2.4 at the rear of the report.

2.6.8 During the March 2024 site visit, surface water flooding was observed to be significant along the northern and western boundaries of Field 1, with adjacent woodland areas seeing notable flooding. In central areas of the field, the ground was observed to be saturated, but the significant depths of water remained in the lower lying areas adjacent to the northern and western site boundaries. The mapping in this area appears to exaggerate the risk in the centre of the field and under exaggerate it along the boundaries. Furthermore, a fallen tree was observed in the northwest of Field 1 to be obstructing surface water flow exiting the field, leading to surface water pooling just outside the site boundary where surface water was subsequently observed to be flowing away to the west.

2.6.9 Surface water and sewer flood risk at the site is expected to be managed by the proposed surface water drainage strategy detailed in Section 3.

3. SURFACE WATER DRAINAGE STRATEGY

3.1 Overview

3.1.1 The following section sets out a high-level strategy for the management of surface water emanating from the new development. The strategy has been developed through use of the sustainable drainage guidance for the South East of England[12], along with the National Statutory guidance outlined in the Non-Statutory Technical Standards for Sustainable Drainage Systems[13].

3.1.2 The Indicative Drainage Strategy Plan is presented in Figure 3.1 at the rear of the report and should be read in conjunction with this section.

3.2 Surface Water Catchments

3.2.1 In order to retain the existing hydrological characteristics of the site, it is proposed to manage surface water based on existing catchments and their associated drainage routes.

3.3 Disposal of Surface Water

3.3.1 Part H of the Building Regulations[14] establishes a hierarchy for surface water disposal, which encourages a SuDS approach. The hierarchy is that surface runoff must be discharged to one or more of the following in the following order of priority:

1. To ground via an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
2. To a watercourse; or where that is not reasonably practicable,
3. To a sewer.

3.3.2 A review of the existing drainage, hydrology, and underlying ground conditions at the site (as described in Section 2), indicates that permeability is likely to be low across the site, and as such infiltration is unlikely to be a feasible option for the disposal of surface water.

3.3.3 On the assumption that infiltration would not be viable, the most convenient point of connection for surface water to a watercourse would be as follows:

- Discharge from the development to be split between two observed watercourses, the first leaving the site in the northwest corner of Field 1 and the second leaving the site in the northwest corner of Field 2.

[12] AECOM, Water. People. Places. A guide for master planning sustainable drainage into developments. Prepared by the Lead Local Flood Authorities of the South East of England [online]. Available at: https://www.westsussex.gov.uk/media/2270/suds_design_guidance.pdf. Accessed September 2024.

[13] Department for Environment, Food and Rural Affairs [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf. Accessed September 2024.

[14] GOV.UK, Statutory guidance, Drainage and waste disposal: Approved Document H, 2010 [online]. Available at: https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h#:~:text=The%20current%20edition%20covers%20details%20of. Accessed September 2024.

3.4 Runoff Rates and Storage

3.4.1 The site is almost entirely greenfield in its current state, and as such runoff from the site post-development will need to be controlled to the equivalent greenfield 1 in 1-year rate. Surface water attenuation and flow control will need to be of sufficient design and capacity to ensure the 1 in 100-year plus 40% climate change event can be attenuated within the site, restricting onward flow to the 1 in 1-year greenfield rate.

3.4.2 The existing site runoff was calculated using the Rainfall-Runoff calculator in the Source Control module of Micro Drainage 2020.1. The ICP SuDS Method was used, due to the less than 50 ha site area. Table 3.1 details the initial greenfield runoff calculations.

Table 3.1: Greenfield Runoff Calculation

Area (ha)	SAAR (mm)	Soil	Region	*Runoff rate (L/s)
15.3	865	0.45	6	73.2

3.4.3 Based on the requirement for attenuating to 73.2 L/s, the following storage volume was calculated. This is summarised in Table 3.2 which provides the schedule of the required storage from each area, assuming a 35:65 ratio of impermeable to permeable areas. The arrangement of all the proposed storage is indicated on Figure 3.1 (Indicative Drainage Strategy Plan). Impermeable areas have been estimated based on the site masterplan.

Table 3.2: Storage Calculation

Imp Area (ha)	M5-60 (mm)	Ratio R	Allowable Discharge (L/s)	Design Storm Event	Required Storage (m^3)
5.36	20.00	0.350	73.2	1 in 100 +40%	3,971

3.4.4 Please see Appendix E for further information/figures.

3.5 SuDS Options

3.5.1 Table 3.3 below provides an overview of potentially suitable SuDS options available for attenuating surface water runoff.

3.5.2 It is noted that within the Indicative Drainage Strategy Plan, as presented in Figure 3.1 at the rear of the report, the larger surface water storage areas proposed at the site are collectively referred to as Proposed Surface Water Attenuation Areas. At detailed design, these areas could alternately form balancing ponds or wetlands, depending on which is most appropriate to each individual location.

Table 3.3: Sustainable Drainage Options

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
Retention	Balancing pond		Provides both storm water attenuation and treatment. Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in runoff volume, land take may limit use in high density sites.	✓ Potential for inclusion in lower-lying areas before discharge from the site.
	Sub-surface storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	✗ Better options available considering nature and character of the development.
Wetland	Shallow wetland Extended detention wetland Pond wetland Pocket wetland Submerged gravel wetland Wetland channel		Wetlands provide stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires baseflow, little reduction in runoff volume, not suitable for steep sites.	✓ Potential for inclusion in lower-lying areas before discharge from the site. Impermeable ground would be well suited to wetlands.
Infiltration	Infiltration trench Infiltration basin		Surface water runoff can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A	Reduces the volume of runoff, effective at pollutant removal, contributes to groundwater	Requires appropriate pre-treatment, basins require	✗ Unlikely to be viable due to underlying ground.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
	Soakaway		prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	recharge, simple and cost-effective, easy performance observation.	a large flat area, offset from foundations.	
	Porous paving Permeable paving		Block or porous paving allows runoff to infiltrate through to sub-base layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems.	Reduces the volume of runoff and if designed for infiltration contributes towards groundwater recharge. Easy to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive.	Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt.	✓ Should be incorporated for parking areas and access roads where appropriate.
Filtration	Surface sand filter Sub-surface sand filter Perimeter sand filter		Structures designed to treat surface water runoff through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of runoff is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2 m required, possible odour problems, high capital, and maintenance cost.	✗ Unlikely to be viable due to impermeable nature of the site.
	Bioretention/filter swale		Vegetated strips of land designed to accept runoff as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit capability, effective pre-treatment option.	Requires landscaping and management, large land requirement, not suitable for steep sites; no significant attenuation or reduction of flows.	✓ Could be used alongside highway areas for treatment of highway runoff.
	Filter trench/drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water runoff.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping	High clogging potential without effective pre-treatment, limited to small	✗ Better options available considering nature and character of the development.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site?
			Receive lateral inflow from an adjacent impermeable surface.	and fit well beside roads and car parks.	catchments, high cost of replacing filter material.	
Detention	Detention basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility.	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in runoff volume, detention depths constrained by levels.	✗ Better options available considering nature and character of the development.
	Enhanced dry swale Enhanced wet swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces runoff rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	✓ Should be used to form the spine of the blue-green network.
Conveyance	Conveyance swales Rills		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	✗ Better options available considering nature and character of the development.
Source control	Green/blue roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.	✗ Not suitable for private dwellings.

3.6 Preferred SuDS Options

3.6.1 Table 3.4 outlines briefly the suitability of each of the SuDS options in consideration of the site conditions. The following section provides more detail on the preferred SuDS options, and how these will combine to form the overall strategy for managing surface water.

3.6.2 The most effective approach to incorporating SuDS into the development is to plan for and include them from the outset, and ensure SuDS and blue-green corridors for the transfer of surface water are represented in the masterplan development. There are good opportunities to do this within the proposed development, due to the relatively low-density of housing proposed, the large amount of amenity and open-space (which is highly suitable for 'doubling up' as SuDS storage), and the good drainage falls across the northern and southern development areas.

3.6.3 The most value can be added by SuDS through adoption of a hierarchical model, whereby measures are incorporated at each level of the development, forming a tiered approach to managing surface water. Table 3.4[15] below summarises how this approach could work at the site.

Table 3.4: Proposed SuDS Hierarchy

Hierarchy	Measures	Flow Control Detail	Design Considerations
Street Level	Permeable paving for all driveways. Permeable tarmac for all internal roads. Rain gardens, serving 2-6 properties as a destination for roof water.	Check dams, small diameter pipes, low gradients, flow baffles. Hydrobrakes should be avoided for street level flow control.	Street level SuDS could be highly effective in managing the flow of surface water through the development, ensuring runoff is diverted away from dwellings. Parking areas and driveways are particularly suitable for permeable paving. Rain gardens can be easily incorporated into grass verges and provide enhancement to green open space.
Neighbourhood Level	Swales to form the basis of connectivity for blue-green corridors. Small storage ponds.	Flow to be controlled through a system of regular check dams, orifices, natural weirs/informal overflows, and engineered levels. Formal/engineered flow control should be avoided at this stage.	Swales would be especially suitable for the controlled transmission of surface water through the site. Drop kerbs can be used to facilitate movement of surface water off highway areas towards SuDS/blue-green infrastructure. Blue-green corridor routes should be used in parallel as overland flow routes for extreme surface water events. Given the identified flood risk, opportunities for storing/slowing the rate of runoff should be adopted.

[15] The proposals presented in Table 3.4 present both outline measures as indicated on the Indicative Drainage Strategy Plan presented in Figure 3.1, and more detailed measures which may or may not be taken forward at detailed design stage.

Catchment Level	Wetlands, larger storage ponds. Swales.	Controlled via formal flow control, either hydrobrake or overflow weir.	The areas of surface water flooding identified onsite should be retained as more formal areas for surface water storage. Large amenity areas would be suitable for storage ponds and could be used to provide biodiversity net gain. Overland flow routes for exceedance events should be engineered to naturally flow to these areas. Would take up typically 10% of the site area, although this can be reduced through effective use of street and neighbourhood level measures.

3.6.4 The preferred configuration of the SuDS/blue-green infrastructure design has been agreed as part of the detailed site master-planning to be submitted as part of the planning application. The drainage strategy has been informed by the site masterplan and is illustrated in Figure 3.1. The strategy proposes the use of swales and larger storage or attenuation areas across the site, connected via surface water sewers where it is deemed necessary to do so. The intention is for ultimate disposal of surface water to the locations as stated in Section 3.3.

3.7 Biodiversity Net Gain

3.7.1 Biodiversity net gain (BNG) is an approach to development. It makes sure that habitats for wildlife are left in a measurably better state than they were prior to the development[16]. In England, BNG is mandatory under Schedule 7A of the Town and Country Planning Act 1990[17], unless exempt.

[16] GOV.UK, Guidance, Understanding biodiversity net gain, 2024 [online]. Available at: https://www.gov.uk/guidance/understanding-biodiversity-net-gain. Accessed September 2024.

[17] Legislation.gov.uk, Environment Act 2021, Schedule 14, Biodiversity Gain as Condition of Planning Permission [online]. Available at: https://www.legislation.gov.uk/ukpga/2021/30/schedule/14/enacted. Accessed September 2024.

3.7.2 The benefit of including SuDS measures across an effective hierarchy is that much of the BNG requirements can be fulfilled through the implementation of certain measures. The use of wetlands, rain gardens, swales, and blue-green corridors in particular, are beneficial in terms of BNG, and their inclusion can reduce the onus elsewhere in the site.

3.8 Treatment of Runoff

3.8.1 The proposed treatment of runoff and removal of contaminants is summarised in Table 3.5.

Table 3.5: Treatment of Runoff

Development Component	Existing Contaminant Profile	Primary Treatment	Secondary Treatment
Low Traffic Roads/Individual Property Driveways	Runoff likely to have light hydrocarbon contamination. Using the CIRIA Report C753[18] indices, the pollutant loading profile will be as follows: • TSS = 0.5 • Metals = 0.4 • Hydrocarbons = 0.4	**Permeable Paving** Will treat surface water through filtration of silt and the attached pollutants; biodegradation of organic pollutants like petrol and diesel; adsorption of pollutants; and settlement and retention of solids. **Storage Ponds/Swales** Will treat surface water runoff through pollutant retention. Will help to reduce the contaminant load discharged to surface waters. Coarse to medium sediments and associated pollutants can be removed by filtration through surface vegetation and groundcover. Fine particulates and associated contaminants can be removed by infiltration.	**Storage Ponds/Wetlands** Will provide treatment of surface water runoff through settling and biological uptake. Dense stands of vegetation facilitate the adhesion of contaminants to vegetation, aerobic decomposition of pollutants and can help stabilise settled sediment and prevent resuspension.
Residential Roof Areas	Using the CIRIA Report C753[18] indices, the pollutant loading profile will be as follows: • TSS = 0.2 • Metals = 0.2 • Hydrocarbons = 0.05		

3.9 Drainage System Performance

3.9.1 The storage values calculated at this stage are indicative and are intended to provide enough detail to inform the next stage of development. When the detailed layout of the 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 building (including a basement); or
    - a utility plant susceptible to water (e.g., a pumping station or electricity sub-station).
- On neighbouring sites during a 1 in 100-year rainfall event.

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

3.10 Adoption and Maintenance

3.10.1 At this stage, no definitive plan or agreement has been entered into regarding the future adoption of surface water drainage. All SuDS features situated in private land (i.e., permeable paving, small rain gardens etc.) would be the responsibility of the homeowner. Surface water drainage in the form of sewers and SuDS features, located in public areas, are proposed to be placed under the responsibility of a private management company. Sufficient access space for maintenance has been provided in the design and this is indicated on the Indicative Drainage Strategy Plan.

3.10.2 In order to support future adoption by West Sussex County Council, all drainage should be constructed in accordance with the following technical guidance:

- Sewers for Adoption 8th Edition[19]; and
- CIRIA report C753 The SuDS Manual[18].

3.10.3 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 of any broken blocks/damaged areas; maintenance of vegetation; three monthly inspections for poor operation and/or weed growth; annual inspection of inspection chambers; annual inspection for silt accumulation.
- **Swales/Rain Gardens** - Monthly removal of litter, grass cutting and vegetation management; annual re-seeding and pruning; repairs due to erosion, reinstatement of design levels, scarification and spiking of topsoil, removal of sediment, and removal of oils or petrol residues as required; monthly inspection for blockages, ponding, compaction and silt accumulation; monthly inspection for blockages and physical damage; six monthly inspection for silt accumulation and functioning of mechanical devices (where necessary).

[18] CIRIA, The SuDS Manual (C753F), 2015 [online]. Available at: https://www.ciria.org/CIRIA/Item_Detail.aspx?iProductCode=C753F&Category=FREEPUBS&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91&OrderLineId=315a5390-84ff-4072-9e87-0a360394b238. Accessed September 2024.

[19] Water UK, Sewers for Adoption, A Design and Construction Guide for Developers, 2018 [online]. Available at: https://www.water.org.uk/wp-content/uploads/2018/10/SfA-8-Master-2.pdf. Accessed September 2024.

- **Flow Control Devices** – To be inspected every three - six months, after a large storm event, or after an observed deterioration in system performance.
- **Attenuation Basins** – Main requirements include mowing along maintenance access routes, amenity areas and across any formed embankments. The remaining areas can be managed as 'meadow'. Grass clippings should be disposed of offsite to remove nutrients and pollutants. Sediment will occasionally require removal when reaching 25 mm depth.
- **Wetlands** – Monthly removal of litter and debris, cutting of grass in public areas; monthly inspection of inlets, outlets, banksides, structures, pipework etc. for evidence of blockage and/or physical damage; monthly inspection of waterbody for signs of poor water quality (May – October); six monthly cutting of meadow grass; six monthly inspection of silt accumulation rates; six monthly inspection of any mechanical devices; annual hand cut of submerged and emergent aquatic plants; annual removal of bank vegetation and tidying of dead growth; remedial repair, replanting, aeration, and realignment as required.

3.10.4 The above represents a typical maintenance schedule; a site-specific schedule should be fully developed and agreed upon detailed design of the site drainage.

3.10.5 The following maintenance measures are noted regarding specific locations within the site:

- During the March 2024 site visit, a fallen tree was observed in the northwest of Field 1 and was observed to be obstructing surface water flow exiting the field. Maintenance works to reduce the risk of pooling are being undertaken with the intent of 'formalising' the exit route for surface water from the site. These works are to be regularly inspected and actioned as required in the future.

3.11 Management of Runoff from Construction

3.11.1 During the stages of site preparation, earthworks, and construction there is the potential for contaminants and/or suspended sediments in surface water runoff entering the surrounding watercourses and existing drainage.

3.11.2 A strategy for managing surface water runoff during the construction phase, including specific measures tailored to the level of risk should be developed and agreed with West Sussex County Council. The extent of sediment/contaminant runoff will vary across the construction cycle, and a strategy should be developed to encompass potential pollution from all stages of construction.

3.11.3 The strategy should include details of how during the earthworks and site preparation stages the contracting engineer will employ the approaches outlined in CIRIA C532 Control of Water Pollution from Construction Sites[20]. This will require a proper understanding of the sensitivity of the downstream watercourses in terms of existing water quality and the potential impact of change. It is expected potential mitigation measures will include:

- Avoiding mass overburden stripping at the site; exposing only that part of the site essential for operation;
- Placing silt fences of geo-fabric or similar material around open or exposed ground and stockpiles; and
- Re-seeding any exposed ground and stockpiles to stabilise the ground and reduce erosion and gullying of such features.

3.11.4 The strategy should be developed and agreed during detailed design and should be implemented prior to the commencement of any enabling and/or construction works onsite.

3.11.5 A strategy for managing surface water runoff during the construction phase, including specific measures tailored to the level of risk at the site should be developed and agreed with West Sussex County Council during detailed design.

[20] CIRIA, Control of water pollution from construction sites. Guidance for consultants and contractors (C532D), 2001 [online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C532D&Category=DOWNLOAD.

4. SURFACE WATER FLOODING MITIGATION

4.1.1 As part of our development of mitigation options, and in consideration of future site development, Ramboll has considered climate change in the following ways:

- Consideration of climate change allowances when considering peak fluvial flood levels – this is also a policy requirement of the EA for all NPPF-compliant FRAs;
- Consideration of greater frequency and higher magnitude of surface water flooding events and overland flow, and assessing how a site and building layout can be designed to manage this risk; and
- Consideration of the likely increased risk of seasonal groundwater flooding as a result of wetter winters.

4.1.2 Each of the above will be considered when assessing the mitigation measures, which are summarised as follows:

- Finished Floor Levels (FFLs) – All FFLs and threshold levels should be at least 150 mm above the surrounding ground to manage future risk from surface water flooding and overland flow.
- Planning for Exceedance Events - This risk relates to the occurrence of intensive rainfall events (expected to become more frequent with the advent of climate change) which could cause overland flow and surface water flooding or cause the capacity of the site drainage system to be exceeded and result in flooding. To manage this risk, the development should consider exceedance overland flow routes during extreme flood events, adopting the principles set out in CIRIA C634, Designing for Exceedance in Urban Drainage[21]. The design of exceedance routes should correlate with the proposed swales/surface water attenuation areas, which will make highly suitable exceedance flow paths. The overall volumes for the surface water attenuation features presented in the Indicative Drainage Strategy Plan have been determined based on calculations where an allowance for the potential impacts of climate change was made.
- External Gradients - Along with the planning of exceedance routes, external gradients where possible, are to be designed to fall away from buildings, so that any overland flow resulting from extreme events would be channelled away from building entrances. Where this is not possible, linear interceptor drains should be located at all building entrances towards which there is a positive gradient for surface water to flow.
- Management of Flood Extents – Areas at risk from surface water were investigated during the March 2024 site visit and have been accounted for in the proposed surface water drainage strategy. Proposed surface water attenuation areas, connected by a network of proposed swales to convey surface water runoff, have been strategically located across the site.

[21] CIRIA, Management of accelerated low water corrosion in steel maritime structures (C634), 2005 [online]. Available at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C634&Category=BOOK.

5. FOUL DRAINAGE STRATEGY

5.1.1 Thames Water sewer records presented in Appendix D at the rear of the report, indicate the presence of a foul water sewer approximately 150 – 200 m south of the site. The presence of this sewer was confirmed during the March 2024 site visit.

5.2 Foul Flow Calculations

5.2.1 The expected peak flows have been calculated based on the British Water Code of Practice 4[22] which states that for a standard residential dwelling a flow rate of 150 L/Person/Day should be assumed.

5.2.2 Based on the number of proposed units, an occupancy of 360 people has been estimated for the Proposed Development (150 dwellings with an average occupancy of 2.4 people per household). This would mean the following:

(150 x 360)/24 (hours in a day)/60 (minutes in an hour)/60 (seconds in a minute) = 0.63 L/s.

5.2.3 For a residential care home, a flow rate of 350 L/Person/Day should be assumed. This would mean the following:

(350 x 65)/24 (hours in a day)/60 (minutes in an hour)/60 (seconds in a minute) = 0.26 L/s.

5.2.4 This would mean a total flow of approximately 0.89 L/s.

5.2.5 To account for the diurnal variation of WC and kitchen facilities use, a peak rate of 6 times the average flow rate will be considered, giving a peak rate of approximately 5.5 L/s.

5.3 Proposed Foul Strategy

5.3.1 The intended foul strategy for the site proposes to connect the majority of the site into the existing 225 mm diameter Thames Water gravity sewer located approximately 150 – 200 m south of the site. The exact route of the sewer is presented in the Thames Water sewer records in Appendix D, at the rear of the report.

[22] British Water, Code of Practice, Flows and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems [online]. Available at: https://cdn.ymaws.com/www.britishwater.co.uk/resource/resmgr/publications/codes_of_practice/flows_and_loads___bw_cop_18..pdf. Accessed September 2024.

5.3.2 For development proposed in Fields 1 and 2, foul water is proposed to connect into a foul pumping station, located in the northwest of Field 1. This pumping station would deliver flows into the existing Thames sewer via a proposed rising main that would cross Fields 1 and 2 before delivering foul flows into a proposed gravity connection at approximately the topographical high point in the southern part of Field 2. This gravity connection would then connect directly into the existing Thames sewer which is outside the site but within Client land.

5.3.3 Thames Water have confirmed capacity in the sewer network for the strategy proposed above. Letters of confirmation are presented in Appendix D at the rear of the report [23].

5.3.4 The foul pumping station is proposed to be adoptable. It will therefore require a compound area of approximately 8x12 m, will be required to be 20 m from any dwellings, and will need to allow for tanker access. Additionally, an allowance of 24 hours of storage will be required for attenuation of foul flows for periods of maintenance/power failure/breakdown.

5.3.5 The drainage strategy is presented in Figure 3.1 at the rear of the report.

[23] It is noted that the original approval from Thames Water was for the addition of 400 homes into the existing network. This included 200 proposed homes to the south of Huntsland that were part of an earlier iteration of the scheme that also included 200 homes in the area of the Proposed Development to the north of Huntsland. As part of the iteration process, it was deemed necessary that approximately 40 – 50 homes to the south of Huntsland should be directed instead to an existing sewer in Turners Hill Road to the east. The Proposed Development (north of Huntsland) is for 150 homes plus a 65 person care home. The removal of 50 homes from the Proposed Development to the north of Huntsland, and the redirection of 40 – 50 homes to an existing sewer in Turners Hill Road (development south of Huntsland) leaves capacity for the 65 person care home. The foul flow rate for 90 homes as per calculations in Section 5.2 would be approximately 0.38 L/s which is comfortably above the 0.26 L/s determined for the care home.

6. SUMMARY

6.1.1 The site located on land to the west of Crawley Down is to be brought forward for development. The Proposed Development will consist of up to 150 residential dwellings and a 65 bed care home.

6.1.2 The site is currently undeveloped, greenfield land, and as such a drainage strategy is required to demonstrate how newly introduced impermeable areas will collect, treat, and discharge runoff in a manner which does not cause a detrimental impact downstream, in terms of both water quality and quantity (i.e., not increase flood risk).

6.1.3 The intent is to discharge to two separate existing watercourses in the northwest of Field 1 and Field 2 respectively. The overall 1 in 1-year greenfield runoff rate, to which discharge from the Proposed Development intends to be limited, is calculated at 73.2 L/s.

6.1.4 This represents a considerable reduction in the peak flows presently emanating from the site area. The strategy will therefore improve upon the current situation with regard to surface water management and flood risk.

6.1.5 Foul water will be collected and discharged via conventional means to an existing Thames Water sewer located within Client land. A foul water pumping station is proposed to be located in the northwest of the site to direct foul flow to its intended destination. Thames Water have confirmed capacity in the existing sewer network for the proposed foul water strategy.

FIGURES

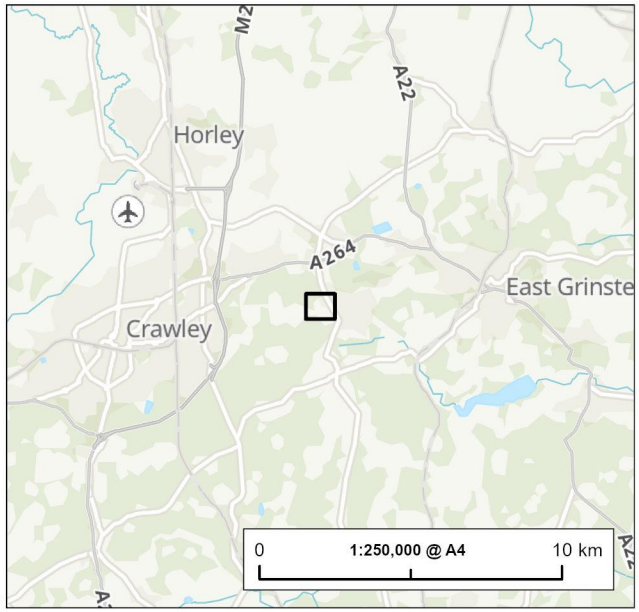
Figure 2.1 – Site Location Plan

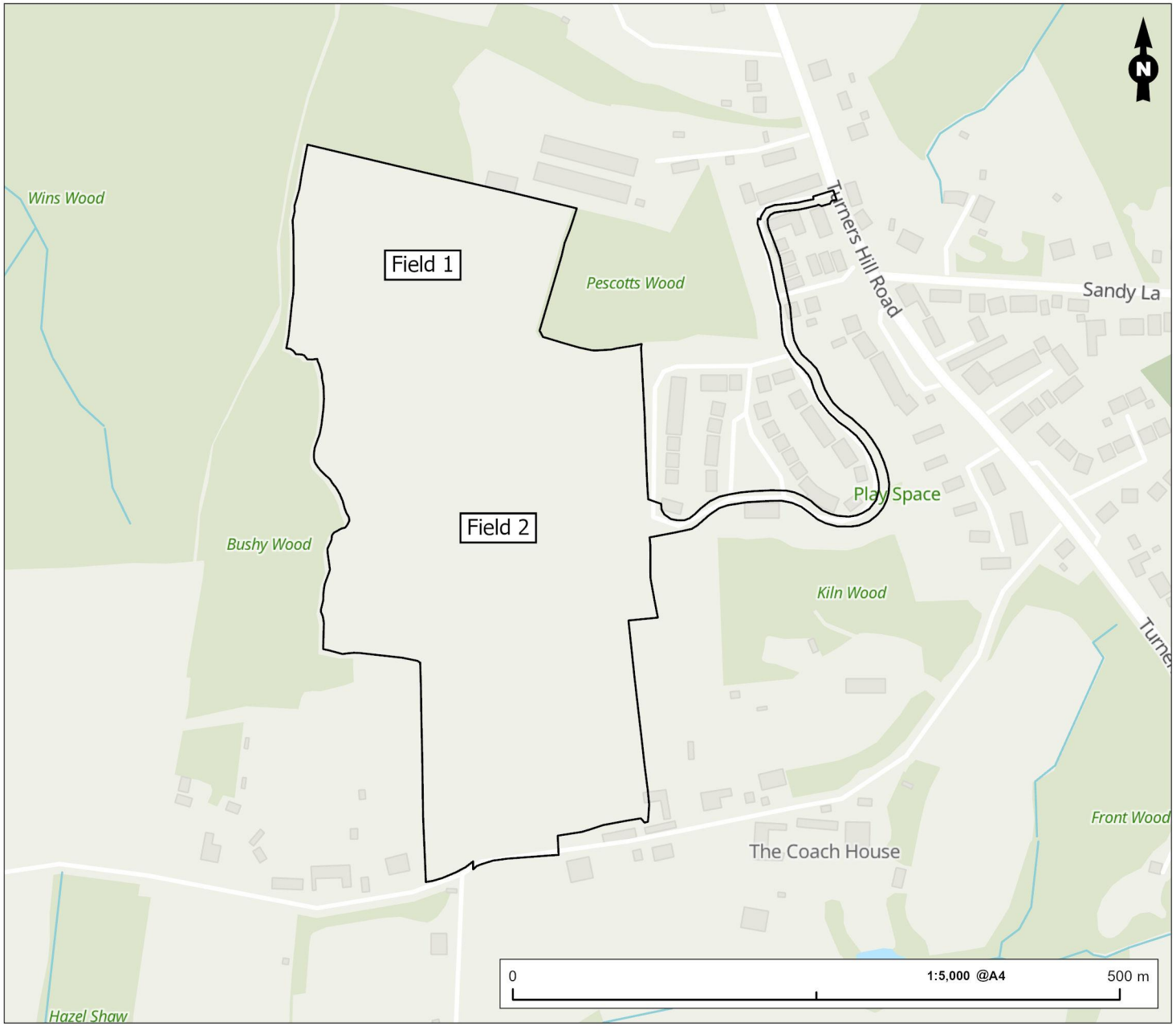
Figure 2.2 – LiDAR Topography

Figure 2.3 – Hydrological Setting

Figure 2.4 – EA Surface Water Flood Risk

Figure 3.1 – Indicative Drainage Strategy Plan



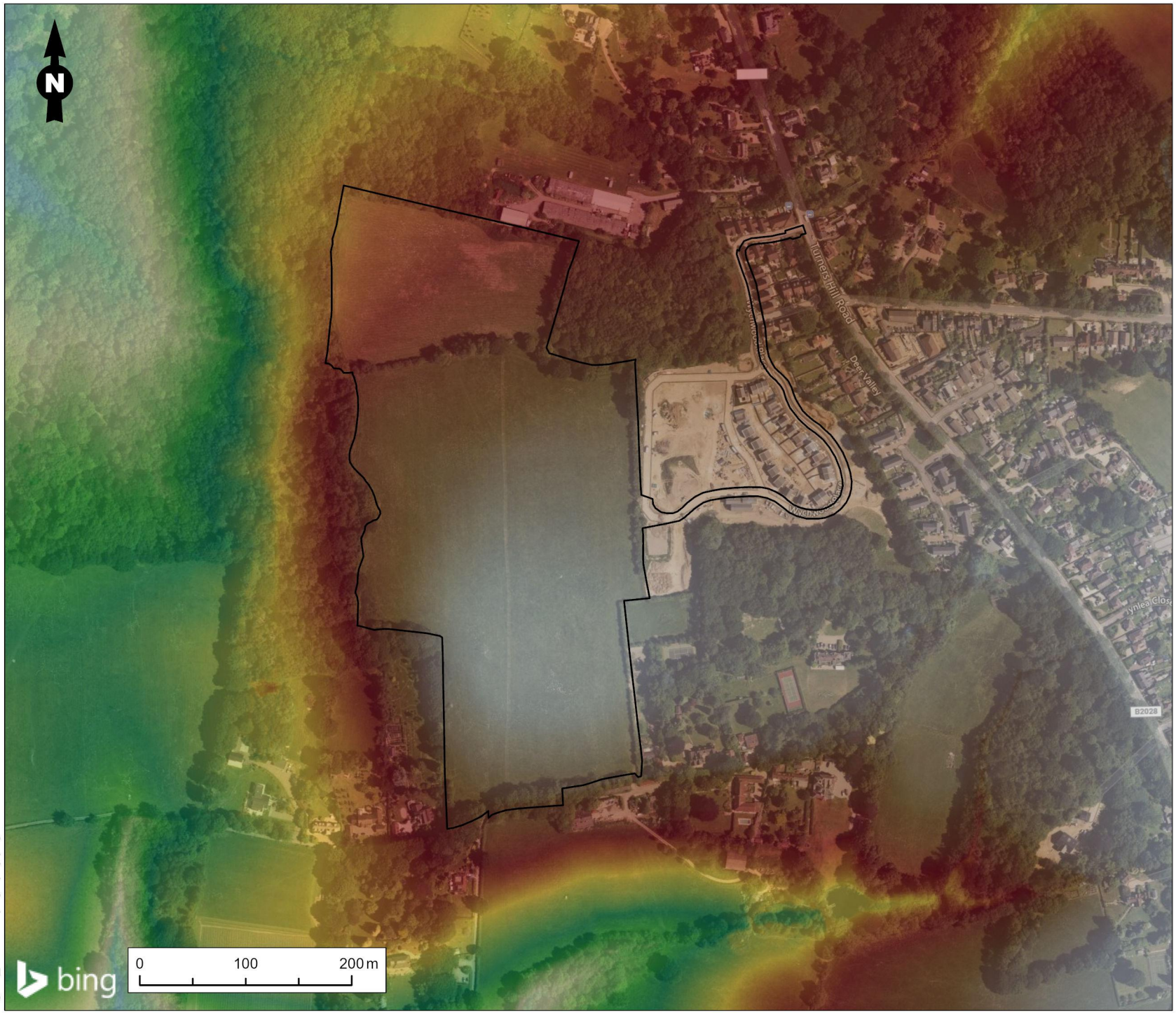


RAMBOLL

Figure Title: Site Location Plan	Project Name: Land West of Crawley Down	Date: January 2025	
		Prepared By: DM	Figure No.: 2.1
Client: **Wates Developments Ltd**	Project No./Filery ID: 162001691-014 / RUK2021N00014	Scale: As Shown	Revision: 2.0

Fig2.1_SiteLocationPlan.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.



Legend

Site Boundary

LiDAR 1m DTM / m AOD

130

95

Figure Title
LiDAR Topography

Project Name
Land West of Crawley Down

Project No./Filery ID
1620011691-014 / RUK2021N00014

Date	Figure No.	Revision
January 2025	2.2	2.0

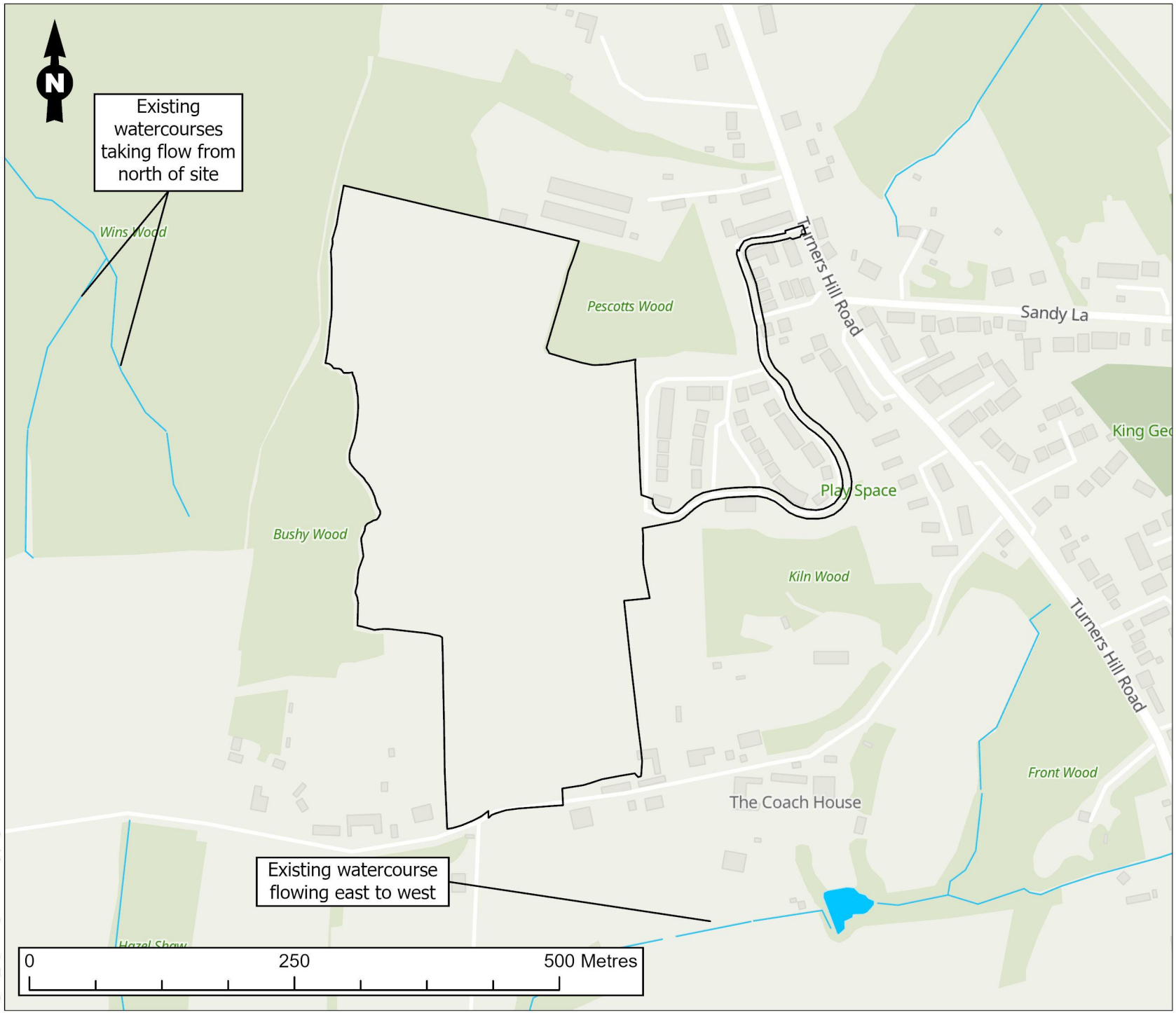
Prepared By	Scale
DM	1:5,000 @A4

Client
Wates Developments Ltd

RAMBOLL

Fig2.2_LiDAR Topography.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.



Legend

- Site Boundary
- OS Waterbodies
- OS Watercourses

Figure Title
Hydrological Setting

Project Name
Land West of Crawley Down

Project No./Filery ID
1620011691-014 / RUK2021N00014

Date	Figure No.	Revision
January 2025	2.3	2.0

Prepared By	Scale
DM	1:5,000 @A4

Client
Wates Developments Ltd

RAMBOLL

Fig2.3_HydrologicalSetting.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

Legend

- Site Boundary
- High Surface Water Flood Risk (Greater than 3.3% Annual Exceedance Probability)
- Medium Surface Water Flood Risk (Between 1% and 3.3% Annual Exceedance Probability)
- Low Surface Water Flood Risk (Between 0.1% and 1% Annual Exceedance Probability)

Figure Title
EA Surface Water Flood Risk

Project Name
Land West of Crawley Down

Project No./Filery ID
1620011691-014 / RUK2021N00014

Date	Figure No.	Revision
January 2025	2.4	2.0

Prepared By	Scale
DM	1:4,000 @A4

Client
Wates Developments Ltd

RAMBOLL

Fig2.4_EASurfaceWaterFloodRisk.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

Legend

- Site Boundary
- Existing Foul Water Manhole
- Expected (Existing) Foul Sewer
- Expected (Existing) Foul Sewer 6m Easement Strip
- Proposed Foul Water Manhole
- Proposed Foul Gravity Sewer
- Proposed Foul Gravity Sewer 6m Easement Strip
- Proposed Foul Pumped Sewer
- Proposed Foul Pumped Sewer 6m Easement Strip
- Proposed Foul Pumping Station 8x12m Compound Area
- Proposed Surface Water Gravity Sewer
- Surface Water Attenuation Area
- Surface Water Attenuation Area 3m Allowance
- Proposed Swale
- Proposed Swale 5m Corridor
- Discharging Swale
- Approximate Route of Existing Watercourses/Ditches

Figure Title
Indicative Drainage Strategy Plan

Project Name
Land West of Crawley Down

Project No./Filery ID
162001691-014 / RUK2021N00014

Date	Figure No.	Revision
January 2025	3.1	2.0

Prepared By	Scale
DM	1:3,000 @A3

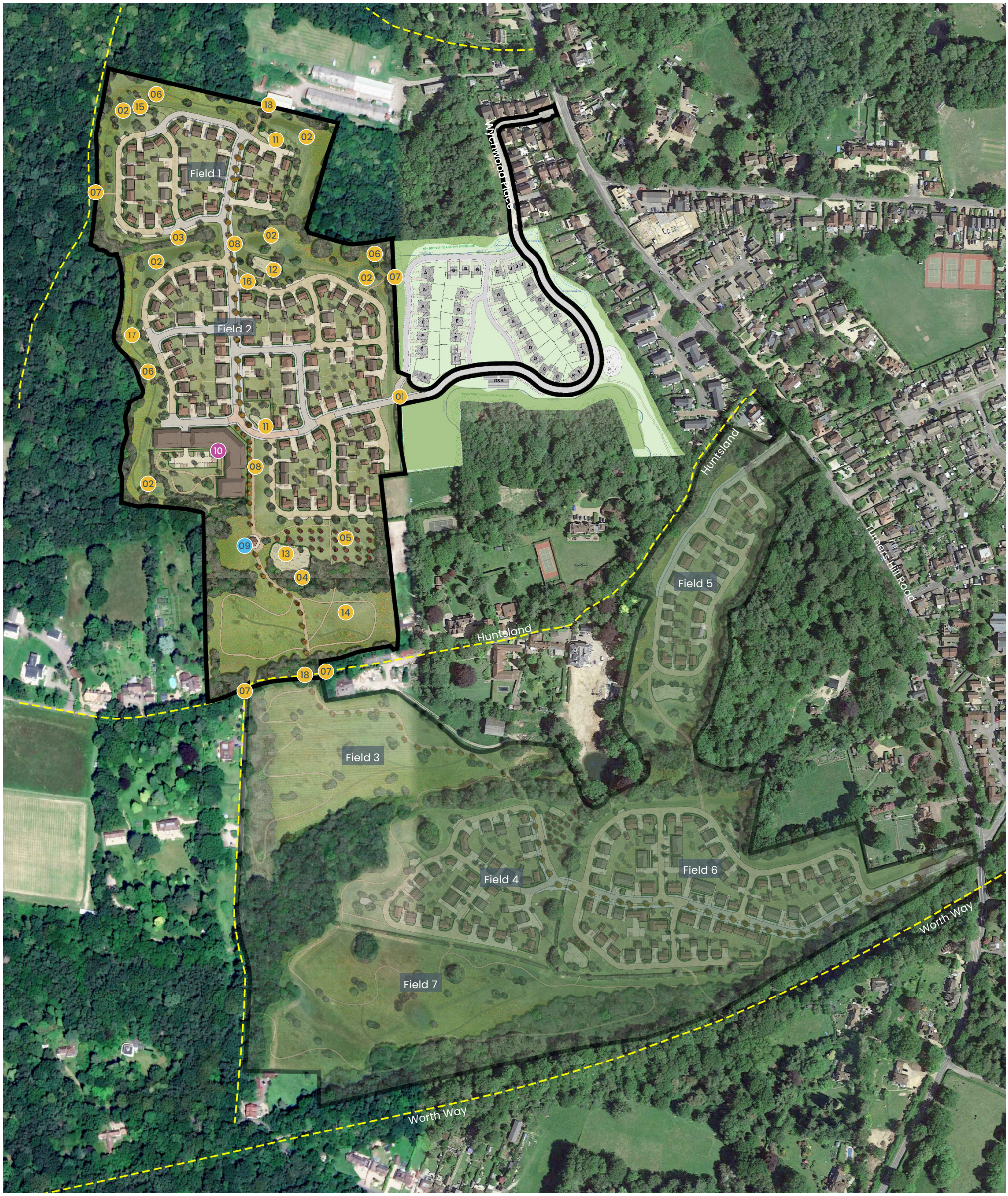
Client
Wates Developments Ltd

RAMBOLL

IndicativeDrainageStrategyPlan.pagx

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

APPENDIX A – SITE ILLUSTRATIVE MASTERPLAN



- Application site
- 01 Vehicular/pedestrian and cycle access point
- 02 Sustainable drainage system including swales
- 03 Retained and enhanced vegetation
- 04 Tree belt planting
- 05 Community orchard/garden
- 06 Meadow planting and species-rich landscapes
- 07 Pedestrian connection points
- 08 Shared cycle/footpath
- 09 Community heart including gathering space/band stand area and St Leonards lookout
- 10 65 bed care home
- 11 Local Area for Play
- 12 Local Equipped Area for Play
- 13 Neighbourhood Equipped Area for Play
- 14 Countryside open space
- 15 Pumping station
- 16 Substation
- 17 Mown paths
- 18 Cycle and pedestrian connection point
- Public right of way: Footpath

N.

Not to scale

CLIENT: WATES DEVELOPMENTS

PROJECT: LAND WEST OF CRAWLEY DOWN

DRAWING: ILLUSTRATIVE MASTERPLAN NORTH 150 UNITS

PROJECT NUMBER: 1314

DRAWING NUMBER: SK001-02

REVISION: V14

DATE:15.01.2025

MOSAIC
Urban Design & Masterplanning

APPENDIX B – SITE TOPOGRAPHICAL SURVEY

Notes:

Whilst every effort has been made to correctly identify species of trees on the site, we advise that an arborologist be consulted before any final decisions are made.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Grid coordinates are based on an OS GNSS system.

Site survey completed in 2017 has not been checked or updated, only additional work has taken place on the surrounding roads.

INDICATIVE

Legend:

Fences

Walls

Hedges

Trees

Buildings

Overhead Electric

Overhead Phone

Gate

Fences:

Barbed Wire Fence	B/W
Corrugated Iron Fence	C/I
Closed Board Fence	C/B
Chestnut Paling Fence	C/P
Iron Railing Fence	I/R
Post and Chain Fence	P/C
Post and Rail Fence	P/R
Post Wire Fence	P/W
Interwoven	I/W
Chain Link Fence	C/L
Larch Lap Fence	L/L
Wire Mesh Fence	W/M

Abbreviations:

BOLLARD	BO	MARKER	MK
BRITISH TELECOM IC	BT	PARKING METER	PM
CONCRETE PAVING SLABS	CPS	ROAD NAME PLATE	RNP
COVER LEVEL	CL	ROAD SIGN	RS
DROP KERB	DK	RODDING EYE	RE
ELECTRICITY POLE	EP	RETAINING WALL	Rtw
FIRE HYDRANT	FH	RAINWATER PIPE	RPW
FLOWER BED	F/B	SOIL VENT PIPE	SVP
FOOTPATH	FP	STOP VALVE	SV
GAS VALVE	GV	TELEGRAPH POLE	TP
GULLY	GY	TRAFFIC LIGHT	TL
INSPECTION COVER	IC	UNABLE TO LIFT	UTL
PIPE INVERT LEVEL	IL	VENT PIPE	VP
KERB OUTLET	KO	WATER METER	WM
MAN HOLE	MH		

Rev. Suffix	Date	Initial	Revision Details
A	26.04.24	TJH	Additonal information added

Surveyor	MB/LW	Verified By	MB/LW	CAD Operator	LW	Approved By	ARL	Date	27.09.17

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

Wates

Location

Land @ Crawley Down
Crawley Down

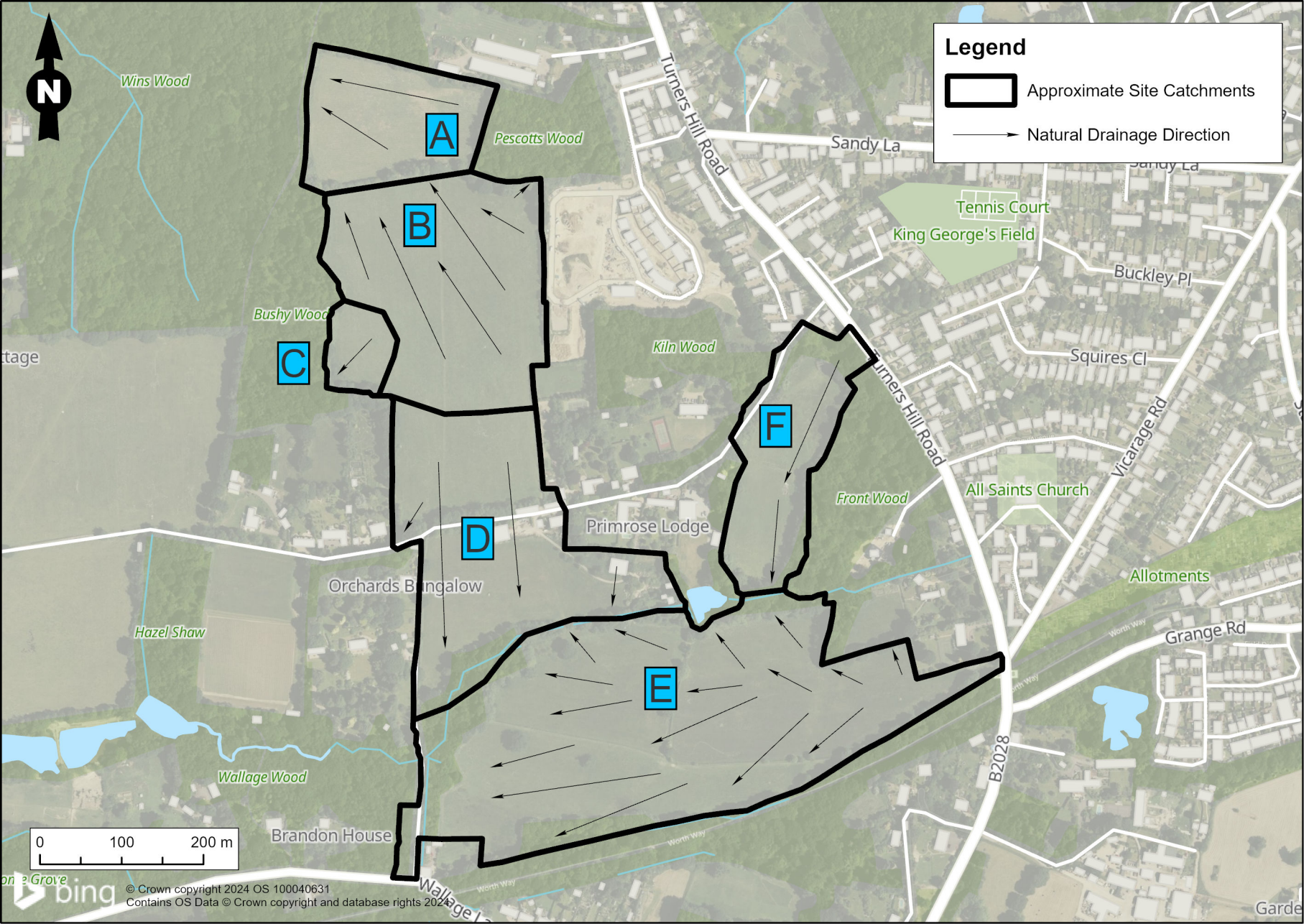
Drawing Title

Topographical Survey Overall

Job No. 2401010	Old Job No. 1702047
Drawing Number W/2401010	Revision Suffix A
Scale Not To Scale	Date February 2024

CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING
PENTIRE - STABLE 1
FORDBRIDGE ROAD,
SUNBURY-ON-THAMES
MIDDLESEX, TW16 6AX
Tel (01932) 761196
Fax (01932) 786419
Email: mail@cdsurveys.com
Visit us at: www.cdsurveys.com

APPENDIX C – SITE VISIT PHOTOGRAPHS AND ACCOMPANYING FIGURES


Legend
Approximate Site Catchments
Natural Drainage Direction
A
B
C
D
E
F
Wins Wood
Pescotts Wood
Bushy Wood
Kiln Wood
Turners Hill Road
Sandy La
Tennis Court
King George's Field
Buckley Pl
Squires Cl
Vicarage Rd
All Saints Church
Front Wood
Primrose Lodge
Orchards Bungalow
Allotments
Grange Rd
Hazel Shaw
Wallage Wood
Brandon House
B2028
Worth Way
0
100
200 m
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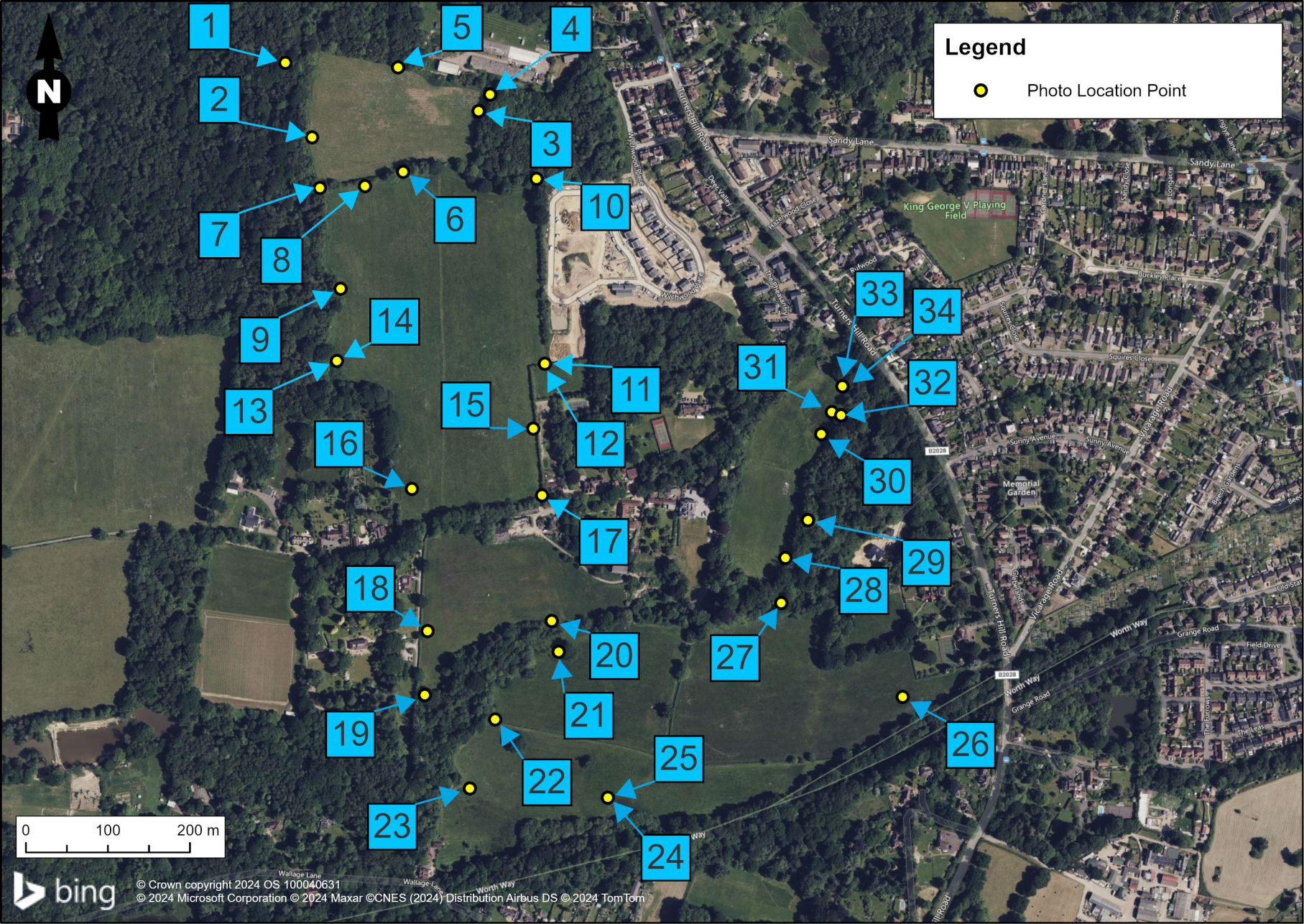
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Sandy Lane
King George V Playing Field
Turners Hill Road
Squires Close
Buckley Place
Rufwood
Sunny Avenue
Vicarage Road
Memorial Garden
Worth Way
Grange Road
Field Drive
Wallage Lane
B2028
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Catchment A

Photographs for Catchment A are presented in Table 3.1 below.

Table 3.1: Catchment A Photographs

 **1.** View of watercourse to the northwest of the site looking west. Watercourse shown to take flows from north of site and direct them westward. Topography visibly sloping from east to west.	 **2.** View of Catchment A looking north along western boundary. Standing water visible in west of site. Topography visibly sloping from east to west.
 **3.** View of Catchment A in the northeast of the site looking west. Topography typically sloping from east to	 **4.** Surface water flooding in the northeast corner of the site.

west although another low point is present in the northeast corner of the catchment.	
 **5.** Surface water flooding in the north of the site. Looking west. Flow observed to be east to west.	 **6.** View of Catchment A looking northwest from the south of the catchment. Land shown to be sloping from southeast to northwest.

Catchment B

Photographs for Catchment B are presented in Table 3.2 below.

Table 3.2: Catchment B Photographs

	
7. View of watercourse flowing from east to west. View looking west. Watercourse shown to take flows from ditch separating Catchments A and B. Topography sloping from east to west.	**8.** View looking south from north of catchment. Topography visibly sloping from south to north.

9. View of Catchment B looking north from the west of the catchment. Topography visibly sloping from south to north and east to west.

10. View of Catchment B looking west from the northeast of the catchment. Topography visibly sloping from south to north leaving localised low point in northeast of catchment.

11. View of Catchment B looking west from southeast of catchment. Topography visibly sloping from west to east in the east of the catchment.

12. View of Catchment B looking north from southeast of catchment. Topography sloping from west to east in the east of the catchment.

Catchment C

Photographs for Catchment C are presented in Table 3.3 below.

Table 3.3: Catchment C Photographs

	
13. View of Catchment C looking north along western boundary of site. Topography sloping from east to west and northeast to southwest.	**14.** View of Catchment C looking east. Topography sloping from east to west. Likelihood is that any potential swale will need to be placed further from the site boundary to ensure a massive depth is not needed.

Catchment D

Photographs for Catchment D are presented in Table 3.4 below.

Table 3.4: Catchment D Photographs

15. View of Catchment D looking west from northeast of catchment. Topography visibly sloping from west to east.

16. View of Catchment D looking north from northwest of catchment. Topography visibly sloping from north to south.

17. View of Catchment D looking northwest from the east of the catchment. Topography visibly sloping from north to south.

18. View of Catchment D looking south along the western boundary. Topography visibly sloping from

	north to south down toward existing watercourse that separates Catchments D and E.
 **19.** View of Catchment D looking east from the southwest of the catchment. Topography visibly sloping from north to south.	 **20.** View of Catchment D looking east from the south of the catchment. Bridge over watercourse visible in top right of image. EA Surface Water Flood Risk mapping suggests a surface water flow path is present to the south of this watercourse in Catchment E. The EA mapping does not account for culverts (like the one beneath this bridge) and the indication therefore is that the surface water flow path shown to the south of the existing watercourse is the result of the EA model assuming a blockage in the watercourse at this location.

Catchment E

Photographs for Catchment E are presented in Table 3.5 below.

Table 3.5: Catchment E Photographs

	
21. View of Catchment E looking northwest from north of catchment, towards existing watercourse. Topography sloping down toward watercourse. Marshy ground ideally suited for an attenuation feature.	**22.** View of Catchment E looking southeast from west of catchment. Topography sloping from east to west and south to north, toward the existing watercourse.

23. Overland surface water flow path flowing from north to south toward the existing watercourse. View looking west.

24. View of Catchment E looking northwest from the south of the site. Topography sloping from east to west and southeast to northwest toward existing watercourse.

	
25. View of Catchment E looking east from the south of the site. Topography sloping from north to south toward the south of the site.	**26.** View of Catchment E looking west from the southeast of the site. Topography shown to be sloping from east to west but is gentle at location photograph was taken.

Catchment F

Photographs for Catchment F are presented in Table 3.6 below.

Table 3.6: Catchment F Photographs

	
27. View of watercourse between Catchments E and F flowing from east to west. View looking west from atop existing footbridge.	**28.** View of Catchment F looking south from the south of the catchment. View looking toward existing watercourse. Steeply sloping toward existing watercourse apparent.

29. Existing tributary watercourse flowing from north to south along eastern boundary of site. View looking north/upstream from atop existing footbridge.

30. View of tributary watercourse flowing from northeast to southwest along eastern boundary of site. Adjacent ground very saturated. View looking south.

31. View of Catchment F looking northwest from east of catchment. Ground very saturated. Topography gently sloping from north to south.

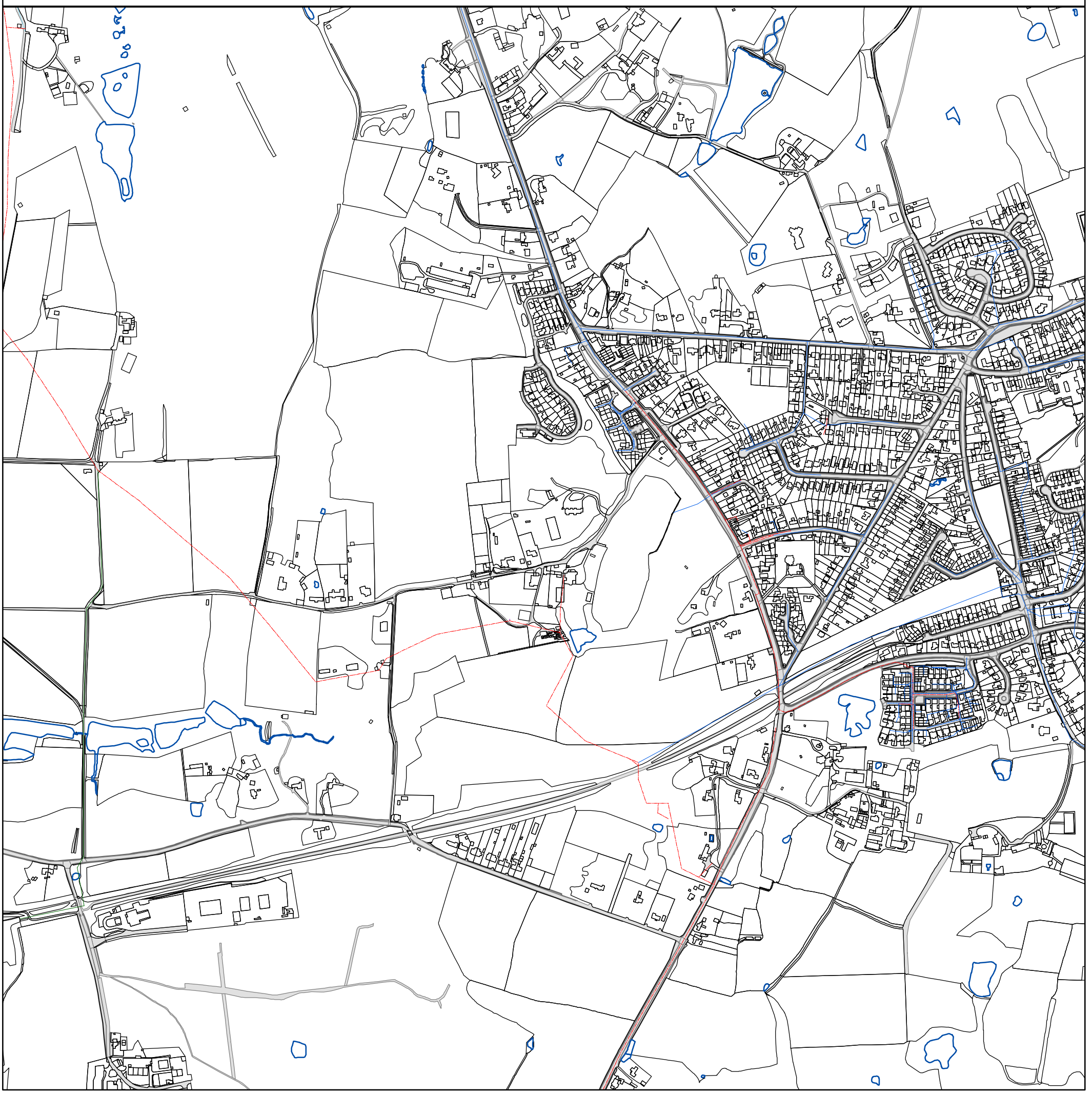
32. View of headwall and culvert along tributary watercourse flowing from northeast to southwest along

	eastern boundary of site. Further tributary ditch visible in top of image.
 **33.** View of Catchment F looking approximately west from the northeast of the catchment. Ground very saturated and topography indicative of potential surface water flow path in part due to lowered edge of small ditch ("tributary watercourse"). See Photo 34 for source of overland flow.	 **34.** View of the tributary watercourse in the northeast of the catchment, beneath tree cover. Backing up and overspill of watercourse onto main catchment area visible. Local land management and potential localised ground raising required to ensure flow remains in the tributary watercourse and is not directed through centre of catchment.

APPENDIX D – THAMES WATER SEWER RECORDS AND COMMUNICATIONS

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2024_4944402



0 45 90 180 270 360
Meters

Scale:	1:7161
Width:	2000m
Printed By:	TSOMASUN
Print Date:	26/02/2024
Map Centre:	533768,137565
Grid Reference:	TQ3337NE

Comments:

Miss Nellie Bates
Ramboll UK Limited
240 Blackfriars Road
LONDON
SE1 8NW

Wastewater pre-planning
Our ref **DS6114146**

27 March 2024

Pre-planning enquiry: Confirmation of sufficient capacity

Site: Land West of Turners Hill Road, Crawley Down, West Sussex, RH10 4HB

Dear Miss Bates,

Thank you for Pre-planning application for the construction of 400 residential houses.

We have completed the assessment of the foul water flows based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

Foul Water

Proposed foul water to discharge via gravity flow into an existing manhole chamber TQ3337 **7201** for approximately 200 houses the other 200 houses into existing manhole TQ3337 **5401**.

Surface Water

Site is to follow SuDS therefore no direct or indirect discharge of surface water into a Thames Water sewer.

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable.
Before we can consider your surface water needs, you'll need written approval from the LLFA (Lead Local Flood Authority) that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1. store rainwater for later use.
2. use infiltration techniques where possible.
3. attenuate rainwater in ponds or open water features for gradual release.
4. attenuate rainwater by storing in tanks or sealed water features for gradual release.
5. discharge rainwater direct to a watercourse.
6. discharge rainwater to a surface water sewer/drain.
7. discharge rainwater to the combined sewer.
8. discharge rainwater to the foul sewer

Where connection to the public sewerage network is still required to manage surface water flows, we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

Please see the attached 'Planning your wastewater' leaflet for additional information.

Diversion

From our records we don't anticipate that any wastewater assets need to be diverted to accommodate your proposals.

Source Protection Zone

The development site boundary falls within a Source Protection Zone for groundwater abstraction. These zones may be at particular risk from polluting activities on or below the land surface. To prevent pollution, the Environment Agency and Thames Water (or other local water undertaker) will use a tiered, risk-based approach to regulate activities that may impact groundwater resources, this may potentially affect your drainage or surface water strategies where deep or infiltration systems are proposed. The applicant is encouraged to read the Environment Agency's approach to groundwater protection (available at https://www.gov.uk/government/publications/groundwater-protection-position-statements and may wish to discuss the full implications for their development with a suitably qualified environmental consultant.

What happens next?

If not already done so, please submit your **S106 Connection Application**, giving us at least 21 days' notice of the date you wish to make your new connection(s).

If you've any further questions, please do not hesitate to contact me.

Yours sincerely,

Colins Akemche
Clean & Waste Pre-Planning Engineer
Adoption Team - Service Delivery

Miss Nellie Bates
Ramboll UK Limited
240 Blackfriars Road
LONDON
SE1 8NW

Wastewater pre-planning
Our ref **DS6117990**

28 May 2024

Pre-planning enquiry: Confirmation of sufficient capacity

Site: Residential Development Turners Hill, Turners Hill Road, Crawley Down, Crawley, West Sussex, RH10 4HB

Dear Miss Bates,

Thank you for Pre-planning application for the construction of **44 residential house**.

We have completed the assessment of the foul water flows based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

Foul Water discharge

Proposed foul water to discharge via pumped flow at **1.0 litres/sec** into an existing manhole chamber referenced TQ3437 **0701** on an existing 225mm foul water sewer.

Surface Water discharge

Site is to follow SuDS therefore no direct or indirect discharge of surface water into a Thames Water sewer/network.

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable.
Before we can consider your surface water needs, you'll need written approval from the LLFA (Lead Local Flood Authority) that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1. rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. rainwater infiltration to ground at or close to source
3. rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. rainwater discharge direct to a watercourse (unless not appropriate)
5. controlled rainwater discharge to a surface water sewer or drain
6. controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is still required to manage surface water flows, we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

More detailed surface water hierarchies can be found within Local Planning Policies.

Diversion

From our records we don't anticipate that any wastewater assets need to be diverted to accommodate your proposals.

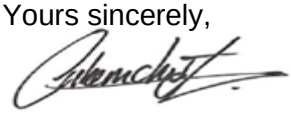
Please see our FAQ's leaflet for additional information.

What happens next?

If not already done so, please submit your **S106 Connection Application**, giving us at least 21 days' notice of the date you wish to make your new connection(s).

If you've any further questions, please do not hesitate to contact me.

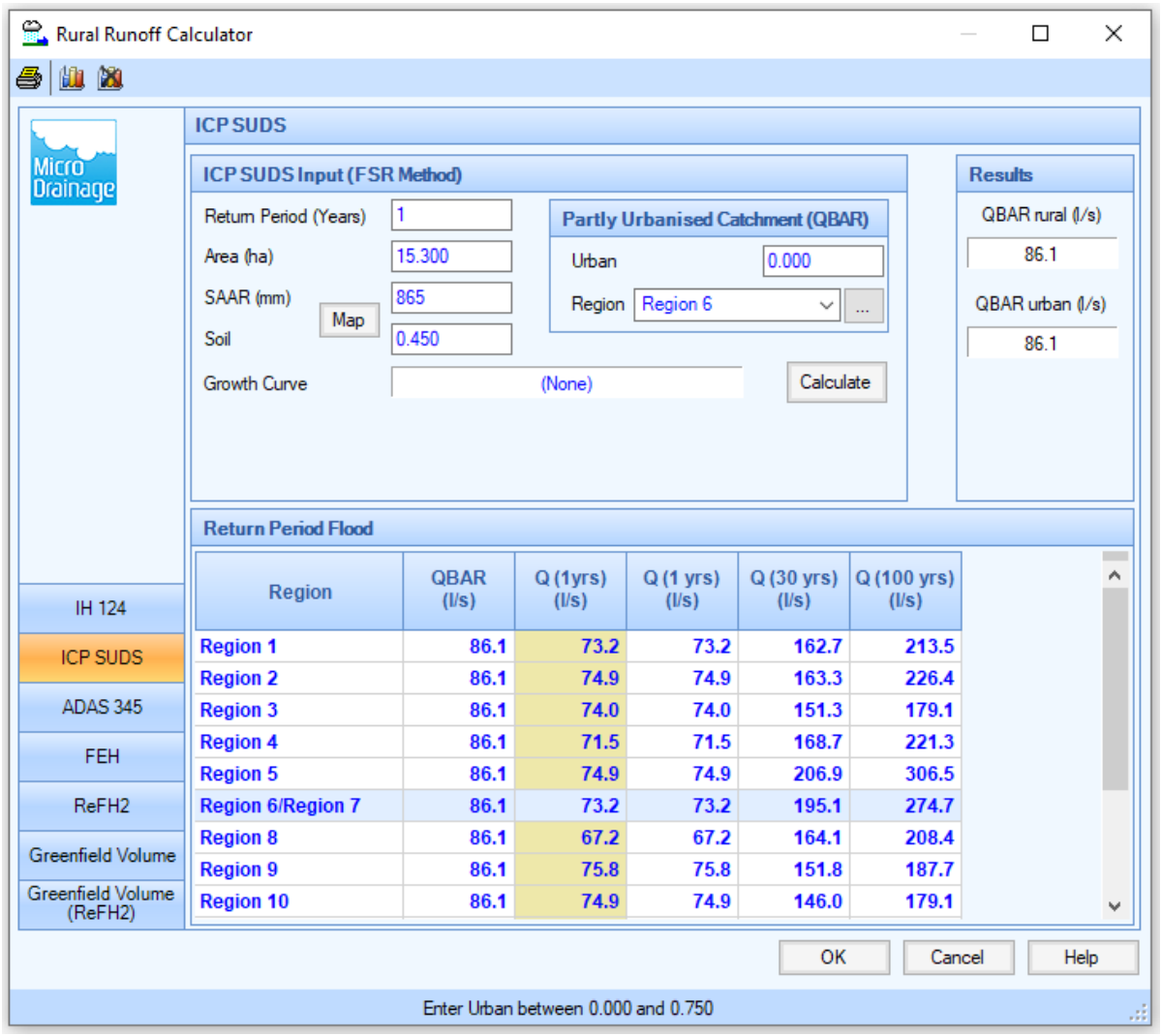
Yours sincerely,



Colins Akemche
Clean & Waste Pre-Planning Engineer
Adoption Team - Service Delivery

Thames Water - Developer Services - Ground Floor West - Clearwater Court - Vastern Road
Reading -Berkshire - RG1 8DB - Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk - Web: www.developerservices.co.uk

APPENDIX E – ADDITIONAL INFORMATION/FIGURES



Region	QBAR (l/s)	Q (1yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	86.1	73.2	73.2	162.7	213.5
Region 2	86.1	74.9	74.9	163.3	226.4
Region 3	86.1	74.0	74.0	151.3	179.1
Region 4	86.1	71.5	71.5	168.7	221.3
Region 5	86.1	74.9	74.9	206.9	306.5
Region 6/Region 7	86.1	73.2	73.2	195.1	274.7
Region 8	86.1	67.2	67.2	164.1	208.4
Region 9	86.1	75.8	75.8	151.8	187.7
Region 10	86.1	74.9	74.9	146.0	179.1

Figure AE.1: Rural Runoff Calculator MicroDrainage 2020.1

Figure AE.1 presents the calculation of the rural runoff value of 73.2 L/s as stated in Table 3.1.

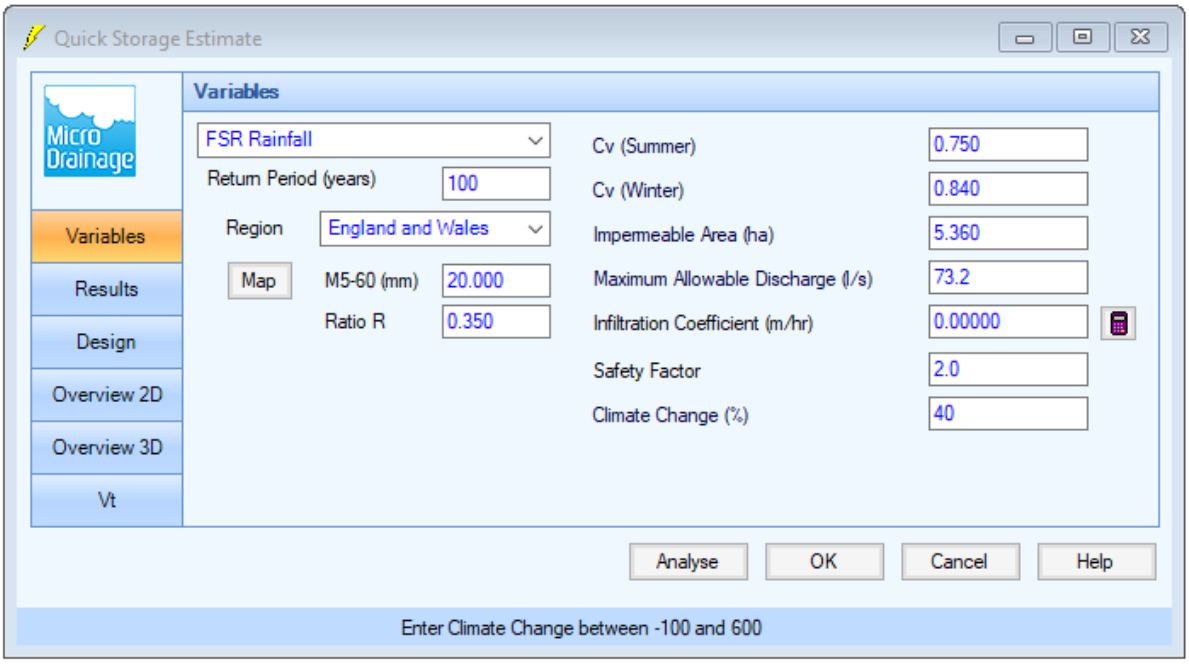


Figure AE.2: MicroDrainage 2020.1 Quick Storage Estimate

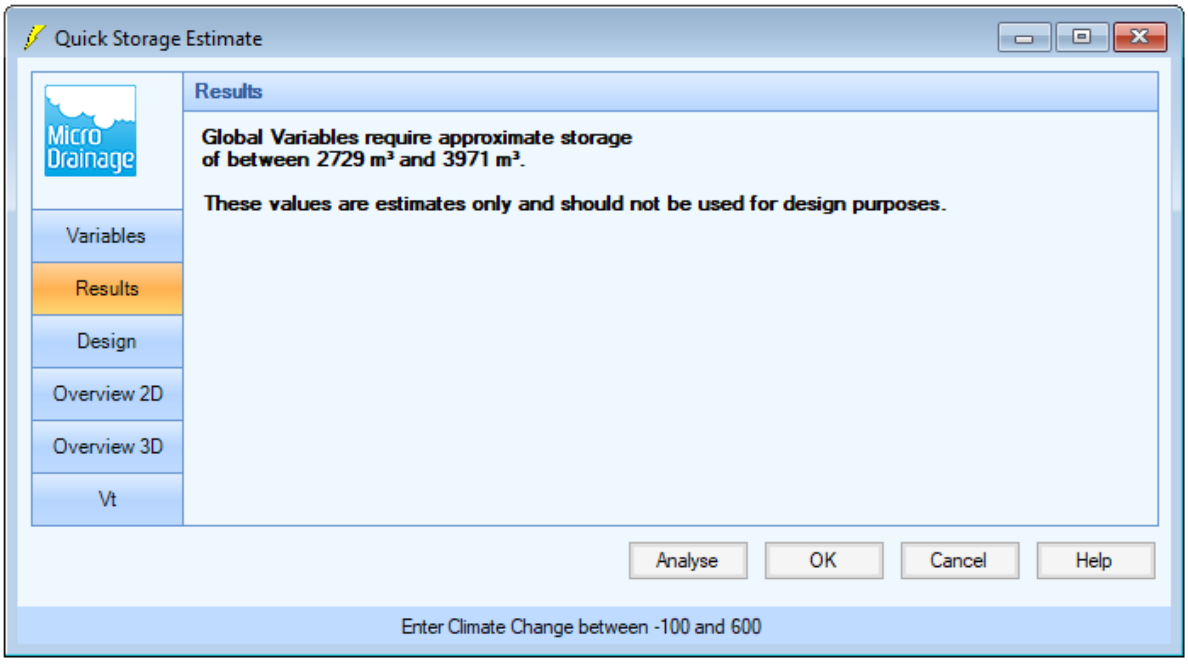


Figure AE.3: MicroDrainage 2020.1 Quick Storage Estimate Results

Figures AE.2 and AE.3 present the storage calculations of 3,971 m^3 as stated in Table 3.2.

Figure AE.4 below provides a screenshot from the Environment Agency Climate Change Allowances mapping[24] which confirms the upper end allowance for the 1% annual exceedance rainfall event should be 40%.

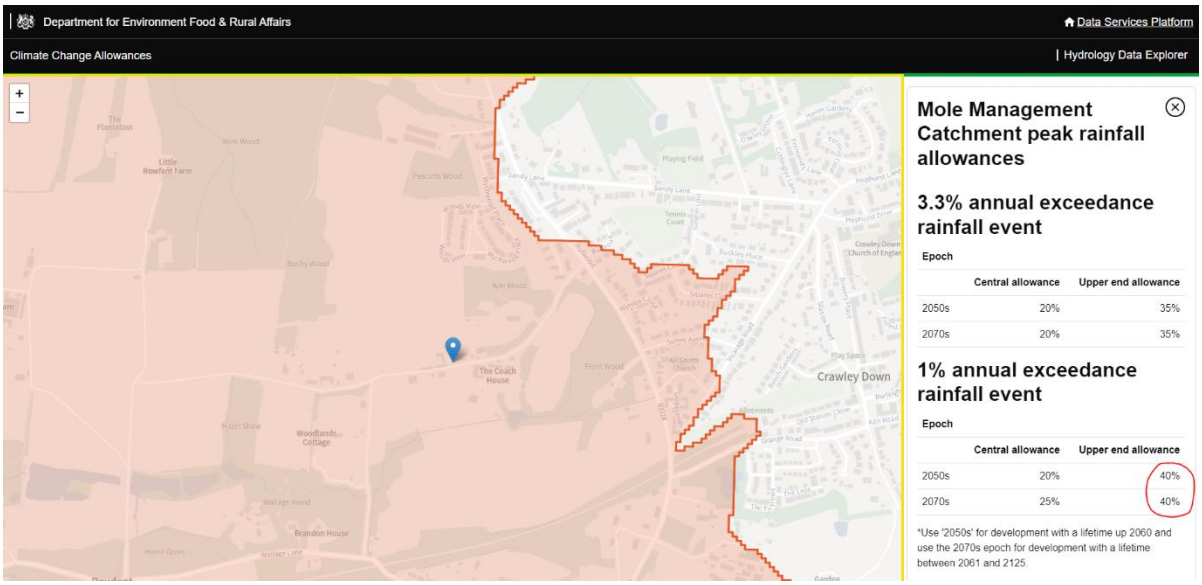


Figure AE.4: Climate Change Allowances Mapping

[24] Department for Environment Food & Rural Affairs, Climate Change Allowances [online]. Available at: https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall?mgmtcatid=3058. Accessed December 2024.